ELECTRONICS

INSTALLATION

AND

MAINTENANCE BOOK

GENERAL

Published by direction of
COMMANDER, NAVAL SEA SYSTEMS COMMAND

APRIL 1983

LIST OF EFFECTIVE PAGES

Datas of issue for original and changed pages ara:

Original .. 0.. ~~January~~ April 1983

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 227 CONSISTING OF THE FOLLOWING:

Page No.	Changa No.
Title	0
A ~~- a -~~	0
i	0
iiBlank	0
iii — xii	0
~~iii Blank~~	~~0~~
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RECORD OF CHANGES

CHANGE NO.	DATE	TITLE OR BRIEF DESCRIPTION	ENTERED BY

BOX SCORE

GENERAL NAVSEA 0967-LP-000-0100

EDITION	PuBLICATION DATE	STOCK NUMBER	LATEST EIB cOVERED(I)
Basic		()$)67 -LP-000-0100	~~081~~
Change 9(2)	(2)	(2)	

NOTES

(1) The number listed in this column indicates that this handbook issue incorporates information from EIB issues up to and including the one shown.

(2) This change reserved for Tab Separator Package.

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PREFACE

POLICY AND PURPOSE

The Electronics Installation and Maintenance Book (EIMB) was established as the medium for collecting, publishing, and distributing, in one convenient source document, those subordinate maintenance and repair policies, installation practices, and overall electronic equipment and material-handling procedures required to implement the major policies set forth in Chapter 400 of the Naval Ships' Technical Manual. All data contained within the EIMB derive their authority from Chapter 400 of the Naval Ships' Technical Mauual, as established in accordance with Article 1201, U. S. Navy Regulations.

Since its inception the EIMB has been expanded to include selected information of general interest to electronic installation and maintenance personnel. These items are such as would generally be contained in textbooks, periodicals, or technical papers, and form (along with the information cited above) a comprehensive reference document. In application, the EIMB is to be used for information and guidance by all military and civilian personnel involved in the installation, maintenance, and repair of electronic equipment under cognizance, or technical control, of the Naval Sea Systems Command (NAVSEA). The information, instructions, and procedures, in the EIMB supplement instructions and data supplied in equipment technicaI manuals and other approved maintenance publications.

INFORMATION SOURCES

Periodic revisions are made to provide the best current data in the EIMB and keep abreast of new developments. In doing this, many source documents are researched to obtain pertinent information. Some of these sources include the Electronics Information Bulletin (EIB), the NAVSEA Deckplate, electronics and other textbooks, industry magazines and periodicals, and various military installation and maintenance-related publications.

ORGANIZATION

The EIMB is organized into a series of handbooks to afford maximum flexibility and ease in handling. The handbooks are stocked and issued as separate items so that individual handbooks may be obtained as needed.

The handbooks fall within two categories: general information handbooks, and equipment-oriented hondbooks. The general information handbooks contain data which are of interest to all personnel involved in installation and maintenance, regardless of their equipment specialty. The titles of the various general information handbooks give an overall idea of their data content; the General Handbook includes more complete descriptions of each handbook.

The equipment handbooks are devoted tQ information about particular classes of equipment. They include general test procedures, adjustments, general servicing information, and field change identification data.

All handbooks of the series are Iisted below with their NAVSEA numbers.

HANDBOOK TITLE	NAVSEA NUMBER
EIMB General Information Handbooks	
General	SE000-00-EIM-100
Installation Standards	SE000-00-EIM-110
Electronic Circuits	SE000-00-EIM-120
Test Methods & Practices	SE000-00-EIM-130
Reference Data	SE000-00-EIM-140
EMI Reduction	SE000-00-EIM-150
General Maintenance	SE000-00-EIM-160
EIMB Equipment-Oriented Handbooks	
Communications	SE000-00-EIM-010
Radar	SE000-00-EIM-020
Sonar	SE000-00-EIM-030
Test Equipment	SE000-00-EIM-040
Radiac	SE000-00-EIM-050
Countermeasures	SE000-00-EIM-060

DISTRIBUTION

Initial Set: An "AF" Restriction Code has been assigned to NAVSEA SEOOO-OO-EIM-OOO to control the over-requisitioning of the EIMB

PREFACE

Series. Fleet and shore activities requiring an initial set of the EIMB Series (13 handbooks with all changes and heavy-duty binders) should submit their requisition (DD Form 1348 with written justification) through their Supply Officer or area, for issue approval to:

Commander
Naval Sea Systems Command
NAVSEA 552412
Washington, D.C. 20362

Use the following data on the DD-1348,
Block A -288 NAVPUBFORMCEN PHILA
Stock No. - 0967-LP-OOO-OOO0
Unit of Issue - SE
Fund -00

All other blocks are to be filled in as normally done by the requisitioner when ordering publications.

Changes and Revisions: The EIMB is continuously being updated. For efficiency these changes and revisions are automatically distributed to using activities who are on the Automatic Distribution List for the EIMB.

Requests and/or changes to the EIMB Automatic Distribution List and any problems in requisitioning should be directed to:

Commander
Naval Sea Systems Command
NAVSEA 55Z412
Washington, D.C. 20362

Individual Handbooks: To order individual handbooks and changes, use the stock numbers listed in the Box Score on page i. Using the stock number for the "BASIC" provides the handbook (with vinyl cover) and all applicable changes.

SUGGESTIONS /CORRECTI ONS

NAVSEA recognizes that users of the EIMB will have occasion to offer corrections or suggestions. To encourage more active participation, a pre-addressed comment sheet is provided in the back of each handbook change. Complete information should be given when preparing suggestions. Suggesters are encouraged to include their name and address so that clarifying correspondence can be initiated when necessary. Such correspondence will be by letter directly to the individual concerned.

If a comment sheet is not available, or if correspondence is lengthy, corrections or suggestions should be directed to the following:

Commander
Naval Sea Systems Command
NAVSEA **552412**
Washington, D.C. 20362

SECTION 1

INTRODUCTION

1-1 PURPOSE

The purpose of the General handbook is to provide policies and instructions pertinent to the proper use of the Electronics Installation and Maintenance Handbook (EIMB) series. The handbook is published for the guidance of all personnel in the naval establishment responsible for or engaged in the installation, maintenance; and repair of electronic equipment.

1-2 SCOPE

The information contained in the General handbook has been carefully selected and arranged so that it is easily identified and retrieved.

The handbook consists of the following:

Section 1 – Introduction.
Section 2 — Administration.
Section 3 – Safety and Accident Prevention.
Section 4 – Publications and their Handling.
Section 5 – EIB/EIMB Indexes.

1-3 USE AND APPLICATION

When properly used, the General handbook is a quick source of information for installation and maintenance personnel. Valuable data pertaining to administration, supply, publications, and safety matters that could be found previously only after considerable research in more than one EIMB handbook have been collected and carefully arranged in a logical sequence within the General handbook. In addition, the EIMB Subject Index (Index C), located in Section 5 of this handbook, provides another handy reference for identifying the EIMB handbook(s) in which all information of a particular subject is located.

1-4 EIMB SERIES HANDBOOKS

The EIMB series handbooks are divided into two main categories: general information handbooks and equipment-oriented handbooks.

The handbooks belonging to the first category contain data which are of interest to all personnel involved in installation and maintenance activities, regardless of equipment specialty.

The handbooks of the second category contain data on equipment of a particular class, such as general test procedures, adjustments, general servicing information, and field change identification.

1-4.1 GENERAL INFORMATION HANDBOOKS

There are seven general information handbooks of the EIMB series. These handbooks are discussed in the following paragraphs:

a. General EIMB handbook, NAVSEA SEOOO-OO-EIM-1OO. The function of the General handbook is discussed in Subsections 1-1, 1-2, and 1-3.

b. Installation Standards EIMB handbook, NAVSEA SEOOO-OO-EIM-11O. This handbook promulgates approved shipboard installation standards, techniques, and practices of NAVSHIPS electronic equipment. The information contained in this handbook had been extracted from numerous publications, instructions, and pamphlets obtained from military and commercial sources. It represents the best current knowIedge in the electronic installation and maintenance field. The handbook has been arranged so that material is presented as nearly as possible in the chronological order of installation events, starting with receipt of equipment from source of supply, to standard installation practices preliminary to pIacing the equipment into service. Periodic revisions and additions will be made to ensure that the handbook always reflects the best current techniques and keeps abreast of new developments. This handbook is intended for installation personnel.

c. Electronic Circuits EIMB handbook, NAVSEA SEOOO-OO-EIM-120. This handbook provides electronic circuitry theory and descriptions for basic vacuum tube and semiconductor circuits. The contents of the handbook were carefully selected and prepared to serve the requirements of naval personnel in the electronics field. The handbook, as sectionalized, permits the addition of new circuits to keep the handbook abreast of current electronic developments. This method permits the addition of new electron-tube, semiconductor, and allied circuits, as well as the revision of existing circuits. Each circuit descrip-

tion includes information on the circuit application, its important characteristics, an analysis of circuit theory and operation, and failure analysis based upon output signal indications. This handbook is intended primarily for shipboard electronic training personnel and as electronic reference material.

d. Test Methods and Practices EIMB handbook, NAVSEA SEOOO-OO-EIM-130. This handbook urovides electronic technicians with reference in formation on the fundamentals of test methods and basic measurements, step-by-step procedures for testing typical electronic equipments and circuits, and functional descriptions of the theory of operation of the test equipment used and circuits tested.

e. Reference Data EIMB handbook, NAVSEA SEOOO-OO-EIM-140. This handbook contains an encyclopedic arrangement of useful and informative references of pertinent definitions, abbreviations, formulas, and other general data related to electronic installations and maintenance. This handbook of reference data is intended for use by all Navy electronics personnel.

f. EMI Reduction EIMB handbook, NAVSEA SEOOO-OO-EIM-150. This handbook contains NAVSHIPS—approved techniques and procedures for the elimination or reduction of electromagnetic interference created by own-forces electromagnetic radiating devices. This handbook is intended for electronic technicians involved in the installation and maintenance of electronic and electrical systems and equipment.

g. General Maintenance EIMB handbook, NAVSEA SEOOO-OO-EIM-160. This handbook contains routine maintenance concepts, techniques, and procedures common to all electronic and electrical equipment. Preventive maintenance programs, equipment-level and system-level maintenance philosophies, and maintenance of subsystems and repair parts are discussed. This handbook is intended for use by all technicians involved in the maintenance of electronic and electrical equipment.

1-4.2 EQUIPMENT-ORIENTED HANDBOOKS

There are six equipment-oriented handbooks of the EIMB series. Each of these handbooks contain general servicing information for the basic equipment category (i.e., radar), general servicing information for specific equipments (i.e., ANISPS-1OD), the Field Change Identification Guide (FCIG) which provides field change information for all equipments of the basic equipment category, and circuit functional descriptions common to the equipment of the basic equipment category. The six equipment-oriented handbooks are:

Communications EIMB	NAVSEA SEOOO-OO-EIM-O1O
Radar EIMB	NAVSEA SE000-00-EIM-020
Sonar EIMB	NAVSEA SEOOO-OO-EIM-030
Test Equipment EIMB	NAVSEA SEOOO-OO-EIM-040
Radiac EIMB	NAVSEA SEOOO-OO-EIM-050
Countermeasures EIMB	NAVSEA SE000-00-EIM-060

1-5 DISTRIBUTION

The distribution of the EIMB handbooks and handbook changes is a joint effort by the Naval Sea Systems Command, SEA 05L3 and the Naval Publications and Forms Center (NPFC), Philadelphia. Requests for changes or additions to the distribution list are processed by NAVSEA and are forwarded to NPFC, Philadelphia, to incorporate the changes or additions into the master distribution file. Periodic revisions to this file are made so that it complies with changes to the Standard Navy Distribution List (SNDL).

Activities not already on the EIMB distribution list and those requiring changes to the list should submit correspondence to NAVSEA in accordance with Subsection 4-6 of this handbook.

1-6 CHANGES

To be an effective publication, the EIMB handbooks must be continually updated. Generally, they are updated by adding applicable information obtained from EIB articles, new and revised specifications, field change bulletins, and pertinent NAVSEA or NAVSHIPS instructions. Also, new data are extracted from technical journals and periodicals. From time to time, fleet personnel will be required to determine what kind of information is desired in the EIMB. Regardless of data source, all new articles to be included in the EIMB publications should be of a permanent nature that will serve as an aid to personnel engaged in electronics maintenance and repair activities. It also should not duplicate any information that is already available in existing technical Navy publications.

1-7 ADDRESS FOR CORRESPONDENCE

The Naval Sea Systems Command recognizes that users of the EIMB will have

occasion to offer comments or suggestions. To encourage more active participation, a self-addressed comment sheet is provided in the back of each handbook. Complete information should be given when preparing suggestions. It is most desirable that the suggestor includes his full name and mailing address on the comment sheet to facilitate direct correspondence in the event that further information or clarification is required by NAVSEA. Instructions for submitting comment sheets are included in Subsection 4-8 of this handbook.

Whenever a comment sheet is not available or correspondence is lengthy, suggestions should be directed as follows:

Commander
Naval Sea Systems Command
SEA 552412
Washington DC 20362

1-8 REQUISITIONS FOR ADDITIONAL COPIES OR BINDERS OF THE EIMB

Activities desiring additional copies or binders of the EIMB handbooks should submit their requisitions directly to NPFC, Philadelphia, in accordance with Subsection 4-6 of this handbook.

SECTION 2

ADMINISTRATION

2-1 INTRO DUCTION

The maintenance of electronic equipment involves more than just correcting malfunctions or performing preventive maintenance. Although these tasks are essential, someone must first determine what should be done, train and assign the personnel to do it, and then supervise them as they do it. In addition, sufficient spare parts must be stocked, publications kept up to date, records kept, reports made, and so on. All of these tasks are part of the electronics administration, without which there can be no effective electronics maintenance.

The purpose of this section is to acquaint Navy electronics personnel with administrative responsibilities and procedures. Organizations, procedures, and facilities for supplying naval electronic material are addressed since an understanding of these phases of support is important for personnel whose duties are concerned with electronic material. This section and the sources of additional information referenced in the text furnish most of the information necessary for proper administration of a Navy electronic division or installation.

2-2 ELECTRON I= Organization AND RESPONSIBILITIES

The ship's organization manual fully describes the ship's organization, outlines the duties and responsibilities of the various departments and divisions, gives the procedures for accomplishing the various tasks and duties, and lists the ship's regulations. In addition, most ships will have department organization manuals; and some ships may have division organization manuals. The U.S. Navy Regulations prescribes the functional organization for ships and is the authority for these publications. The following diagram (Figure 2-1) shows the various sources of information concerning shipboard organization.

Within the organization for electronics, the assignment of operational and material responsibilities is as follows:

a. Operational responsibilities (i.e., operational use, manipulation, operational maintenance, and those portions of preventive maintenance not requiring realignment after accomplishment) are assigned to personnel charged with operating electronic equipment and associated equipment. Very often, a competent equipment operator can detect a malfunction in an equipment, which he can correct without the aid of a technician. He is qualified to make some adjustments and minor repair, provided that they do not require a high degree of technical skill.

b. Material responsibilities include the general upkeep and maintenance of all assigned electronic equipment. Such responsibilities include those portions of routine and preventive maintenance which require alignment after accomplishment, installation of Class A field changes, corrective maintenance, and maintenance of records, reports, technical manuals, and other maintenance documents.

2-3 SECURITY

The security of the United States in general, and of naval operations in particular, depends in part upon the success attained in the safeguarding of classified information. It is of paramount importance that all who engage in administering security preserve a balanced and common sense outlook toward the subject. The ideal to be sought is the indoctrination of all personnel to the point that they automatically exercise proper discretion in the discharge of their duties and do not think of security of information as something separate and apart from other things. In this way, security of classified information becomes a natural element of every task and not an additionally imposed burden. The attainment of the desired objective requires sound direction from competent authority and full alertness and cooperativeness of the part of all subordinates.

2-3-1 RESPONSIBILITY

The Chief of Naval Operations is responsible to the Secretary of the Navy for all policies relating to the maintenance of the security of all classified information within the naval establishment. Owing to the close relationship of counterintelligence and the preservation of security, the Director of Naval Intelligence has been designated as the officer primarily responsible to the Chief of Naval Operations for the protection of classified information. Therefore, the office of Naval Intelligence formulates and promulgates

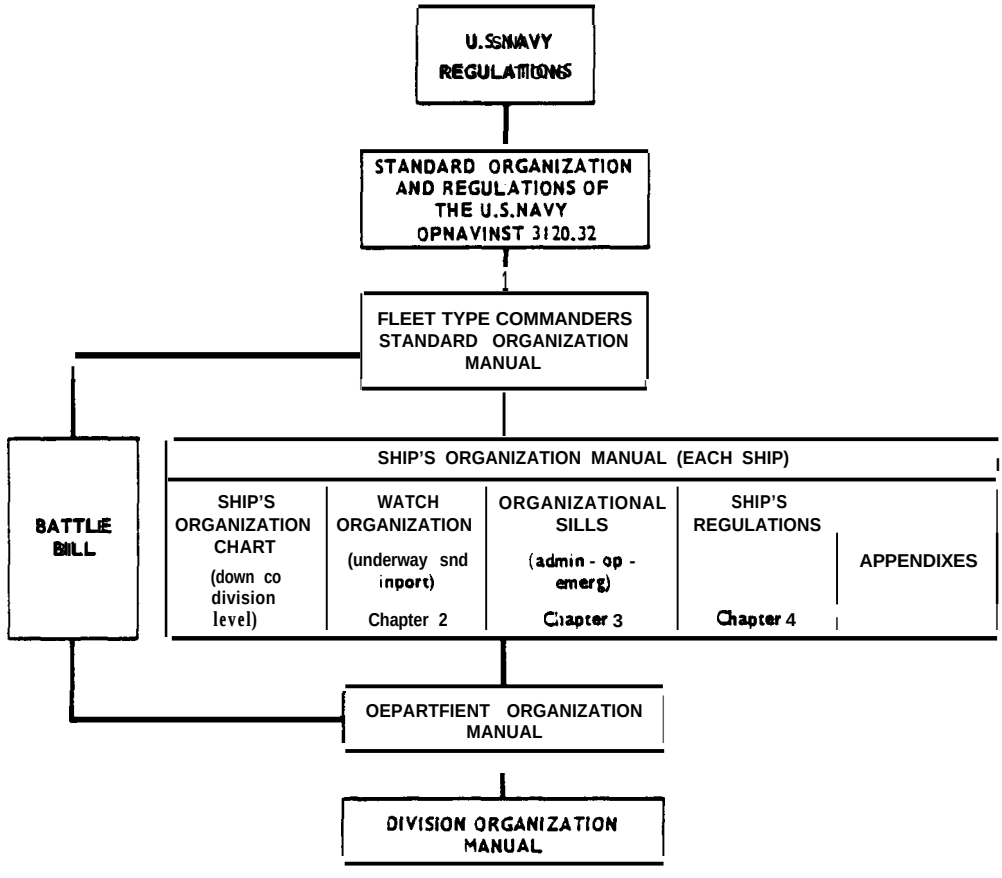

Figure 2-1. Sources of Information Concerning Shipboard Organization

Navy policies which relate to the security of all classified information.

Chapter 15 of the Navy Regulations specifies that commanding officers are directly responsible for safeguarding all classified information within their commands and are responsible for instructing their personnel in security practices and procedures. The electronics material officer is responsible to the commanding officer for seeing that security is the responsibility of all electronics personnel, and that each of his personnel complies with the regulations pertaining to the security of electronic equipment, spaces, and printed matter.

The Department of the Navy SeCurity Manual for classified information, OPNAVINST 5510,1, is the basic security document. The purpose of this document is to provide all naval activities and personnel with detailed regulations and guidance for classifying, marking, and handling classified information. A thorough knowledge of this security document and of all locally established security procedures are required for all electronics personnel.

2-3.2 SECURITY CLASSIFICATION CATEGORIES

Official information or material which requires protection against unauthorized disclosure in the interest of the national defense or foreign relations of the United States are classified in one of three categories, namely "Top Secret," "Secret," or "Confidential" depending upon the degree of its significance to national security.

These classification categories are defined as follows:

a. **Top Secret.** "Top Secret" refers to that national security information or material which requires the highest degree of protection. The test for assigning "Top Secret" classification shall be whether its unauthorized disclosure could reasonably be expected to cause exceptionally grave damage to the national security. Examples of "exceptionally grave damage", may include, but is not limited to, armed hostilities against the United States or its allies; disruption of foreign relations virtually affecting the national security; the compromise of vital national defense plans or complex cryptologic and communications intelligence systems; the revelation of sensitive intelligence operations; and the disclosure of scientific or technological developments vital to national security, This classification shall be used with the utmost restraint.

b. Secret. "Secret" refers to that national security information or material which requires a substantial degree of protection. The test for assigning "Secret" classification shall be whether its unauthorized disclosure could reasonably be expected to cause serious damage to the national security. Examples of "serious damage" may include, but is not limited to, dismption of foreign relations significantly affecting the national security; significant impairment of a program or policy directly related to the national security; revelation of significant military plans or intelligence operations; compromise of significant military plans or intelligence operations; and compromise of significant scientific or technological developments relating to national security. The classification "Secret" shall be sparingly used.

c. **Confidential.** "Confidential" refers to that national security information or material which requires protection. The test for assigning "Confidential" classification shall be whether its unauthorized disclosure could reasonably be expected to cause damage to the national security. Examples of "damage" may include, but is not limited to, the compromise of information that indicates strength of ground, air and naval forces in the United States and overseas areas; disclosure of technical information used for training, maintenance, and inspection of classified munitions of war; revelation of performance characteristics, test data, design and production data on munitions of war.

2-3.3 ACCESS TO CLASSIFIED MATERIAL

The availability of classified material is restricted to those persons who have the proper security clearance and a "need-to-know". The "need-to-know" term means that the dissemination of classified information is available ordy to those persons whose official military or other governmental duties require knowledge or possession thereof. Reaponsibility for determining whether a person's duties require that he possess or have access to classified information and whether he is authorized to receive it rests upon each individual who has possession, knowledge, or command control of the information involved and not upon the prospective recipient. This principle is applicable whether the prospective recipient is an individual, a command, a defense contractor, another federal agency, or a foreign government. A "need-to-know" is recognized as established when (1) the disclosure is necessary in the interests of national defense; (2) there clearly appears from the position, status, duties, and responsibilities of the applicant that he haa a legitimate requirement for access to the classified information in order to carry out his assigned duties and responsibilities; (3) there is no other equal or ready source of the same classified information available to him; and (4) the applicant is or can be appropriately cleared for access to the degree of classified information involved and is capable both physically and mentally of providing the degree of protection which that information requires.

2-3.4 INSPECTIONS

Commanding officers establish a requirement for review and inspection procedures to determine and evaluate the effectiveness of the security indoctrination. These inspections inquire into the security procedures and practices, and includes, but is not limited to: classification, dissemination, transmission, control and accounting, atowage, downgrading and declassification procedures, security orientation, education and training. Such inspections may be conducted as an integral part of existing inspections, provided the results are readily identifiable so as to provide a basis for m-evaluation of the objectives of the security program. (Refer to the current edition of OPNAVINST 5040.70)

2-3.5 DOWNGRADING AND DECLASSIFICATION

Effective 1 August 1982, the previous limitations on the duration of classifications are removed (e.g., original Secret and Confidential classification authorities could classify information up to six years and original Top Secret classification authorities could classify information up to 20 years). With the 6 and 20 year declassification/review time limits of E.O. 12065 eliminated, the original classification authorities will now classify information for as long as required by national security considerations.

2-3.5.1 Originally Classified Documents

Effective 1 August 1982, originally classified documents, classified by a security classification guide, shall be marked for declassification as follows:

"Declassify on: _____"

(If known or appropriate, insert the specific date or event which is certain to occur. Otherwise, insert the notation "Originating Agency's Determination Required" or "OADR.")

2-3.5.2 Previously Marked Documents

There is no need to re-mark documents marked under E.O. 12065 or predecessor orders. Those documents already marked with a specific date or event for downgrading or declassification shall be downgraded or declassified accordingly. Documents not marked for automatic downgrading or declassification on a specific date or event shall not be downgraded or declassified without authorization of an original classification authority from the originating agency. Information extracted from such documents shall be marked "Declassify on: OADR." However, when conversion of previous Executive Order markings are required, the following applies:

a. If a source document contains a specific date or event for declassification and the information remains unchanged, then that date is carried forward.

b. If a source document contains a review for declassification date, then the date is converted to the notation "OADR."

The mandatory 20-year systematic review program of E.O. 12065 has been eliminated. The Archivist of the United States will, under E.O. 12356, systematically review for declassification all permanently valuable 30-year old Navy records accessioned into the Archives pursuant to guidance provided by CNO (OP-009DX).

Mandatory declassification review requests will be accepted by Department of the Navy (DON) components only if received from U.S. citizens or permanent resident aliens or from a federal agency or state or local government. DON components need not accept requests for mandatory declassification review from foreign addresses or from persons whose citizenship or status is not known. It is the intent of the DON, however, to demonstrate flexibility in the treatment of such requests and to effect declassification reviews whenever feasible with available resources.

DON components may not automatically declassify information because of its unofficial publication or its inadvertent or unauthorized disclosure in the United States or elsewhere or because of the open publication or release of identical or similar information. Information may be declassified by the "OADR," original classification authority only, when its continued classification is no longer warranted.

2-3.6 CLASSIFICATION MARKING:

Some of the basic changes to the security classification and marking system, effective 1 August 1982, are set forth below:

2-3.6.1 Categories of Information Considered for Classification

There are four categories of information which may be considered for classification:

a. Vulnerabilities or capabilities of systems, installations, projects, or plans relating to the national security

b. Intelligence activities including special activities, or intelligence sources or methods

c. cryptology

d. A confidential source

OriginaI classification authorities must elect to classify when doubt exists as to whether or not classification is appropriate. The higher classification level must be selected when doubt exists as to which level of classification should be appiied.

Information and material may be classified under E.O. 12356 when, taken together with other information, the same can cause damage to the national security if released without authorization. Original classification authorities shall now, as part of the classification process, consider all information in light of previous disclosures, or in context with other information classified or unclassified, as to whether or not the information should be classified.

2-3.6.2 Classification Designations

Information or material that requires protection against unauthorized disclosure in the

interest of the national security shall be classified in one of three designations, "TOP SECRET," "SECRET," or "CONFIDENTIAL." The marking "FOR OFFICIAL USE ONLY" shall not be used to identify classified information or material. No other term(s) (e.g., "Sensitive," "Conference," or "Agency") shall be used in conjunction with the authorized classification designations to identify classified information or material. The three classification designators are defined in paragraph 2-3.2.

2-3.6.3 **Original Classification Authority**

"Original classification" is defined as an initial determination that information or material requires, in the interest of the national security, protection against unauthorized disclosure together with a classification designation signifying the level of protection required. When the information or material is originally classified, only the original classification authorities shall be cited in the "classified by" line. Further, only an original classification authority shall upgrade, downgrade, or declassify information or material. If a classification guide is not available or an originator of classified information is not a designated classification authority, the information shall be marked by the originator with the highest classification believed to be warranted.

2-3.6.4 **Derivative Classification.**

Derivative Classification is defined as, a detemnination that information or material is in substance the same as information or material that is currently classified and assigned a designation of the same level of classification. The "Classified by" line on derivatively classified documents shall reflect the identity of the applicable classification guide, source document or other authority for the classification. If more than one such source is applicable, insert the phrase "Multiple Sources." When "Multiple Sources" is cited in the "classified by" line, it is the responsibility of the originator to maintain with the file or record copy of the document the identification of the source material (e.g., classification guides, documents, etc.) used.

2-3.6.5 **Duration of Original Classification**

At the time a determination is made by an official with authority to originally classify information and material as "TOP SECRET," "SECRET," or "CONFIDENTIAL," such official must also determine how long the classification shall remain in effect.

Original classification authorities may not be able to predetermine a date or event for automatic declassification, in which case, they shall provide for the indefinite duration of classification. The "Declassify on" line shall read "Originating Agency's Determination Required" or "OADR."

2-3.6.6 Subject **and Title Marking**

Subjects and Titles of Classified Documents shall be marked with the appropriate symbol, "(TS)," "(S)," "(C)," or "(U)" placed immediately following and to the right of the item. When applicable, other appropriate symbols (e.g., "(RD)," "(FRD)," "(WNINTEL)") shall be added.

2-3.6.7 **Position Marking**

Each section, part, paragraph, subparagraph, or similar portion of a classified document shall be marked to show the level of classification of the information contained therein or revealed by it or that it is Unclassified. Portions of documents shall be marked in a manner that eliminates doubt as to which of its portions contain or reveal classified information. Classification levels of portions of a document shall be shown by the appropriate classification symbol placed immediately following the portion's letter or number, or in the absence of letters or numbers, immediately before the beginning of the portion.

2-3.6.8 **Transmittal Documents**

A transmittal document, including endorsements and comments, when such endorsements and comments are added to the basic communication, shall carry on its face a prominent notation as to the highest classification of the information or material transmitted by it, and a legend showing the classification, if any, of the transmittal document, endorsement or comment standing alone. For example, an Unclassified document that transmits as an attachment a classified document, shall be marked with a notation substantially as follows:

> "Unclassified upon removal of classified enclosure(s)"

Transmittal documents shall also be marked with any additional applicable warning notices described in paragraph 2-3.6.9 below.

2-3.6.9 **Additional Warning Notices**

In addition to the marking requirements prescribed the following warning notices, when applicable, shall be prominently displayed on classified documents and materials.

"RESTRICTED DATA" – "This mate% contains "Restricted Data" as defined in the Atomic Energy Act of 1954. Unauthorized disclosure subject to administrative and criminal sanctions." Portion mark "RD."

b. "FORMERLY RESTRICTED DATA" – "Unauthorized disclosure subject to administrative and criminal sanctions. Handle as "Restricted Data" in foreign dissemination. Section 144.b, Atomic Energy Act, 1954." Portion mark as "FRD."

"WARNING NOTICE – INTELLIGENCE SOURCES AND METHODS INVOLVED." Portion mark as "WNINTEL" or "WN."

d. "NOT RELEASABLE TO FOREIGN NATIONALS". Portion mark as "NOFORN" or "NF". "NOFORN" markings are authorized for use only on the following categories of information and material:

(1) Naval Nuclear Propulsion Information (NNPI)

(2) Intelligence data, other than WNINTEL

(3) Communications information and material (COMSEC)

(4) Cryptographic information and material (CRYPTO)

2-3.7 SECURITY PUBLICATIONS AND INSTRUCTIONS

Basic security regulations and criteria for safeguarding classified information are covered in detail in OPNAV Instruction 5510.1, Department of the Navy Security Manual for Classified Information. The purpose of this document is to provide all Naval activities and personnel with detailed regulations and guidance for classifying, marking, and the handling of classified information.

The following documents are listed for specific guidance in safeguarding classified information. A more comprehensive listing of security-oriented documents is contained in OPNAV Instruction 5510.1.

2-3.7.1 Naval See Systems Command Shore Activities Standards; NAVSEA Instruction 5610.2.

The purpose of this instruction is to provide an updated security guide for the protection of classified information and materials in the custody of or under the cognizance of the Naval Sea Systems Command. The policies and procedures contained in this instruction are based on the Department of the Navy Security Manual for Classified Information (OPNAVINST 5510.1) and other security regulations interpreted to meet specific needs of the NAVSEA Command.

2-3.7.2 Security Classification and Cognizant Activity of Electronic Equipment, MIL-HDBK-140.

This handbook is the Department of Defense's document which provides the official security classification and cognizance data of Air Force, Army, and Navy electronic equipments. It lists the official nomenclature, current security classification, engineering cognizance, procurement cognizance, and automatic time-phased downgrading information of equipments covered.

2-4 TRAINING

The principal objective of Navy training is to maintain a naval force in an optimum state of readiness for the defense of the United States. Navy training consists of fleet training, shipboard training, and naval school training. General policies for fleet training are stated in Ship Exercises, FXP-3-B, and (except for shakedown and refresher training) are discussed only briefly in this section. Shipboard training and naval school training, however, are discussed in considerable detail, especially as they pertain to the ship's electronics department. All three phases of Navy training are closely allied and contribute to the development of highly trained and fully qualified individuals who man the ships of our modem Navy.

2-4.1 FLEET TRAINING

Fleet training of ships is the responsibility of the Deputy Chief of Naval Operations for Fleet Operations and Readiness, and is controlled and supervised by the Commander in Chief, Atlantic Fleet, and the Commander in Chief, Pacific Fleet. The Fleet Commanders in Chief exercise their training responsibilities through their type commanders. This delegation of authority provides for battle readiness at every level of administrative command while assuring unity of purpose and uniformity of standards. Fleet type organization is illustrated in Figure 2-2. The fleet training command (Commander, Training Command) of each fleet assists the other type commanders by supplying services for programs and conducting training programs (shakedown and refresher training) as directed by the fleet commanders.

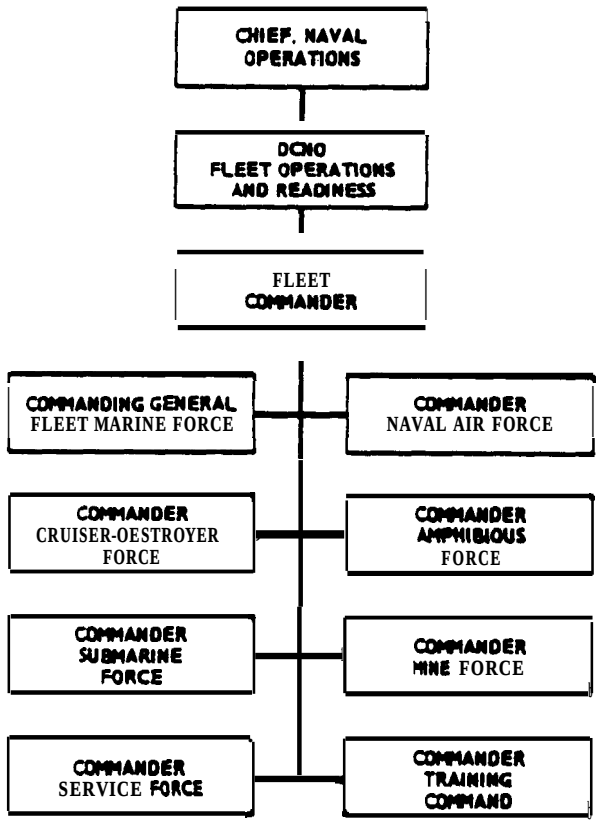

Figure 2-2. A Fleet Type Organization

The training cycle for each ship corresponds to the period between regularly scheduled shipyard overhauls. The most important feature of the training cycle is that it furnishes a basis for scheduling inspections and trials. The intratype competitive period corresponds to the fiscal year regardless of the training cycle. Fleet operating schedules are issued on both a quarterly and an annual basis, and govern many factors which must be taken into consideration in the planning of maintenance and training.

2-4.1.1 Types of Training Exercises

Type commanders prescribe the training exercises to be conducted by ships of the type during the intratype competitive period. The tactical commander of ships in a task force requires that ships of the force perform, either separately or in company with other ships, the exercises required by the type commanders.

Each type commander is responsible, under the fleet commander, for the administration and control of the training program of each ship assigned to his administrative command. In the discharge of his training responsibilities, the type commander (1) designates the required exercises and establishes minimum exercise requirements, (2) reallocates ammunition allotted to him by the fleet commander, (3) selects exercises to meet specific training requirements, (4) divides ships into competitive groups, (5) provides for observation of certain exercises by qualified observers, (6) appraises the performance of each ship, and (7) evaluates and maintains records of the overall performance of each ship. When awarding a final grade for performance, the type commander has broad authority and may weigh separate exercises and other performances, at his own discretion, to allow realistic evaluation of the ship's organization, discipline, and opportunities for training. The type commander may delegate his authority for fleet training (except for policy guidance) to subordinate commanders of units operating outside his supervision and observation.

Maximum benefit is derived from any training exercise when the performance of the exercise is properly observed and analyzed. If the exercise is to be graded, formal observation is mandatory. When the importance of the exercise justifies such assignment, the observation will be from the outside of the observed ship. The analysis of the exercise, in the form of a critique, is held as soon as practicable after the completion of the exercise to determine errors committed, deficiencies in material or procedures, and recommendations for improvement.

Exercise appraisal is based on the readiness of the ship to deal effectively with the situation simulated by the exercise. The effect of factors over which the ship has no control, however, is taken into consideration. The observing command submits a recommended grade along with the report of the exercises observed; however, the award of a final grade is the responsibility of the type commander (or a designated subordinate) and is aimed at establishing uniformity within the type. In the evaluation of readiness, consideration is given to the performance of basic exercises, the performance of prescribed exercises, and the handling of actual casualties which occur.

2-4.1.2 Shakedown and Refresher Training

After a ship has been commissioned and has completed fitting out, she undergoes shakedown training. A newly activated ship or a ship leaving a shipyard after regular overhaul undergoes refresher training. In either case, the ship is put through an intensive combat readiness

training period by a designated Fleet Training Group, under the direction of the Commander, Training Command, U. S. Atlantic or Pacific Fleet, as applicable. It is during this period which the Operational Readiness Inspection (ORI) is conducted.

Ships reporting for refresher training receive a training readiness evaluation inspection prior to the ORI. The purpose of this inspection is to determine the organizational and material readiness of the ship to commence refresher training. The inspection checkoff lists are based upon standards prescribed by Battle Control (U), NWIP 50-1( ), Naval Ships Technical Manual, and directives of the fleet commander and type commanders.

Immediately following the training readiness evaluation inspection, a critique is held and a complete written report of the discrepancies noted is left with the executive officer of the ship. A formal report is submitted to the Commander, Training Command, with a copy to the type commander. Those deficiencies which will affect refresher training should be corrected as soon as possible. It is expected that all deficiencies will be corrected prior to the ORI.

2-4.1.2.1 The **Fleet Treining Group**

The primary function of a Fleet Training Group (FTG) is to help ships train themselves. In implementation of this, training groups have been delegated authority to control and assignment of operating areas, to coordinate and regulate the conduct of training exercises, and to supply training services in their assigned operating areas.

A Fleet Training Group is generally divided into two sections–au administrative section and an afloat training section. The administrative section performs the work of scheduling the activities of ships undergoing training; it correlates such activities as target towing services, camera services, and dual ship exercises.

The afloat training section is organized into departments in the general pattern of shipboard organization. Their instructors also act as observers, advisors, and inspectors. In these capacities, they may offer constructive criticism or recommended improvements. At times they may assist with impromptu instruction, lectures, and demonstrations.

During battle problems, FTG personnel are observers both by title and function. They impose damage by setting up, as realistically as possible, various exercises and then observing action taken by ship's personnel to combat the imposed damage. They do not operate any equipment, but will endeavor to stop an evolution that may result in damage to equipment or injury to personnel.

FTG shipboard instructors have observed many ships in training; they know which methods work and have picked up many pointers both in training techniques and administrative procedures. When conditions following the day's exercises permit, the instructors conduct a critique with the ship's personnel involved in the training. During the critique, the instructors call attention to errors observed during drills, make recommendations for improvement, and answer questions concerning the training.

2-4.1.2.2 Operational **Readiness Inspection**

The purpose of the Operational Readiness Inspection is to evaluate the ability of the ship to perform her assigned mission. (See also, Subsection 2-12.2 Operational Readiness Inspection.) In addition to the final battle problem, ORI includes evaluation of the ability of the ship's Condition III Watch Organization to conduct a full power run, fight fires, rescue a man overboard, and render assistance to another ship. These drills and the full power run are usually conducted prior to the day of the final battle problem.

The final battle problem serves to familiarize the personnel of the ship with a full scale battle problem and the manner in which it is conducted. Insofar as practicable, the battle problem approximates wartime operations expected of the type ship involved.

2-4.2 SHIPBOARD TRAINING PROGRAM

Shipboard training and the maintenance of material are two of the major factors contributing to battle readiness. Neither can be said to be more important than the other except that training is a prerequisite to proper maintenance.

The shipboard training program must consider the organizational framework and operating schedules of the ship. The application phase of the training program involves the actual teaching of personnel and the evaluation of individual progress as well as the ability to function as a team. Analysis of the results of shipboard training entails (1) observation of team (group) and individual performance, (2) comparison of performance with standard criteria, and (3) recognition of methods for improvements. The effective sbipboard training program has as its objective the development of optimum individual and team efficiency.

The basis of all training is the development of skills in the individual. The individual is trained to fill successfully his billet aboard ship and to prepare for advancement in rating and for acceptance of more responsibilities. Team training, or training of a ship as a whole, can only be accomplished with a successful individual training program as a base.

2-4.2.1 **Training Organization**

The commanding officer heads the shipboard organization for training, as shown in Figure 2-3. The organization is responsible for phmning, coordinating, and conducting drills, classes, and instruction designed to increas$_e$th$_e$ specialized and general professional knowledge of the personnel of the command. The organization is governed in its actions by the policies and plans of higher authority-principally those of the type commander.

Close attention must be given to the training potentialities of the individual ship, and to the elimination of all but essential paperwork in the program. Training methods will vary from ship to ship, depending on the size, design, and personnel allowance; and each ship's training time must be carefully balanced with the time allotted for maintenance. The proper time apportionment must be made by officers who know existing shipboard training and maintenance conditions. Once a balance is established, programs for training and for maintenance should be carefully planned, executed, and controlled. The executive officer exercises overall supervision of the training program under the direction of the commanding officer.

2-4.2.1.1 **Planning Board for Training**

The ship's planning board for training is generally composed of the executive officer as chairman, the heads of departments, the training officer, and the educational services officer. (See Figure 2-3) The board performs the following generaf functions:

a. Advises and assists the commanding officer in the formulation of training policies.

b. Establishes the training program for the ship and periodically evaluates the training program by reviewing the schedules within the program.

c. Establishes a training syllabus for the training of junior officers and one for enlisted men.

The planning board meets periodically to evaluate progress, coordinate action, and propose changes to improve the training program

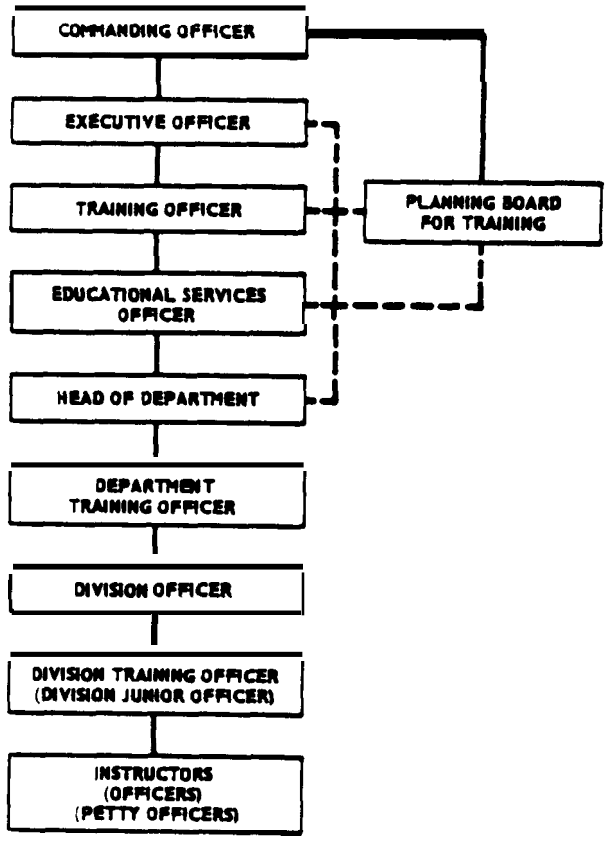

Figure 2-3. Shipboard Training Organization (Destroyer Type)

and future requirements. The personal knowIedge of members, the reports of the educational services officer, and the use of various control devices, all serve to indicate areas needing improvement.

Regardless of the care exercised in the development of the original training program, the need for changes will occur often. The following items should be examined periodically for their possible effect on the training program:

1. Changes in the nature of schedule of the ship's operations.

2. Installation of new or improved equipment.

3. Changes in the qualifications for advancement in rating.

4. Changes in personnel assignments.

5. Change in regulations or procedures under which the ship is operating.

6. Completion of any phase of the training program.

7. Increases or decreases in facilities or availability of fleet and bureau controlled training establishments.

2-4.2.1.2 Educational Services Officer

The Educational Services Officer (ESO) assists the executive officer in the administration of the training, information, and education programs of the ship. (See Figure 2-3.) In large ships it may be possible to assign the duties of the educational services officer to an officer as primary duty. In smaller ships, the duties may be assigned an officer as collateral duty or the executive officer may elect to perform the duties himself. The educational services officer performs the following duties:

a. Supervises the administration and operation of the training office and of the ship's training aids.

b. Serves as a member of the ship's planning board for training.

c. Maintains contact with fleet and bureau controlled training activities and advises the planning board for training and other ship's personnel of the use of facilities for training.

d. Secures quotas, as recommended by heads of departments, for personnel attending fleet or functional schools.

e. Assists examining boards by providing material and personnel as requested.

f. Schedules orientation and indoctrination courses for officer and enlisted personnel.

g. Directs the educational services program including the interviewing and counseling of personnel; processing of applications for officer, enlisted, and correspondence courses; administration of special and end-of-course tests; and assisting personnel in obtaining high school, college, business, and military education credits.

h. Processes applications and makes necessary interviews and tests for limited duty officer, Naval Academy Preparatory School, Officer Candidate School, and Naval Reserve Officer's Training Corps.

i. Prepares, maintains, and submits required training records and reports.

The ESO reports to the executive officer in the performance of assigned duties. The ESO collaborates with and advises department training officers and division training officers concerning the overall training program and the implementation of special training programs.

2-4.2.1.3 Division Training Officer

The duties of the division training officer are generally assigned as collateral duty for the junior division officer or are performed by the division officer. (See Figure 2-3.) As the assistant to the division officer for the administration and coordination of the division training program, the division training officer performs the following duties:

a. Plans, develops, and ensures the preparation of division training schedules, and obtains the training space and materials necessary to support the schedules.

b. Selects and trains instructors for the division.

c. Supervises the preparation of training material and reviews curriculums, courses, and lesson plans for the division.

d. Obtains, maintains custody of, and issues required training aids and devices.

e. Evaluates all instruction within the division.

f. Prepares, maintains, and submits training records and reports required of the division.

g. Initiates requisitions for training supplies and materials for the division.

h. Encourages division personnel to use available naval schools.

i. Encourages division personnel to further the advancement of their careers through use of Navy and Defense Activity for Non-Traditional Education Support (DANTES) correspondence courses.

The division training officer reports to the division officer for the performance of assigned duties. The division training officer consults with the electronics training officer and the educational services officer, as appropriate, in training matters affecting the division. The instructors of the division report to the division training officer.

2-4.2.1.4 **Instructors**

Every officer and petty officer must take an active part in the training program, and each is expected to be a competent instructor. (See Figure 2-3.) There is no better method for junior officers or petty officers to attain definite positions as leaders than by demonstrating ability as an instructor. Each instructor must be capable in his specialty and display a potential teaching ability that can be developed through training and experience.

The job of instructing is twofold. An instructor not only must pass on knowledge, but the instructor must develop certain attitudes in the personnel, The most effective method of teaching these attitudes is by example. The instructor must possess and constantly display these attitudes if the instructor is to be a good instructor.

Pride in the Navy is one of the major desirable attitudes the instructor must foster. To be proud of the Navy you must first be proud of your part in the Navy, and proud of those parts of it with which you come in contact. The instructor, because of being an immediate contact with the individual, is a symbol of the Navy. Everything that the instructor says and does should be calculated to foster pride in the Navy.

Respect for authority is another desirable attitude which the instructor must develop in the personnel. The instructor as a representative of authority, must be someone that the personnel can respect. In the matter of being correct in relationships with personnel, the instructor must be fair, firm, and friendly.

Many times in a career a sailor is called upon to exercise ingenuity. In order to develop a willingness to exercise ingenuity, the instructor must (by example or otherwise) show the person what ingenuity is and then give that person the technical knowledge with which to work. One way to do this is to encourage the individual to discuss makeshift or substitute materials or methods which may be used to accomplish tasks encountered on the job.

Enthusiasm plays an important role in teaching. The instructor who approaches a job with pride and vigor will find that the class will respond in a like manner. No one can be enthusiastic about anything which is felt is not important or useful. The wise instructor will always show the value of the things taught, An enthusiastic approach by the instructor, helps to develop (1) the desire to advance professionally, (2) pride in doing any job well, and (3) pride in doing more than is expected.

2-4.3 ELECTRONICS TRAINING

The primary purpose of the electronics training program must be to ensure that the personnel assigned to the electronics division know how to maintain the electronic equipment to ensure its peak performance. The electronics material officer (E MO) is responsible for establishing and supervising the training program. In addition, the EMO may be responsible for training equipment operators since the effectiveness of electronic equipment is also dependent on the operation of the equipment. The quantity and kinds of electronic equipment, the number and capabilities of the personnel on board, and the mission of the ship dictate the training needs.

2-4.3.1 ELECTRONICS MATERIAL OFFICER

The electronics material officer (EMO) is responsible, under the operations officer, for the readiness of all assigned electronic equipment; and for the administration of the electronics material maintenance, technical maintenance, and repair of all shipboard electronic equipment other than weapons control radar and equipment specifically assigned to another division. In ships having a combat systems department, the above general duties and the following special duties will be assumed by the Electronic Coordination Officer (ECO). The electronics coordination officer reports directly to the combat systems officer. The specific duties of the EMO are:

a. Be responsible for the maintenance and repair of all electronic equipment, excluding weapons control radar and equipment specifically assigned to another division.

b. Prepare and supervise the electronics preventive maintenance program.

c. Provide for maximum operational readiness of electronic equipment by means of operational tests and established maintenance procedures.

d. Provide for correct use, manipulation, maintenance, and repair of assigned electronic repair equipment.

e. Direct equipment modifications required by authorized field changes.

f. Establish and maintain a reporting and record system which wilJ provide, to all personnel concerned, current information regarding the material status of all electronic equipment under his cognizance.

g. Assist and advise operating personnel as requested by cognizant officers, including the CIC and communications officers, in the proper operational procedures and characteristics of electronic equipment, including performance capabilities and limitations.

h. Prepare, for forwarding through the engineer officer, work lists for shipyard availability repairs; and provide detailed specifications and information requests for shipyard work. Follow up work, in close liaison with shipyard officials, keeping informed of work progress; and carry out inspection of completed work.

i. Keep informed concerning the ship's current electronic equipment allowance, and ensure the requisitioning and procurement of authorized equipment; and, when necessary, supervise the installation of such equipment, subject to the approval of the operations officer, in order to maintain these allowances.

j. Act in an advisory capacity to the supply officer to ensure the proper requisitioning of electronic spare parts in accordance with the minimum requirements of the appropriate allowance lists, and ensure the ready availability of such spare parts.

k. Ensure the maintenance of accurate records of equipment changes, installations, repairs, and expenditure of repair funds in accordance with current instructions.

1. Ensure the preparation and submission of electronic material reports as required by NAVSEASYSCOM and the type commander.

m. Maintain a technical library including one or more copies of instruction books for each type of equipment under his cognizance and other related Navy manuals and commercial publications.

n. Establish and maintain a program for the training, supervision, and effective employment of assigned personnel.

o. Be responsible for the cleanliness and preservation of spaces assigned.

p. Keep informed of current developments in electronic equipment, maintenance and repair techniques, and so forth, especially that information which may effect the ship's electronic installation.

2-4.3.1.1 **What the EMO Does**

When new electronics personnel report aboard, their service records are examined by the electronics material officer. The EMO also interviews each person to get an idea of any previous experience, or interest in electronics, and to let the person know what is expected-as a member of the electronics division. Strikers are first assigned to work along with experienced personnel, and rated technicians newly reporting are assigned in accordance with their previous experience.

The EMO is ready and eager to talk with any of the personnel about their problems, either professional or personal. The EMO will find that from these talks can be learned additional details about the electronics installation rmd about how the division is working as a team as well as how a particular person is developing. The EMO finds, too, that these talks afford an opportunity to build toward team work through instilling a right attitude in the personnel as well as furthering their technical knowledge by discussing specific problems.

The EMO also explains to the personnel that before they can be considered eligible for advancement they must satisfactorily complete certain rate training manuals and fulfill both the military and practical requirements for advancement. These latter include satisfactory completion of the applicable practical factors listed in the Manpower and Personnel Classifications and Occupational Standards, NAVEDTRA 18068. They must also pass a Navy-wide competitive examination.

In addition they must complete any required formal schooling. The EMO makes it clear that completion of all of the above does not mean that they will be advanced immediately; they must await openings in the next higher pay grade in accordance with quotas and complements established by the Bureau of Naval Personnel. The EMO may do none of the actual instructing, but is responsible for the effectiveness of the training program. The EMO must know what suitable texts and training aids are available. To get this information, the EMO examines the latest edition of the List of Training Manuals and Correspondence Courses, NAVEDTRA 10061, the latest DANTES Catalog DoD 1322.8, and the U.S. Navy Film Catalog, OPNAVINST 3157.1.

In planning a training program, the EMO keeps in mind the other shipboard training programs and cooperates with the officers in charge of these in order that the personnel may receive proper training in the subjects required of all hands, such as damage control and seamanship.

2-4.3.2 **The Instructors**

In many ships, the leading technician, under the guidance of the EMO, administers the electronics training program; in other ships, one of the division petty officers may be assigned the collateral duty of training petty officer. All petty officers, however, participate in the training program. For example, one person may be assigned the task of presenting a lecture on safety precautions, another person to conduct a course on the use of test equipment, and still another to teach some other subject. Each person in the division is usually assigned responsibility for some area of training. All technicians have the added responsibility of training operators in the performance of their maintenance duties.

2-4.3.3 Navy Service Schools

The Navy provides through its various training activities, instruction and train-

ing in electronics to assist the forces afloat. Navy schools fall into the following types:

2-4.3.3.1 **Enlisted Service Schools**

Schools are designated as Class "A" or "C" to classify the level and type of training offered. Class-A schools offer the basic technical knowledge and skills required to prepare personnel for job entry level performance and further specialized training. Class-C schools offer the advanced knowledge, skills and techniques for personnel to perform a particular job in a billet. Class-C schools include the courses formerly identified as Class "B".

2-4.3.3.2 **Fleet Team Training Schools**

Fleet team training schools (Class "F") provide team training and refresher training to fleet enlisted personnel and officers. The team training courses are normally offered to members of ships' companies or to those enroute to duty as ships' companies. Refresher training offers operator and technical courses on a specific piece of equipment by a specialist in the field. The electronic equipment concerned is usually used for instruction and thus, provides on-the-job training. The courses are short and the knowledge gained for exceeds the loss of the person's time to the ship. The specific courses offered, their subject matter and the frequency with which they are given, are governed by the requirements of the fleet. The information concerning courses is promulgated locally and ships of a command are usually aware of them. If an electronics material officer desires that the rated technicians be instructed on a particular equipment for which a course does not presently exist, these needs should be made known and a special course requested. Ships can also request, through the type commander, that a mobile technical unit (MOTU) come aboard to provide instruction. (Refer to subsection 2-4.5.2), Mobile Technical Units, following.)

2-4.3.4 **Shipboard Classes and On-The-Job Training**

The EMO establishes classes in the fundamentals of electronics and electricity for the personnel who have not attended Class-A school. The purpose of classes in these subjects is to help the personnel understand the theory behind the practical work they are learning on the job, to increase their judgment of what practices are safe in working with equipment, and to give them sufficient background to obtain greater benefit from the studying they will do when sent to naval school for further training.

It is emphasized that the sailors major shipboard training is received on the job. Since the ultimate purpose of classes is to supplement on-the-job training, class work must be tied in as closely as possible with the sailors jobs.

To make the training as useful as possible, practical as well as theoretical problems are considered. One of the first practical things taught the personnel is the correct use and care of the tools they will use in their work. They are taught this both on the job and in classes through discussion, demonstration, and practice. They are taught also the purposes of the various electronics testing equipments and how to use and care for them.

The personnel are encouraged to bring to class problems they have had on the job. They explain the symptoms of an equipment failure and tell what they did to discover the cause of and to remedy the trouble. The technical manual, the service notes section of the equipment-oriented EIMB handbooks, and issues of the EIB for the equipment in question are brought out. Frequently the group goes to the equipment itself in order to understand just what caused the failure and the action taken to diagnose and remedy it. In this way, the personnel as a group learn from each other's individual experiences on the job.

In order that the personnel will appreciate the necessity for conserving maintenance parts and for timely requisitioning of replacements, the electronics material officer gives them a brief discussion of the fundamentals of electronics supply. The EMO indicates the publications that assist in identifying material, and the importance of submitting correctly completed requisitions.

The EMO explains electronics allowances and points out the routine established aboard his ship for stowing, accounting for, and requisitioning parts.

The electronics material officer takes advantage of visits of repair teams and contract field technicians (such as provided by MOTU) to arrange for as many of his personnel as possible to observe the work accomplished under the supervision of these skilled people and to talk with them about problems which have arisen on the job.

2-4.3.5 **Correspondence Courses**

Correspondence courses are still another method of training. The EMO should encourage the rated technicians to enroll in all applicable training courses. When they complete the required courses, they should be encouraged to take others that will help them when they take their examinations for promotion. Applications for

correspondence courses are handled by the educational services officer.

2-4.3.6 **Training of Operator Personnel**

It will be the responsibility of the senior electronics petty officer to train or ensure the training of operator personnel to properly perform the preventive maintenance procedures as outlined in the Planned Maintenance Sub-System (PMS) program, or as assigned by the EMO. The operator's duties should be limited to nontechnical procedures or to the performance of simple maintenance operations for which adequate training and supervision has been received. Improper or inadequate training of any of the personnel for the performance of the maintenance operations may result in unnecessary equipment breakdown andJor prove hazardous to personnel.

An operator should be trained to perform preventive maintenance only on those equipments to which assigned or may be assigned. The technician designated to train the operator should be the one that is assigned to maintain that specific equipment.

When qualified by the senior petty officer the operator should carry out authorized performance standards tests on electronic equipment to which assigned.

2-4.4 NAVSEA MINIATURE AND MICROMINIATURE (2M) ELECTRONIC REPAIR PROGRAM

This program is sponsored by the Chief of Naval Material, Washington, DC. NAVSEA 06C1 is the program manager.

The 2M program objective is to provide the Fleet with a miniature electronic repair capability at all maintenance levels afloat and ashore and a microminiature repair capability on selected ships, Intermediate Maintenance Activities (IMAs) and shore facilities. At each respective activity, repairs shall be made to those components that are Source, Maintenance and Recoverability (SM&R) coded on the Allowance Parts List (APL) for that maintenance level, Additionally, the program is intended to provide organizational and intermediate maintenance level activities with the capability to repair, on an emergency baais only, components coded for discard or depot maintenance. The 2M program is applicable to all systems containing miniaturehnicrominiature electronic components.

2-4.4.1 **Definitions**

2-4.4.1.1 Microelectronics

Microelectronics is that area of electronic technology associated with or applied to the realization of electronic systems from extremely small electronic parts or elements. Microelectronics includes extremely small circuits having a high equivalent circuit-element density, which is considered as a single part composed of interconnected elements on or within a single substrate to perform an electronic-circuit function. Included are all types of flatpacks, dual-in-line packages (DIPs), and other microelectronic packages. Generally, only external, bent, or broken connections can be repaired outside a laboratory. (This excludes, for example, printed wiring boards, circuit-card assemblies, and modules composed exclusively of discrete electronic parts.)

2-4.4.1.2 **Miniature Electronics**

Miniature electronics, which is not a clearly defined area of technology, includes miniature electronic packages such as PCBS and other assemblies and discrete components (excluding microelectronic packages) mounted thereon. "Mother" boards with plub-in PCBS and other assemblies are part of miniature electronics. PCBS and other assembly-mounted miniature electronics may include miniature motors, synchros, timers, optical and other encoders, sensors, relays, latches, trippers, interlocks and other miniature electronic/electrical devices.

2-4.4.1.3 2M **Repair.**

The NAVSEA 2M Program identifies two basic skill levels in electronic repair of miniature electronics.

2-4.4.1.4 Miniature **Electronic Repair**

Miniature repair includes all repairs to single-sided and double-sided PCBS and other miniature electronics up to and including: the removal and installation of DIPs and other microelectronic packages; the repair of PCB laminate and printed wiring; and conformal coating removal and application. These repairs can be satisfactorily made under this program only with proper training, parts and equipage approved for 2M use.

2-4.4.1.5 **Microminiature Electronic Repair**

Microminiature electronic repair of miniature electronics includes all the more delicate repairs requiring the use of more sophisticated equipment. Microminiature repair includes all repaire described under miniature electronic repair and, in addition, all repairs to multilayer PCBS and small "daughter" boards (too complex and densely packaged for miniature electronic repair) flexible PCBS, flexible printed circuit cables, and removal and installation of special connectors, eyelets, and terminals. Repairs may include electroplating,

microsoldenng, the use of a stereo microscope, or the complete rebuilding of all or part of a PCB or other miniature electronic assembly. Authorized repairs to optical encoders and edge-lighted panels are included in microminiature electronic repair.

2-4.4.1,6 2M Repair Limitations

Internal repair to microelectronic packages is not authorized under the 2M program. Similarly, internal repairs to special components and miniature assemblies which may be critically sensitive to frequency, voltage, temperature, etc., (such as miniature radio frequencylbalanced mixers) and require the use of special calibration equipment, are not authorized at the "O" and "I" level of maintenance under the 2M program. Normal 2M repair is limited to the levels and types of repair taught in the approved 2M training courses.

2-4.4.2 **Certification**

The primary means of ensuring quality assurance of the 2M program is annual certification of personnel and repair sites including equipment, tools and consumables. The only NAVSEA approved Allowance Equipage List (AEL) for the 2M miniature electronic repair technician is AEL No. 2-670034022. The only NAVSEA approved microminiature electronic repair technical AEL is No. 2-670034035. Mobile Technical Unit (MOTU) 2M trained inspectors designated by NAVSEA annually inspect and recertify 2M technicians and sites, To be certified a site must have on board two 2M technicians certified at the appropriate skill level for each 2M station installed.

2-4.4.2.1 **Station Certification/ Recertification Requirements**

Each authorized 2M repair station must maintain current certification status. The recertification process will consist of: Inspection to ensure equipment is available and in proper condition, inspection to ensure compliance with facility requirements, and ascertain that activity has on board two 2M technicians certified at the appropriate skill level.

2-4.4.2.1.1 **Equipment Requirements**

Miniature electronic repair stations shall be equipped with all items listed in Allowance Equipage List (AEL) No. 2-670034022 (Tools/ Equipment Miniature Electronic Repair).

Microminiature electronic repair stations shall be equipped with all items in AEL No. 2-670034035 (Tools/Equipment-Microminiatur, Electronic Repair).

NOTE

Since the skill levels acquired during training and initial certification were developed using this equipment, substitutions of required items must be kept to a minimum. When a question exists as to whether other equipment may be substituted for required items (i.e., the applicable AEL), 2M inspectors may provide technical advice. Questions unresolved by the 2M inspectors will be referred to NAVSEA 06 C12).

2-4.4.2.1.2 Facility requirements

Adequate facilities generally include consideration of lighting, ventilation, physical accommodations, security, and noise levels for each activity or work station. With the exception of requirements imposed by the Naval Environmental Health Center and other appropriate authorities for ship and shore work conditions, requirements will be tailored by each activity to optimize the effectiveness of this repair capability as dictated by local conditions.

The lighting requirement is to provide 100 footcandles, measured at the work surface, from a direct lighting source. Light-colored (i.e., white or off-white) ceilings, walls, and workbench tops will be used to complement the lighting provided.

Adequate ventilation is required due to toxic fumes given off by solder, coating, materials, grinding dust, and plating materials. Use of toxic and flammable substances, solvents, and especially coating compounds dictates the need for a ventilation system ducted to the outside to prevent contamination of normal closed ventilation systems. This is particularly important onboard ship. Vented hoods, ducts, or laminar flow installations exhausting outside must meet the minimum standards set by the Naval Environmental Health Center, e.g., when using tnchloroethane 1.1.1, there shall be no more than 350 parts per million of solvent in the atmosphere during any given eight-hour period.

Noise levels in the work area must be acceptable for exposure of personnel for normal work periods as approved for each activity involved (i.e., ship, IMA). Due to the tedious and tiring nature of this type of work, the noise levels will be as low as possible. Ear protectors may be used if necessary.

Work stations will be a minimum work surface 60 inches wide and 30 inches deep. Standard Navy desks are excellent, but standard shipboard workbenches are acceptable. Chairs, with backs and without arms, should be comfortably padded and of the proper, standard height to be compatible with work surfaces. The work surface should be white, heat resistant (formica or similar material), and have drawers or tool storage facilities.

A 2M work station shall be capable of becoming a static-free work station as specified in NAVSEA OD 46363, "Requirements for the Electrostatic Discharge Protection of Electronic Components and Assemblies". When so equipped, no work on energized circuits will be performed within three feet of the 2M work station.

No special power or equipment mounting is required. The repair equipment operates on 115 VAC, 60Hz power. A 15 ampere circuit is sufficient and should have six individual power receptacles.

2-4.4.2.2 **Technician Certification/ Recertification Requirements**

Knowledge, skills, and tasks which must be demonstrated to a satisfactory degree of proficiency in the certification and recertification process are specified below. Certification will normally be valid for a period of one year. Recertification of technicians should be obtained prior to extended deployments if current certification will lapse during that deployment. The appropnate inspector should be contacted by those requiring recertification to establish date and time of recertification inspection.

2-4.4 .2.2.1 **Initial Certification**

Initial certification will normally be accomplished through successful completion of training specified in NAVSEAINST 4790.17A.

2-4.4.2.2.2 **Recertification**

The recertification process for repair technicians consists of an evaluation of capabilities by a 2M inspector and includes:

a. Practical demonstration of repsir technician proficiency which, consists of demonstration of the knowledge and skills specified.

b. Evaluation of past repair work.

Recertification usually will be conducted at the technician's activity but may be accomplished at a MOTU. If required, on-the-job training may be provided by 2M inspectors to ensure technicians maintain current capability.

2-4.4.2.2.3 Performance Tests

Performance tests for recertification of individual technicians wiU require demonstration of acceptable knowledge and skill levels through accomplishment of certain representative repair tasks included below. Minor training and practice may be included if required for the technician to reach acceptable levels. By observing the processes and finished workplaces from these tasks, a qualified 2M inspector can accurately determine the technician's recertification (performance) level.

2-4.4.2.2.4 2M Miniature Electronic Repair Technician

A technician qualified to perform miniature electronic repairs will have demonstrated knowledge and skills. He must show his ability to perform consistently reliable repairs on miniature circuits to receive and maintain certification as a qualified miniature component repair technician. The knowledge and skills he must master and demonstrate include all of the following:

a. InstaUing and soldering components on printed circuit boards.

b. Removing conformal coating and potting compounds.

c. Resoldering and removing both miniature and microminiature components.

d. Repairing damaged circuit boards.

e. Hand soldering turret terminals.

f. Hand soldering hook and tab terminals.

g. Hand soldering bifurcated terminds.

h. Using solderable connector pins.

i. Maintaining the repair station.

j. Observing safety precautions as taught in the 2M miniature repair course.

k. Making high reliability microminiature solder connections on single- and double-sided PCBS.

1. Performing a valid analysis of the repair tasks required and the procedures necessary to accomplish repair.

2-4.4 .2.2.5 2M Microminiature Electronic Repair Technician

Technicians qualified to conduct microminiature component repairs will have demonstrated knowledge and skills superior to those of the average miniature component repair technician in performing the same types of repair. In addition, the microminiature technician will have mastered repair tasks that are beyond the capability of the miniature repair technician. Characteristics of component construction that necessitate a higher degree of skill and knowledge include: microminiature size of components; hard-to-remove conforma.1 coatings; susceptibility to damage; complexity of laminates; multilayer construction; high density package for discrete components; and extent of damage to the component undergoing repair. This type of repair also necessitates use of special tools. In addition to the skills listed above, the knowledge and skills the microminiature technician must master and demonstrate include all of the following:

a. Desoldenng and removing components in microminiature circuits.

b. Repairing microminiature and multilayer circuit board laminates and conductors.

c. Consistently making high reliability, microelectronic solder connections.

d. Splicing electrical wire.

e. Repairing microminiature solderabIe connectors.

f. Correcting disassembly, repairing, cleaning, and reassembling of digital encoders.

g. Repairing plastic edge-lighted panels and their conductors.

h. Electroplating electronic circuits, including edge connectors.

i. Maintaining and repairing the microminiature repair station and its components.

j. Demonstrating the ability to inspect microelectronic repairs and identifying defects in workmanship affecting reliability.

2-4.4.2.3 Issuance of Identification Cards

Upon successful completion of the applicable performance tests by the candidate, the 2M Inspector (i.e., MOTU, 2M school) will issue the appropriate card, record its issuance, and forward a completed NAVSEA 2M Program Certification/Recertification Card to NAVSEA 06C12. These cards are provided to inspectors by NAVSEASYSCOM (N AVSEA 06 C12), Washington, DC 20362.

2-4.4.2.4 Inspector Recertification Requirements

Each inspector will qualify for recertification annually by returning to Fleet Training Center, Norfolk, VA, or Advanced Electronics School Department, Service schools Command, San Diego, CA, for a three-day evaluationlupdate conducted by an instructor. Any changes to training course content, AELs, or techniques will be discussed at this time. The school will then make a recertification recommendation to NAVSEA. Inspector recertification will be provided by NAVSEA or its designated representative.

2-4.4.3 2M Training

Training courses are provided at NAVSEA sponsored schools at the following locations: Norfolk, VA; Charleston, SC; San Diego, CA; Mayport, FL (proposed) and Pearl Harbor, HI (proposed). Training is also available at 12 Naval Air Maintenance Training Detachments. The 2M miniature electronic repair course lasts 4 weeks and Microminiature course adds an additional 2 weeks.

2-4.4.4 supply support

Initial outfitting for ships (excluding new construction) is provided by NAVSEA 06C1. Other users such as new construction should obtain the initial equipments through NAVSEA 06C1, 2M Acquisition Engineering Agent, Naval Undersea Warfare Engineering Station (Code 2640) Keyport, WA. Consumable items are obtained via MILSTRIP by requesting activity.

Applicable documents include the following:

a. NAVSEAINST 4790.17 Miniature/Microminiature 2M Electronic Repair Program; responsibilities and procedures for

b. NAVSEA TEOOO-AA-HBK-010/2M, Repair Handbook

c. NAVSEA TEOOO-AA-HBK-02012M, Workmanship Standards

d. NAVSEA TEOOO-AA-HBK-030/2M, Reference Data

2-4.5 TECHNICAL ASSISTANCE FOR ELECTRONICS TRAINING

Ships may request assistance from electronic field engineers and Mobile Technical Units for the purpose of training shipboard electronics personnel in certain installation, maintenance, and operation philosophies.

2-4.5.1 Electronic Field Engineers

Electronic field engineers are civilian electronics personnel from commercial firms which are under contract with the Naval Sea Systems Command or Naval Electronic Systems Command. Their services are obtained by request to the appropriate operational or type commander. On-call engineering services are arranged by the appropriate systems command if the requested services are not already available through the Mobile Technical Units under Service Force Command.

Ordinarily, electronics work assigned to or undertaken by the field activities of the systems commands (i.e.) NAVSEA, NAVAIR, or NAVELEX is accomplished by naval military and civilian personnel. However, when necessary, NAVSEA or NAVELEX will provide the professional services of electronic field engineers. As directed by the appropriate systems command, electronic field engineers are assigned by contractors to shipyards, maintenance yards, and fleet service commands requiring their services.

They provide technical information to naval military and civilian personnel on unusual design, planning, installation, and maintenance problems associated with the introduction of new equipment. The major justification for their use, however, is their contribution in helping naval personnel to perform their duties more efficiently through training. At naval shipyards, for instance, they train and instruct shipyard personnel in the installation, checkout, and adjustment of equipment. Shop personnel are given detailed information on the fine points of equipment, maintenance, and techniques. On board ships, electronic field engineers familiarize the ship's force with the adjustment, maintenance, and operation of installed electronic equipment.

In addition, electronic field engineers train naval personnel at regularly established schools. These schools provide continuous training on such systems as ASW equipment, fire control radar, certain communication equipment, and other electronic equipment in use by the Navy.

2-4.5.2 Mobile Technical Units (MOTU)

Mobile Technical Units (MOTU) consists of civilian contract engineers, civil service and senior technical enlisted personnel. MOTU'S function is to promote the achievement of technical self-sufficiency of the operating forces primarily through on-the-job training in maintenance or operation of electronics and weapons equipments and through responsive technical assistance.

The responsibilities of MOTU include: training of fleet personnel; engineering and technical assistance of installations; electronics pretraining checkouts; recommending field changes or modifications; through the proper authorized engineering field service activity, to improve operation and reliability of equipment.

The services of MOTU can be obtained by contacting MOTU or the cognizant command directly, unless intermediate procedures are required by the type or operational commander, The following priorities will be utilized in scheduling technical assistance:

a. Casualty correction involving CASREPS.

b. Non-CASREPS casualty correction.

c. On-the-job training not related to immediate casualties.

d. Dedicated assistance programs such as AN/ULM-4 range, TEMPE ST, Miniature/Microminiature (2M) electronic repair program, EMI/WCAP.

e. Technical reviews.

f. Exercise ship radar not specifically related to casualties.

CO MN AVMATINST 4350.13 establishes MOTU as the primary contact point for weapons/electronics assistance and information.

Type Commander Instructions established MOTU'S as info addees for CASREPS and SITREPS on all electronic or ordnance related equipments, and provides additional information for MOTU utilization. Use of these instructions will simplify and accelerate requests for assistance and result in faster response time.

At the time services are provided, it is essential that equipment qualified technicians, preferably those regularly assigned to the equipment, be present when MOTU personnel are on board. Ship's Technicians are to perform the work required, advised and assisted by MOTU personnel. It is desired that a cognizant officer also be designated to coordinate details. The ship must provide test equipment in working condition, technical manuals, repair parts, and adequate working facilities so that MOTU personnel may carry out their assignment promptly and efficiently.

2-4.6 SOURCES OF TRAINING INFORMATION

The following sources of information will be useful in establishing and administering a

training program aboard ship:

a. NWP 50 (A), Chapter 10, Shipboard Procedures-Provides the basic policy and requirements as set forth by OPNAV.

b. NAVEDTRA 10052, Bibliography for Advancement E xamination Study—Lists the training courses and other publications prescribed for use by all personnel concerned with advancement in rating, training; and examinations. It is revised annually.

c. NAVEDTRA 10061—Lists training manuals and correspondence courses. It is revised semiannually and lists the latest available training manuals and correspondence courses.

d. NAVEDTRA 10500–Catalog of Navy Training Courses–Presents a compilation of general information concerning courses conducted at training activities under the management control of the Chief of Naval Personnel. In addition, information has been included concerning the Joint Colleges, Foreign Staff Colleges and schools of other branches of the Armed Services in which the Chief of Naval Personnel is granted a student quota. The catalog contains such information as course location, and convening schedule; a scope of instruction; and information concerning quota requests and the eligibility of personnel.

e. Catalogs of Training Courses—Prepared and distributed by various type commanders; and presented in the form of a publication-type instruction, a listing of all the courses under their management control for which they have quota control. Also include information for quota requests.

f. Fleet Training Command Publications and Directives.

g. DANTES Catalog; DoD 1322.8-C

h. NAVEDTRA 18068; Manpower and Personnel Classifications and Occupational Standards

i. U.S. Navy Film Catalog; OPNAVINST 3157-1

j. NAVEDTRA 10056 Military Requirements for Petty Officer 3 & 2

k. NAVEDTRA 10057 Military Requirements for Petty Officer 1 & C.

2-5 LEVELS OF EQUIPMENT MAINTENANCE

Three levels (or echelons) of equipment maintenance that will be performed within the Navy are prescribed by NAVMATINST 4700.4. The definitions of these three levels of equipment maintenance are included in the following subsections.

2-5.1 ORGANIZATIONAL MAINTENANCE

Organizational maintenance is that maintenance which is the responsibility of and performed by using organizations on its assigned equipment. Its phases normally consist of inspecting, servicing, lubricating, adjusting and the replacing of parts, minor assemblies and subassemblies. This normally includes shipboard maintenance of its own equipment, mobile or portable (van), unit or aircraft squadron maintenance, including scheduled preventive maintenance, and in the case of Civil Engineering Support Equipment (CESE) this is service station or field servicing.

2-5.2 INTERMEDIATE MAINTENANCE

Intermediate maintenance is that maintenance which is the responsibility of and performed by designated maintenance activities for direct support of using organizations. Its phases normally consist of calibration, repair or replacement of damaged or unserviceable parts, components, or assemblies; the emergency manufacture of non-available parts; and providing technical assistance to using organizations. This normally includes maintenance performed by aircraft carriers, by tenders in support of other ships, airwing/group maintenance departments, aircraft maintenance departments, public works centers, public works departments, public works transportation centers, and shore activities officially designated as such,

2-5.3 DEPOT MAINTENANCE

Depot maintenance is that maintenance performed on material requiring major overhaul or a complete rebuild of parts, assemblies, subassemblies, and end items, including the manufacture of parts, modifications, testing and reclamation as required. Depot maintenance serves to support lower categories of maintenance by providing technical assistance and performing that maintenance beyond their responsibility. Depot maintenance provides stocks of serviceable equipment by using more extensive facilities for repair than are available in lower level maintenance activities. This is normally that maintenance performed by the Naval Air Rework

Facilities, Depot Field Teams, Naval Ammunition Depots, Naval Ordnance Stations, Naval Weapons Stations, Naval Torpedo Stations, Naval Construction Battalion Centers, Polaris Missile Facilities, contractor depot level rework activities and at commercial facilities or Navy Shipyards (including Ship Repair Facilities) during availabilities designated "voyage repairs, " restricted, technical, regular overhauls and the like.

2-6 PREVENTIVE MAINTENANCE

Preventive maintenance is the systematic accomplishment of actions deemed necessary to reduce or eliminate the occurance of failures, and prolong the useful life of the equipment. All preventive maintenance actions are grouped into three basic categories: routine maintenance, testing, and adjusting. These categories are discussed briefly in the following subsections, however, a more useful knowledge of preventive maintenance can be acquired by understanding the programs which plan and schedule the routine maintenance, testing, and adjusting of equipment. These programs, the Performance Operation and Maintenance System for Electronics Equipment (POMSEE); the Planned Maintenance Sub-System (PMS); and the Reliability Centered Maintenance (RCM) program are discussed in Subsection 2-7.

2-6.1 ROUTINE MAINTENANCE

Routine maintenance is the application of special procedures of inspection, cleaning, and lubrication of equipment. They are special procedures in that approved and standard methods are employed whenever such maintenance actions are performed. For example, certain approved methods have been developed for the cleaning and lubrication of ball bearings. Whenever a ball bearing requires lubrication, it must first be cleaned using approved methods and solvents, and must then be lubricated with the proper lubricant. Included with the lubricating instructions are lubrication charts which specify approved lubricants and their general usage. Such approved methods are routine in that they apply whenever ball bearings are lubricated and must be accomplished periwlically.

Routine inspections include such actions as checking equipment ground straps for loose connections and broken or frayed straps, checking tightness of screws, bolts, and nuts, checking oil reservoirs for the proper quantity of oil, checking front panel indicators and illumination for burned-out bulbs, etc. Inspections of such require direct analysis and judgement by the person performing the check.

A source of routine inspection, cleaning, and lubrication procedures is contained in Section 3 of the General Maintenance EIMB, NAVSEA SEOOO-OO-EIM-160.

2-6.2 TESTING

Testing of electronic equipment involves the use of calibrated instruments to monitor or record the electrical, mechanical, and chemical properties of functions of the equipment's circuits and other devices for comparison with established standards. By observing the responses and indications of the test instruments, and by comparing the information presented with established standards, it can be determined if the circuit or device is functioning as it should.

The difference between a test, as explained here, and on inspection, as explained in the preceding subsection, is that a test involves the use of an instrument to present information representing a form or function of energy not perceivable by the human senses or which could be hazardous to health. With the information presented by the instrument, a person can then make an examination and analysis. Inspections require direct examination by human senses, normally sight and touch.

2-6.3 ADJUSTING

Adjusting of electronic equipment is a broad term which encompasses all phases of (1) adjustments to rearrange or change a function or characteristic, (2) circuit alignment which adjusts two or more sections of a circuit or system so their functions are properly synchronized, and (3) circuit calibration by which circuits or instruments of a given accuracy standard are checked against standards of higher accuracy and then aligned or adjusted accordingly. Sometimes other terms (e.g., collimation) are used to indicate special adjusting techniques. Collimation is the precise alignment of the mechanical system of a radar antenna, by comparison with an optical device aligned on known points in azimuth and elevation. It also applies to the process of making light rays or the paths of electrons or other particles in a beam parallel to or concentric with, each other. 4

2-7 PREVENTIVE MAINTENANCE PROGRAMS

An electronics preventive maintenance program consists of a schedule of inspections, tests, adjustments, and routine maintenance procedures and a system of checkoff lists to ensure that the schedule is carried out. The administration of such a program aboard ship requires that the preventive maintenance needs of every equipment be recognized, planned for, accomplished, and recorded.

The preventive maintenance program, developed to accomplish these tasks: is the Planned Maintenance Sub-System (PMS). This program, however, does not provide an efficient means for technicians to report certain maintenance problems. Such a system employing automatic data processing was then developed. This system, the Maintenance Data Collection Sub-System (MDCS), complements the PMS to form the basic Maintenance and Material Management (3-M) System.

2-7.1 MAINTENANCE AND MATERIAL MANAGEMENT (3-M) SYSTEM

The Maintenance and Material Management (3-M) System is an integrated management system which, when properly used, provides for orderly scheduling and accomplishment of maintenance and for reporting and disseminating significant maintenance related information. It is composed of two sub-systems, the PMS (Planned Maintenance Sub-System) and the MDCS (Maintenance Data Collection Sub-System); and it forms the nucleus of a shipboard maintenance program which can contribute significantly toward achieving improved fleet readiness with reduced expenditure of resources.

The 3-M System is not envisioned as a cure for all equipment problems and attendant maintenance resource demands, nor does it eliminate the urgent need for good leadership and supervision based on experience and reasoned judgment. The system will, however, produce a logical and efficient approach to the solution of maintenance problems, and a large reservoir of knowledge about maintenance. Proper application of these system products will result in improved equipment performance with less maintenance effort and will lead to meaningful improvements in equipment design and logistic support.

The primary objective of the Ship's Maintenance and Material Management System is to provide for managing maintenance and maintenance support in a manner which will ensure maximum equipment operational readiness. To this end, the intermediate objectives of the 3-M Systems are as follows:

a. Achievement of uniform maintenance standards and criteria.

b. Effective use of available manpower and material resources in maintenance and maintenance support efforts.

c. Documenting information relating to maintenance and maintenance support actions.

d. Improvement of maintainability and reliability of systems and equipment through analysis of documented maintenance information.

e. Provision of the means for reporting ship configuration changes.

f. Identification and reduction of the cost of maintenance and maintenance support in terms of manpower and material resources.

g. Reduction of the cost of accidental material damage by means of accurate identification and analysis of the cost.

The 3-M Systems is fully applicable to all ships, service craft, small boats, nonaviation fleet support equipment and equipment used ashore which is identical to shipboard equipment (in so far as the Planned Maintenance System is concerned). A separate OPNAV Installation will be issued for all other shore-based equipment.

The Ship's 3-M Systems include alf equipments installed in ships except fleet ballistic missile weapon systems, nuclear power plants and associated test equipment. Ships, service craft and small boats that are operated and maintained by civilian crews (Naval Stations, shipyards, repair facilities, etc.) are also excepted from the requirements of the 3-M Systems.

2-7.1.1 3-M SYSTEMS DESCRIPTION

The 3-M Systems are the nucleus for managing maintenance aboard all ships and selected shore stations of the Navy. They provide all maintenance and material managers throughout the Navy with the means to plan, acquire, organize, direct, control, and evaluate manpower and material resources expended or planned for expenditure in support of maintenance. Thus, it is essential that all hands recognize the importance of the Systems, and understand the role they play in assisting management to improve the material readiness of equipment in the Fleet. In referring to "management," the term is used in its broadest sense, including the work center on the ship as well as Navy Headquarters in Washington.

The Ships' 3-M Systems consist of those systems designed for maintenance management:

a. PMS (Planned Maintenance System)

(1) Inactive Equipment Maintenance (IEM)

b. MDS (Maintenance Data System)

(1) AMS (Alteration Management System)

(2) IMMS (Intermediate Maintenance Activity Maintenance Management System). The scope of these systems is as described below.

2-7.1.2 PMS (Planned Maintenance System)

PMS provides each user with a simple and standard means for planning, scheduling, controlling, and performing planned maintenance of all equipment. PMS is the most efficient means developed to date for using available maintenance resources.

PMS maintenance actions are the minimum required to maintain the equipment in a fully operable condition, within qualifications. If performed according to schedule, these maintenance actions will provide the means to identify parts requiring replacement prior to failure. PMS procedures are, therefore, preventive in nature in that they are designed to prevent future equipment failures which might otherwise result in repeated corrective maintenance actions.

These PMS procedures and the periodicities in which they are to be accomplished are developed for each piece of equipment baaed on good engineering practice, practical experience, and technical standards. These procedures are contained on cards designated Maintenance Requirement Cards (MRCS). MRCS provide the detailed procedures for performing the preventive maintenance and state who, what, when, how and with what resources a specific requirement is to be accomplished. Some MRCS have Equipment Guide Lists (EGLs) accompanying them to serve os location guides for identical equipments; such aa, motors, controllers, valves, life rafts, deck fittings, C02, bottles, etc., which are impractical to schedule individually for routine, periodic preventive maintenance.

PMS procedures me developed by the activities and offices of the Naval Material Command that are responsible for the development and procurement of the systems equipments for active, new construction, major conversion and activation ships, boats, and craft. PMS documentation [Maintenance Index Pages (MIPs) and Maintenance Requirements Cards (MRCS)] me developed as part of the Integrated Logistics Support (ILS) effort for all new procurements, reprocurements, alterations, and modifications of systems and equipments.

A MIP (Maintenance Index Page) contains a brief description of the requirements on the MRC(S) for each item of equipment, including the periodicity code, the estimated manhours involved, the recommended rates and, if applicable, the related maintenance requirements. The MIPs for all equipment for which a department is assigned the maintenance responsibility are contained in a departmental master PMS manual. This manual also contains an index of the effective MIPs, called a LOEP (List of Effective Pages). Report PMS 5. The Department Master PMS Manual is used by the department head as a scheduling tool when scheduling maintenance on the PMS schedule forms, and also as a cross--reference guide. Additionally, each work center has a Work Center PMS Record which is identical to the Departmental Master PMS Record, except that it contains only those MIPs and LOEPS applicable to the work center. The division officers, work center supervisors, and maintenance personnel use these records for cross-reference purposes. 4

The planning and scheduling of maintenance requirements are accomplished on the cycle, quarterly, and weekly schedules. Transferring maintenance requirements from the MIPs for each work center contained in the Departmental Master PMS Manual and scheduling them on the Cycle Schedule creates the ship's overhaul to overhaul planned maintenance schedule. Quarterly and Weekly Schedules are prepared, using the Cycle Schedule as a guide. Maintenance requirements indicated on the Weekly Schedule are assigned to specific personnel for accomplishment. Scheduled maintenance actions are crossed over with an "X" when they are completed, and actions not completed are circled and arrowed to a new scheduled date or left where it is if it is known that the action cannot be completed or if it is not known when it cau be completed. The c symbol is used to mark those requirements which have been satisfied by the successful completion of its parent system test. Quarterly Schedules are updated in the same manner.

Changes to PMS are issued by the NAVSEACEN (Naval Sea Support Center). (Atlantic and Pacific).

The PMS FBR Form (OPNAV Form 4790 7B) provides Fleet maintenance personnel

with the means to report discrepancies, problems, PSDA (Partial Source Data Automation) requirements, and to request PMS software. All PMS FBRs are sent to NAVSEACENS or TYCOMS (Type Commanders). based on the category of the FBR.

The procedures and tools of the PMS are discussed in detail in the Ship's 3-M Manual, Volume 1, OPNAVINST 4790.4.

2-7.1.2.1 **IEM (Inactive Equipment Maintenance)**

IEM provides PMS procedures modified and reduced for maintenance of systems and equipment during overhaul, availabilities, and other extended periods during which equipment is not operated.

a. IEM development commenced in 1974. This is an improved concept for modification of PMS during extended periods of equipment inactivation or nonoperation. IEM does not require separate PMS material and assistance from TYCOM teams to implement. Modified procedures to institute during appropriate periods are included on regular PMS documents.

2-7.1.3 **MDS (Maintenance Date System)**

MDS is the means by which maintenance personnel report corrective maintenance actions on specific categories of equipments (except for submarines who report corrective maintenance on all equipments). Information is retrievable from the TYCOM and the NAMSO (Navy Maintenance Support Office) data banks for analyzing maintenance and logistic support problems, for the development of the CSMP, and for generation of automated work requests for maintenance actions deferred for outside assistance.

It is a basic premise of the MDS that maintenance data will be recorded once and only once by fleet personnel and that the MDS data bank (not the maintenance activity) will thereafter provide information to all who have need for it in such form as may be required. In this connection, the NAMSO data bank is designed to be the focal point for receipt and distribution of maintenance and material data. Direct requests to the fleet for data which is available from the NAMSO imposes an unnecessary burden on the operating forces. It is the policy of the CNM (Chief of Naval Material) that the Naval Material Command minimize requests to the fleet for special data. However, if some such requests are deemed essential. Special requests for data will include a phrase "The NAMSO data bank has been queried and the data is not available. "

From the 3-M Systems central data bank maintained at NAMSO, numerous reports are already programmed and available upon request by any command. These reports yield data concerning equipment maintainability and reliability, manhour usage, equipment alteration status, material usage and costs, and fleet material condition. Many reports are produced periodically for users in both the Navy Shore Establishment and Operating Forces. General information concerning NAMSO products is contained in Chapter 4 of this manual. Detailed information is contained in NAMSOINST 4790.2. "An Outline and Guide for use in the Selection of Ships 3-M Information Reports."

From the deferred maintenance that is reported, a CSMP file is developed by the ADP (Automated Data Processing) facility designated by the TYCOM. From the CSMP file a series of computer reports is provided the ship andlor unit commander. These reports are also used by the TYCOM. The reports provide either a detailed or summary listing of deferred maintenance information in various format options. By-products of the CSMP include automated work packages, PRE-INSURV packages, etc. A package of AWRS (Automated Work Requests) is generated by the ADP facility for each ship prior to overhaul and availability periods. These packages contain work requests for CSMP items appropriate to the designated repair activity as well as standard work requests for routine jobs performed during Intermediate Maintenance Activity (IMA) and shipyard availabilities.

Prior to an inspection by the Board of Inspection and Survey, a package of automated INSURV items is generated by the TYCOM from all deferrals listed in a CSMP file. These items are in a format similar to AWRS. After the INSURV board has screened these items and assigned priority numbers, if appropriate, the package is used to update the CSMP.

The usefulness of MDS is dependent upon the accuracy, adequacy and timeliness of the information reported into the system. It is a system in which potential benefits are directly proportional to the efforts applied. Present programs for improving reliability, maintainability, and logistic support of Fleet equipment are dependent upon conscientious adherence to reporting procedures.

Much of the Fleet support effort resulting from use of 3-M Systems data is not always visible immediately to the Fleet because of the time span required to test, evaluate, and imple-

ment engineering and design changes. Correction of malfunctioning equipments through improvement in design often occur subsequent to reassignment of personnel who provided the information which precipitated the corrective action.

2-7.1.3.1 **AMS (Alteration Management System)**

The AMS is an automated accounting procedure designed to assist the Type Commander in fulfilling responsibilities toward monitoring and controlling the configuration of attached units and in satisfying the requirements of the Fleet Modernization Program (FMP). The AMS computer programs produce reports of the alteration in convenient formats so that the Type Commander may properly advise the Chief of Naval Operations concerning the structure of the FMP.

Procedures and tools of the MDCS are discussed in detail in the Ship's 3-M Manual, Volume 2, OPNAVINST 4790.4.

2-7.1.3.2 **IMMS (Intermediate Maintenance Activity Maintenance Management System)**

IMMS is comprised of computerized procedures used aboard tenders, repair ships, and repair bases' activities. These mechanized procedures are used to manage the planning, scheduling, production, and monitoring of the maintenance workloads of tended ships. Procedures and tools of the IMMS are discussed in detail in The Ships 3-M Manual, Volume 3, OPNAVINST 4790.4.

2-7.2 POMSEE PROGRAM

The Performance Operation and Maintenance Standards for Electronic Equipment (POMSEE) program was designed to help operational and maintenance personnel determine proper performance of electronic equipment. Specifically, the POMSEE program was designed to: (1) provide procedures for determining these standards on an equipment basis following initial installation (2) utilize these standards for reference purposes when checking equipment's performance during scheduled maintenance, and (3) provide a basis for check-out validation after repair and/or reinstallation of the equipment.

The requirement for establishing reference standards for electronic equipment after installation, and for using the reference standards procedures as a basis for equipment check-out after overhaul or restoration, continues in effect. In this respect, there has been no change in the POMSEE program since its initiation in 1956. (Refer to NAVSHIPSINST 9670.86, Shipboard POMSEE Program, Implementation of.) POMSEE is a valid test document for an electronics equipment after installation or reinstallation in a ship, and after all steps have been taken to ensure that the equipment is properly installed aud operating satisfactorily.

2-7.3 "RELIABILITY CENTERED MAINTENANCE (RCM)".

RCM is a methodology intended for use in developing the preventive maintenance tasks which, together, comprise the preventive maintenance program for a ship.

2-7.3.1 **RCM Application**

RCM provides an opportunity to apply reason—not dogma—to preventive maintenance program design. Well used, it will provide significant benefits. Where data are limited, unstructured judgment will always be offered as an alternative to analysis. Whatever the level of data available, a structured decision logic will provide better decisions. RCM is not a cure-all, but it is a logical way to attack important preventive maintenance task needs using the available information and knowledge that can be brought to the problem. Obviously, judgment has a role in this process. RCM is used after collecting the facts, not instead of collecting them. RCM does not presume that hardware needs preventive maintenance but uses knowledge about systems, their functions, and their failures to identify applicable and effective preventive maintenance tasks.

Applying RCM requires an understanding of each ship system, its failures, and the impact of these failures.

RCM is reliability-centered. Its objective is to maintain the inherent reliability of the design, recognizing that changes in inherent reliability are the province of design.

Rather than focusing immediately on subsystems or equipments RCM starts from the top by:

a. Partitioning the ships into systems and subsystems that require analysis;

b. Identifying functionally significant items;

c. Determining the maintenance requirements (tasks) for each significant item based on analysis of its functions, both evident and hidden, and its likely failures;

d. Determining when, how, and by whom each task will be done, and identifying needs for design change when safety is threatened

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by a failure for which there is no applicable and effective task; and

e, Using information obtained from operations and appropriate analytical techniques to adjust these intervals and revise task content.

RCM is intended to consider the total preventive maintenance program for a ship, irrespective of the level of the maintenance resources assigned to perform the required tasks. Therefore, it intends to include all echelons of preventive maintenance. Its ability to do this effectively requires an integrated organizational structure totally responsible for maintenance program planning and management.

2-7.3.2 **Analyst and Staff Training**

Preparing an RCM-based preventive maintenance program requires general training in RCM concepts and in use of the documentation specified in MIL-P-24534 (Navy), Appendix F. It is also important that you, as an analyst, be very familiar with the design, operating characteristics, and operating experience of the systems assigned. A team approach that includes participation of ship work center supervisors having current operating experience is a particularly useful way of acquiring knowledge about failures and failure modes that will ensure high quality analysis.

Preparing an RCM-based program is intended to be an innovative, creative search for applicable and effective tasks. You will do a better job by thinking about what should be done, rather than by reviewing the PM tasks that are being done on the system to which you are assigned. Further information on the RCM system may be obtained in NAVSEA 59081 -AB-GIB-010/ MAINT.

2-8 CORRECTIVE MAINTENANCE

Corrective maintenance of electronic equipment consists of the actions and operations needed to restore an inoperative equipment, or an equipment operating at reduced capability, to a fully operative condition. Corrective maintenance actions may be those needed to repair an equipment after a fire, to locate and then replace a defective component, or to locate a faulty function and then adjust its circuit for an output which is within specification. Common to each of these examples of corrective maintenance actions, and to all other corrective maintenance actions, is a sequence of three basic operations which are always performed. These actions, listed below, are discussed in the subsections which follow.

a. Symptom recognition

b. Malfunction location (troubleshooting)

c. Repair (organizational, intermediate, and depot levels)

2-8.1 SYMPTOM RECOGNITION

Symptom recognition is, perhaps, the weakest link of the three basic operations. Numerous incidents have occurred where malfunctioning equipment were operated for hours, days, and even months without any symptom of malfunction being recognized by anyone. Of course, repair was not affected and the equipment continued to operate, but in a status of reduced capability. How hazardous! The symptoms of many malfunctions are quite subtle and may not be easily recognized, even by highly skilled and experienced operators and technicians. Consequently, the need for trained operators and technicians in the methods of symptom recognition is very important. A good training aid is the equipment with which the operators and technicians are responsible. They must know proper equipment operation, they must know what function each operating control performs, and they must know the function of each operating mode even of those rarely used.

Symptom recognition may be difficult under electronic countermeasures (ECM) attack, but consider the probable consequences if corrective action is not taken, because the symptom was not reported to a technician, In many cases, a mode change or the adjustment of an operator's control is all that is needed.

Very often, a competent equipment operator can see or sense a malfunction in an equipment, which the operator can correct without the aid of a technician. The operator is qualified to make some adjustments and changes to an equipment, provided they do not require a high degree of technical skill. Operators who are not technically qualified technicians on the equipment they operate are still responsible for reporting a malfunction or a probable symptom of malfunction to the electronic technician.

Not all equipments produce symptoms that are easily recognized and may be discovered while performing preventive maintenance. It is important that the "not so apparent" as well as the apparent troubles be recognized.

2-8.2 MALFUNCTION LOCATION

The process of malfunction location, or more appropriately stated—troubleshooting, begins after a symptom of malfunction has been recognized and terminates when the cause of the malfunction has been located and verified. But, what else can be said about troubleshooting? Technicians, operators, and others who have worked with electronic equipment or with any other type of equipment consisting of two or more repairable or replaceable parts, know what troubleshooting is. But, then, why does so much down-time occur?

Modern electronic equipment is extremely complex because there is so much interfacing and interacting circuitry, and to troubleshoot such equipment can be exasperating. It should be apparent that troubleshooting efficiency depends on the knowledge that one has of the operation of the equipment as well as the technical aspects. This is very important. You must know what the equipment does before you cam determine what it is not doing or is doing incorrectly. To troubleshoot efficiently, five logical operations must be performed. These operations are listed below and are discussed subsequently:

a. Identifying the symptom
b. Identifying the malfunction
c. Localizing the malfunction
d. Locating the cause of malfunction
e. Failure analysis

2-8.2.1 Identifying the Symptom

After an equipment trouble has been recognized, all the available aids designed into the equipment should be used to further elaborate on the symptom. Use of front panel controls and other built-in indicating and testing aids should provide better identification of the symptom. The equipment operation section of technical manuals may serve as a guide.

2-8.2.2 Identifying the Malfunction

The next step in troubleshooting is to formulate a number of logical choices as to the basic cause of the symptom, or what function is at fault. The logical choices should be mentaJ decisions based on knowledge of equipment operation, a full identification of the symptom, and information contained in technical manuals. The overall functional description with associated block diagrams of technical manuals can help the electronics technician formulate logical choices.

2-8.2.3 Localizing the Malfunction

Now, that the malfunction is identified, its basic source must be localized to a circuit, group of circuits, unit, or equipment. Localizing the malfunction is normally accomplished by using the servicing block diagrams in technical manuals. The logical choices should be tested by following the signal flow of a function believed to be at fault through the diagrams in an order that will require the least time. If one test does not prove that a particular function is at fault, the next choice should be tested, and so on, until the faulty function or basic cause of the symptom is localized.

2-8.2.4 Locating the Cause of Malfunction

Once the malfunction is localized, it may be necessary to make additional choices as to which circuit, or group of circuits is at fault. Again, the servicing block diagrams supported with these parameters are used, along with schematics and other test location information that may be helpful in bracketing the faulty circuit. If the trouble is not immediately apparent, test methods are then necessary to further isolate the fault. Of the most common test methods are waveform analysis, voltage checks, resistance checks, tube testing, semiconductor testing, and module testing. This process continues until the specific cause is located. Examples of specific causes are defective components, improper wiring and soldering of components and terminations, loose connectors and shielding, covers left off of circuits and equipment cabinets, circuits not in proper electrical alignment, and dirty air filters.

2-8.2.5 Failure Analysis

After the faulty component, misalignment, etc., has been located, but prior to making the repair, the procedures followed up to this point should be reviewed to determine exactly why the fault affected the equipment in the manner it did. This review is usually necessary to make certain that the fault discovered is actually the cause of the malfunction, and not just the result of the malfunction. For example, a defective transistor may have caused the loss of a certain function. Upon analysis, it may be determined that insufficient cooling of the transistor caused it to fail. The real culprit could be merely a dirty air filter or an improperly installed heat sink. In addition to replacing the faulty transistor, the cause of overheating must also be corrected.

2-8.3 REPAIR AT THE ORGANIZATIONAL LEVEL (SHIPS FORCE REPAIR)

Regardless which preventive maintenance program is employed or how effective the program is, electronic equipment will continue to

malfunction and be deranged by battle, foul weather, accidents, etc. Most equipment malfunctions and minor darnage can be repaired by the ship's force, but the more severe casualties may necessitate repair at the intermediate or depot level.

Each ship should, insofar as practicable, be self-sustaining with regard to normal repairs. Each ship should be well supplied with materials, repair parts, and tools test equipment so that much of its own repair work can be accomplished by ship's force. Repairs should be undertaken under the supervision of the most competent and experienced personnel. Personnel not familiar with specific repairs and tests should be instructed to take advantage of shipyard or repsir ship availabilities or tender assignments to observe how such work is undertaken.

An interdepartment routine request for work requiring assistance by another shipboard department is referred to as a ship's work request. Such a form enforces proper channeling of work request between departments, and permits the settings up of priorities of available manpower and facilities, The work request form, the 4790-2K Maintenance Data Form, should be utilized to request interdepartment work.

2-8.4 REPAIR AT THE INTERMEDIATE AND DEPOT LEVELS

Ships can operate only a certain length of time without repairs. To keep a ship in prime condition, constant attention must be given to the material upkeep and definite intervals of time must be allotted for overhaul work, repairs, and alterations.

The control and disposition of a ship is at all times a function of certain operating commands. A commanding officer, therefore, may not, informally take a ship to a shipyard or alongside a tender or repair ship for repairs. Instead, when there is a need for assistance at the intermediate or depot level, the commanding officer informs the type commander, or in some cases, the operational commander, who assigns an availability at a repair activity.

2-8.4.1 Ship Availabilities

As it applies to work on naval ships, an availability is a period of time assigned a ship by competent authority for the accomplishment of corrective maintenance at a repair activity. During certain availabilities a ship may be incapable of engaging in fleet operations and the operating schedule is adjusted accordingly. Only the authority granting the availability can alter or extend the period of the availability; however, a repair activity may request that the ship's availability be extended so that work can be completed or recommend a completion date to the authority granting the availability.

The following paragraphs describe the types of availabilities for U.S. Naval ships. These availabilities vary with the purpose of their assignments.

2-8.4.1.1 Restricted Availability

A restricted availability is an availability for the accomplishment of specific items of work by a repsir activity, normally with the ship present, during which period the ship is rendered incapable of fully performing its assigned mission and tasks due to the nature of the repsir work. (This availability applies to shipyards only.) For example. Assume that a leak is discovered in the sonar dome, Since it is necessary that the ship be in dry dock for the repair of the dome, the commanding officer would request restricted availability for the repair of the specific item. If additional urgent repairs of a kind requiring shipyard accomplishment are discovered after the ship is in the yard, accomplishment must be requested from the type commander. Additional repairs may be undertaken during a restricted availability, provialed that they can be accomplished within the time required to repair the specific items for which availability was requested, and provided that funds are available. Routine shipyard repsirs, however will not be accomplished during a restricted availability. They will be deferred until the ship's regular overhaul period.

2-8,4.1.2 Technical Availability

A technical availability is an availability for the accomplishment of specific items of work by a repair activity, normally with the ship not present, during which period the ship's ability of fully performing its assigned mission and tasks is not affected by the nature of the repair work. (This availability applies to shipyards only.) For example, should a component of an equipment require repair and the component, such as an amplidyne motor, can be removed and repaired without the ship being present, a technical availability would be requested. The item to be repaired would be removed, repaired, and then returned to the ship. The request for a technical availability must be approved by the type commander. If the type commander approves the request, he makes the arrangements and provides funds for the availability.

2-8.4.1.3 Regular Overhaul

A regular overhaul is an availability for the accomplishment of general repairs and alterations at a naval shipyard or other shore-based repair activity, normally scheduled in advance and in accordance with au established cycle.

2-8.4.1.4 **Voyage Repairs**

Voyage repairs, which apply to shipyards work only, are emergency repairs necessary to enable a ship to continue on its assigned mission and can be accomplished without requiring a change in the ship's operating schedule or the general steaming notice in effect. For example, a ship may be scheduled to be in port for a week, at which time emergency repairs may be accomplished by such repair facilities as are available.

2-8.4,1.5 **Regular Tender Availability**

A regular tender availability is an availability for the accomplishment of general repairs and authorized alterations which are beyond the capacity of the ship's force alongside a tender of repair ship. It is normally scheduled in advance.

2-8.4.1.6 **Upkeep Period**

An upkeep period is a period of time assigned a ship, while moored or anchored, by competent authority for the uninterrupted accomplishment of work by the ship's force or other forces afloat.

2-8.4.1.7 **Supply Availability**

A supply availability is a period of time assigned a ship for the uninterrupted accomplishment of a supply overhaul. (A supply overhaul is the work involved in the purification and adjustment of on-board stocks and records to bring them into conformity with prescribed allowances or other stockage objective criteria.) A supply availability is normally scheduled to coincide with a regular overhaul.

2-8.4.2 **Repair Activities**

Repair activities afloat include repair ships and tenders. Repair activities ashore include naval shipyards, private shipyards under contract with the Navy, and naval ship repair facilities (usually located outside the continental limits of the United States). The repairs and alterations that are within the capacity of a ship's force are accomplished by the ship's force. Repairs and alterations that are beyond the capacity of a ship's force may be accomplished by repair activities afloat or ashore as directed by the cognizant type commander or other authority assigning the availability.

Repair ships and tenders are normally available to fleet and type commanders for the accomplishment of regular tender availabilities, emergency tender availabilities, parent tendedautomatic availabilities, and concurrent availabilities. Work that is beyond the capacity of the repair ships and tenders may be accomplished by repair activities ashore. In addition to the type of work requesti, the availability of funds and the workload of available repair activities govern the assignment of repair work that is beyond the capacity of the ship's force.

The placement and administration of contracts for the repair or overhaul of naval ships at private shipyards are functions of an Office of the Supervisor of Shipbuilding (SUPSHIP) of the naval district in which the shipyard is located.

2-8.4.2.1 **Repair Ships and Tenders**

In order to provide adequate facilities for unusual repair requirements and to meet varying operational commitments, particularly of ships deployed outside the continental United States, the ship assignments to the various repair activities afloat are flexible. The final assignment is usually made by message, designating the activity and the period and type of availability. These assignments are made by either the fleet or type commander.

Ships are scheduled for a regular tender availability or an upkeep period alongside repair ships or tenders at certain intervals of time which vary with different types of ships. The availability periods, which are usually planned far in advance, depend upon the quarterly employment schedule of the ship concerned.

When a ship receives its employment schedule, or is otherwise notified, it can begin to prepare the necessary paperwork in advance of the scheduled availability period. The requirement for maintenance assistance (work request) is accomplished on the Ship's Maintenance Action Form (2-KILO) (OPNAV 4790-2 K).

The work requests, with the required number of copies, are sent with a forwarding letter to the type commander or an authorized representative. The staff officer handling material and maintenance screens the work requests. Most of the ship's availability work list items are approved and authorized. Also, the ship may have to furnish more detailed information on certain work requests. The amount of corrective action taken by the reviewing staff officer will depend upon how well the work requests are written and the extent to which they follow established policies and pro-

cedures. Upon the completion of this screening, the ship's work requests are forwarded to the repair ship or tender. This is done well in advance of the assigned period of availability so that the repair department personnel can schedule the work and make any necessary preparations.

2-8.4.2.2 **Ship Repair Facilities**

Ship repair facilities (SRF) are located outside the continental limits of the United States. employ civilian personnel indigenous to the country in which they are located, and are supervised by naval officers assisted by enlisted and civil service personnel. An SRF has dry docks and shops capable of accomplishing nearly all ship repair work. Typical utilization includes voyage repairs, restricted availabilities, and overhaul of ships whose home ports are not in the area.

An SRF is a component of a fleet activity or a shore-based naval activity which exercises military area coordination. The mission of an SRF is as follows:

a. Provide logistic support, including drydocking, overhaul, repair, alteration, and conversion of naval ships and service craft and ships of other Government departments, as assigned.

b. Perform voyage repairs and related work, including drydocking of naval ships.

c. Install and maintain shore-based electronic equipment and provide technical guidance to assigned naval activities.

d. Perform additional related functions requested by competent authority.

2-8.4.2.3 **Naval Shipyards**

Naval shipyards are under the command of the Chief of Naval Material; primary support is provided by the Naval Ship Systems Command. Naval shipyards perform the following tasks and functions:

a. Provide logistic support to activities and units of the active fleet of the U.S. Navy and the naval shore establishment.

b. Perform authorized shipwork in connection with the new construction, conversion, overhaul, repair, alteration, activation, inactivation, and outfitting of naval ships and service craft.

c. Design naval ships.

d. Operate as planning yards for ship alterations and prepare allowance lists for ships under construction and conversion.

e. Perform research, development, test, and evaluation work as assigned.

f. Serve as primary and secondary stock points for designated material controlled by systems commands and offices of the Navy Department.

g. Provide accounting civil payroll, public works, industrial relations, medical, dental, berthing, messing, fire protection, security, and other services to naval activities and other governmental agencies as assigned.

h. Perform work for other U.S. Government departments, private parties, and foreign governments, as directed by competent authority.

A shop in a naval shipyard is assigned certain specific work, usually by trades, and manned with specifically trained and qualified personnel adept in the type of work assigned. The shop usually performs its peculiar type of work for the entire yard. Most of the shops are assigned to the production department. All production department shops are under the supervision of the production officer. Each shop group is under the control of a civilian group master.

A typical production department shop group organization is shown in Figure 2-4. Each shop is assigned a number and a name. Certain shops are not located in some shipyards; some shops, however, are common to all shipyards. At some shipyards, certain shops may be combined with another shop.

To ensure that service is rendered to the fleet more effectively, each ship in the active fleet is assigned a home yard by the Chief of Naval Operations. Two naval shipyards (one on the east coast, and one on the west coast) are designated as planning shipyards for each of the various ship types. A home shipyard is the naval shipyard to which a ship is usually assigned for regular overhaul. The concept of home shipyards, with regularity in repetition of overhauling and dealing with the same ship, promotes a stability in relationships between the ship and the naval shipyard. The yard forces gain a familiarity with the material condition of the ship and with the ship's personnel; the ship's force learns the physical layout of the shipyard and its capabilities and gains an acquaintance ship with key yard personnel.

Regularity in assignment of work permits a better analysis and uniformity of workload. Home shipyards maintain certain basic records on assigned ships which serve as a continual source of reference. Records are maintained on outstanding job orders with the status of both physical completion and material deliveries. Finished plans and allowance lists, consisting of hull, machinery, navigation, and ordnance items, are filed and

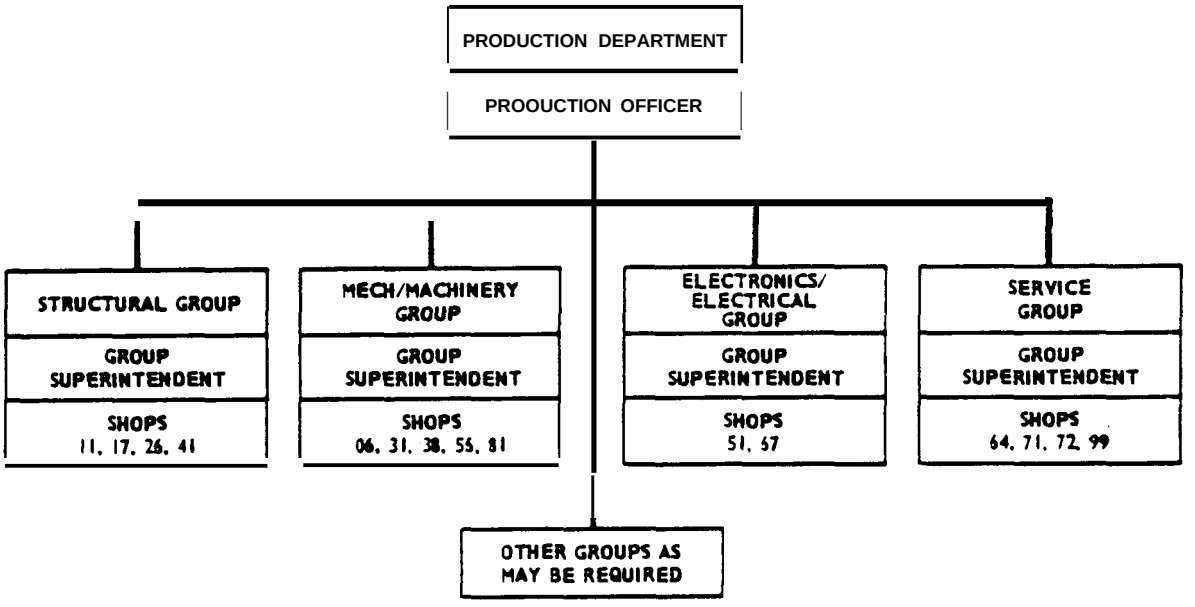


Figure 2-4. Shop Group Organization of the Production Department

maintained current. Thus, for each item of work, the time required for familiarization and investigation of details is held to a minimum, permitting more time to be devoted to actual work accomplished.

As a further expansion on permanency of relationship between ships and naval shipyards, each class of ship has been assigned a planning shipyard. A planning shipyard undertakes the design work for the class of ship assigned it and, when authorized, procures material required by other overhauling yards for the accomplishment of work affecting all the ships of the class. It can readily be seen that with several shipyards overhauling the same class of destroyers on the east coast, an economy in the use of design manpower is gained if this work is performed in only one yard and the developed plans supplied to the others.

2-9 CLASSES OF OVERHAUL WORK

Five classes of overhaul (A, B, C, D, and E) define the type of overhaul work to be performed, and should not be confused with the term "regular overhaul." A regular overhaul, as defined earlier, is a scheduled availability for a ship during which time needed maintenance is performed and equipment improvements are made. The classes of overhaul describe the type and scope of work which is required of each equipment.

2-9.1 CLASS "A" OVERHAUL

A class "a" overhaul includes that work which requires such overhaul, repairs, or modifications (e.g., field changes, ORDALTS, SPALTS, or SHIPALTS) as will sustain or improve the operating and performance characteristics of the system, sub-system or component to meet its most recent design and technical specifications. The end product should be in a "like-new" condition in appearance, operation, and performance. All manufacturers' and technical manual performance standards and specifications, unless superseded by proper authority, will be met as will all technicaf documentation. The repair activity will demonstrate that the end product successfully meets all performance criteria specified by the governing specifications. Defining an overhaul as Class "A" means that all actions required to meet the definition are authorized. The definition is applicable to all components, sub-systems and systems whether machinery/electrical/hull, electronics or weapons, without regard to equipment cost, size or complexity. Thus, a Class "A" overhaul of a IO-horsepower motor is just as much Class "A" as that of a radar set or a boiler; although the demands on resources differ greatly.

2-9.2 CLASS "B" OVERHAUL

A Class "B" overhaul includes that work which requires such overhaul or repairs as

will restore the operating and performance characteristics of a system, sub-system or component to its "original" design and technical specifications. If it is required to restore the operating and performance characteristics of an item to meet its service application, it must be so specified and the performance criteria defined. SHIPALTS, ORDALTS, SPALTS, field changes, and other modifications, even if applicable, are not to be accomplished unless specified by the customer. Maintenance adjustment and calibration routines specified by the applicable instruction manual, unless superseded by authority, are required. The repair activity will demonstrate that the end product successfully meets all performance criteria specified by the governing specifications.

2-9.3 CLASS "C" OVERHAUL

A Class "C" overhaul includes repair work on a system, sub-system or component specified by the work request or that work required to correct the particular deficient conditions or malfunctions specified by the customer. The repair activity must demonstrate that the work requested has been accomplished or that the conditionslmalfunctions described have been corrected, but the repairing activity has no responsibility for the repair or proper operation of the associated components of the equipment or for the operation of the systemlsub-system equipment as a whole.

2-9.4 CLASS "D" OVERHAUL

A Class "D" overhaul includes that work associated with the "open, inspect and report" type of work request where the customer cannot be specific about what is or may be wrong with the item. This class of work is intended to be diagnostic in nature and thus depending on the type of equipment, may require various tests, followed by inspection to assist in a complete diagnosis. The repair activity will report findings, recommendations and cost estimates to the customer for authorization prior to any repair work being accomplished. When requested by the customer, minor repairs and adjustments may be accomplished without prior authorization to the extent specified.

2-9.5 CLASS "E" OVERHAUL

A Class "E" overhaul includes that work required to incorporate all alterations and modifications specified for a designated system, sub-system, or component. The repair activity will demonstrate the successful checkout of the work accomplished to assure compliance with the performance standards established for the modification only to the extent of the work performed. When required by the customer, the repair activity will conduct system tests to prove system operability through affected interfaces. Repairs, if any, are minor in nature.

2-1o ALTERATIONS TO SHIPS AND EQUIPMENT

An alteration to a naval ship is defined as any change in the hull, machinery, equipment, or fittings that involves a change in design, materials, number, location, or relationship of the component parts of an assembly regardless of whether it is undertaken separately from, identical to, or in conjunction with, repairs.

2-10.1 CATEGORIES OF ALTERATIONS

Alterations to navaJ ships, whether they be promulgated as Ship Alterations (S HIPALTS) or Ordnance Alterations (ORDALTS) by the Naval Sea Systems Command (NAVSEA), Special Project Alterations (SPALTS) by the Project Offices of the systems commands or as designated by the Chief of Naval Material, or as any other systems command controlled alteration or modification (except electronic equipment field changes) are categorized by one of the following three terms:

2-10.1.1 **Military Alteration**

A military alteration is one which changes or improves the operational or military characteristics of a ship.

2-10.1.2 **Technical Alteration**

A technical alteration is one which does not affect the operational or military characteristics of a ship. In general, technical alterations concern matters of safety of personnel and equipment and effectiveness of equipment performance.

2-10.1.3 Alteration-Equivalent-to-Repair.

An alteration-equivalent-to-repair (AER) is an alteration which meets one of the following conditions:

a. The substitution, without change in design, of different materials which have prior approval of the cognizant systems command for similar use and which are available from standard stock.

b. The replacement of worn or damaged parts, assemblies, or equipments requiring renewal by those of later and more efficient

design previously approved by the cognizant systems command.

c. The strengthening of parts which require repair or replacement in order to improve reliability of the parts and of the unit, provided no other change in design is involved.

d. Minor modifications involving no significant changes in design or functioning of equipment, but considered essential to eliminate recurrence of unsatisfactory conditions.

2-10.2 AUTHORITY FOR THE APPROVAL AND AUTHORIZATION OF ALTERATIONS

The word "approve" used in correction with an alteration indicates an action of approval of a proposed change. Promulgation of an approved alteration constitutes authority to expend design resources to plan for the accomplishment, but does not constitute authority to procure material or accomplish the alteration. The word "authorize" is used to signify permission to proceed with the installation and the granting of funds for a particular ship during a particular availability.

Alterations affecting the military characteristics of a ship (i.e., military alterations) may be approved only by the Chief of Naval Operations who shall establish the priority for the accomplishment of such alterations by the systems commands concerned.

Alterations not affecting the military characteristics of a ship (i.e., technical alterations) may be approved and authorized for accomplishment by the systems command concerned without reference to the Chief of Naval Operations.

Alterations-equivalent-to-repairs may be approved and authorized for accomplishment by fleet type commanders to the extent that such authority has been delegated to them by the systems commands concerned.

2-10.3 UNAUTHORIZED MODIFICATIONS

Alterations shall not be made unless previously approved and authorized for accomplishment by competent authority or unless accomplished for emergency purposes. Unauthorized alterations to electronic equipment, or to cabling and wiring which affect existing systems or approved plans, must be reported to NAVSEA and to any other applicable cognizance systems command, upon their determination. Appropriate action should then be taken to correct them or to obtain approval for them. Annual inspections and other inspections and tests performed must be carried out with a view to revealing unauthorized alterations. d

2-10.4 EMERGENCY ALTERATIONS

Alterations accomplished for emergency purposes, where advance authorization is impossible, must be reported to NAVSEA and to other cognizance hardware systems commands (if applicable) at the earliest practical time, and authorization requested. (See Subsection 2-10.5 following.)

When circumstances warrant emergency alterations, adequate consideration should be given to the safety of personnel and equipment and to the basic equipment performance requirements. 4

2-10.5 REQUESTING THE APPROVAL OF NON-AUTHORIZED ALTERATIONS

Requests for the approval of alterations to the ship or ship's equipment or systems shall be forwarded to NAVSEA via the applicable type commander (with an information copy to the type commander of the opposite fleet.) The two type commanders will then forward to NAVSEA their recommendations concerning the proposed (or emergency) alteration and a list of ships affected.

2-10.6 SHIP ALTERATIONS (SHIPALTS)

A ship alteration (SHIPALT) is an alteration as defined in Subsection 2-10, Alterations to Ships and Equipment, but which involves material under the technical cognizance of NAVSEA. Alterations which affect shipbome systems and equipment under the technical cognizance of other systems commands (e.g., ORDALTS, Air Alterations, and SPALTS) are not SHIPALTS, but may require concurrent SHIPALTS where system interface changes are involved.

SHIPALTS are assigned categories (or "Titles") as follows:

a. Title "A" is assigned to alterations required for certain ships under construction, in which authorization is anticipated during the obligation period under construction funds. Title "A" SHIPALTS are authorized by NAVSEA.

b. Title "D" is assigned to alterations-equivalent-to-repairs. Title "D' SHIPALTS are authorized by type commanders.

c. Title "F" is assigned to alterations that are capable of being accomplished by forces afloat and do not require Special Program Material. (Special Program Material is that material which is procured specifically to support accomplishment of approved SHIPALTS and is provided to the installing activity on a non-reimburseable basis.) Title "F" SHIPALTS are authorized by type commanders and no industrial assistance is required.

d. Title "K" is assigned to all other types of SHIPALTS authorized by NAVSEA.

2-10.7 ELECTRONIC EQUIPMENT FIELD CHANGES

Alterations to electronic equipment are issued as field changes in accordance with the General Specification for Field Changes and Field Change Kits, MIL-F-17655 (currently MIL-F-17655C(NAVY), 4 February 1969). A field change is any modification or alteration made to an electronic equipment after delivery to the government. Recommendations for field changes may originate from any of several sources including the fleet, Naval shipyards, contractors, project managers, and equipment engineers.

Field Changes are developed for the purpose of improving performance, operational characteristics, maintenance, reliability, and safety features of equipment. They may be of a nature which require minor wiring or mechanical changes to an item of equipment and consist only of instructions for making the change. Other field changes may be more extensive, requiring circuit changes and the removal and/or substitution of parts. The nature of each field change issued is identified by a type and class designation operational category and an accomplishment priority.

2-10.7.1 Types of Field Chenges

Field Changes are designated as Type I, Type II, Type III, or Type IV. These type designations afford an abbreviated method of indicating the material (including the publications package) which is contained in the field change kit and/or furnished by the installing activity. The publications package consists of the Electronic Field Change Bulletin, and changes to technical manuals, reference standards books, and other NAVSEA/NAVELEX-supplied equipment manuals. Planned Maintenance System (PMS) documentation, Allowance Parts List (APL) documentation, or other documentation not controlled by NAVSEA or NAVELEX are not included in the publications package. Corrections and revisions to these documents, as a result of field changes, will be issued by the activities which have cognizance of them, Definition by type is as follows:

a. **Type 1.** A Type I field change requires parts, all of which are included in a kit. The kit consists of a publications package, all parts, materials, and special tools required to accomplish the change to one equipment and to revise existing equipment nameplates, publications, and charts.

b. **Type II.** A Type II field change requires parts, none of which are included with the field change. The Type II field change may be either a kit consisting of only the publications package, or instructions which are published in the Electronics Information Bulletin (EIB) or other official instruction or letter. When published in the EIB, complete instructions for accomplishing the field change and for correcting related publications are included. The parts, tooks, and test equipment required to accomplish a Type II field change are either standard shipboard items (e.g., wire, terminal lugs, soldering irons, etc.) or readily available from stock supplies (e.g., repair parts stucked for the equipment).

c. **Type III.** A Type III field change requires parts, of which some, but not all, are included in a kit. The kit consists of a publications package and some of the parts, materials, and special tools required to accomplish the field change to one equipment and revise existing equipment nameplates, publications, and charts. The parts, tools, and test equipment not included in the kit are either standard shipboard items (e.g., wire, terminal lugs, soldering irons, etc.) or readily available from stock supplies (e.g., repair parts stocked for the equipment).

d. Type IV. A Type IV field change does not require parts or use of special tools. This type of field change maybe either a kit consisting of only the publications package, or instructions which are published in the EIB or other official instruction or letter. When published in the EIB, complete instructions for accomplishing the field change and for correcting related publications are included.

2-10.7.2 Classes of Field Changes

There are three class designations (A, B, and C) for field changes, one of which is assigned to each field change. They provide an abbreviated method of indicating the funding and installation responsibility. Definition by class is as follows:

a. Class A. A Clsss A field change designates that the field change is approved for accomplishment by forces afloat or station personnel, and no installation funding is required.

b. Class B. A Class B field change requires fleet installation funding. Class B field changes to shipboard equipment are approved for accomplishment by Naval Shipyards, tenders, or repair facilities under the conditions stated in the field charige bulletin, when authorized by type commanders. Class B field changes to equipment at training activities are approved for accomplishment and funded by the appropriate systems command. EXCEPT FOR CLASS B FIELD CHANGES PRESENTLY UNDER PROCUREMENT, IN THE SUPPLY SYSTEM, OR IN THE FLEET INSTALLATION PLANNING STAGE, THIS TYPE OF FIELD CHANGE WILL NO LONGER BE ISSUED.

c. Class C. A Class C field change normally requires industrial assistance for installation and requires the appropriate systems command installation funding.

2-10.7.3 Operational Categories of Field Changes

Two operational categories are assigned to field changes which describe the effect of the change on the operating characteristics of the equipment. These categories are: Operational and Non-Operational. An Operational change effects the military characteristics of the equipment (e.g., a range increase of a radar, the addition of electronic countermeasures equipment to a radar, etc.). A Non-Operational change does not effect the military characteristics of the equipment. They concern matters of equipment maintenance and reliability improvements, safety of personnel and equipment, and effectiveness of equipment performance.

2-10.7.4 Accomplishment Priorities of Field Changes

An accomplishment priority (i.e., Emergency, Urgent, or Routine) is assigned to each field change to indicate the urgency of the accomplishment.

2-10.7.4.1 Emergency

This priority is assigned to field changes for either of the following reasons:

a. To effect a change in operational characteristics which if not accomplished without delay, may seriously compromise the national security.

b. To correct a hazardous condition which may result in fatal or serious injury to personnel, extensive damage, or destruction of equipment.

2-10.7.4.2 Urgent

This priority is assigned to changes for the following reasons:

a. To effect a change in operational characteristics which if not accomplished expeditiously, may seriously compromise the mission effectiveness of deployed equipment.

b. To correct a potentially hazardous condition which may result in serious injury to personnel or in damage to equipment. A potentially hazardous condition compromises safety and embodies risk, but within reasonable limits, permits continued use of the affected equipment, provided the operator has been informed of the hazard and appropriate precautions have been defined and distributed to the user.

c. To meet certain significant contractual requirements.

d. To effect an interface change which if delayed, will cause a schedule slippage or increased cost.

e. To effect through value engineering or other cost reduction efforts substantial life cycle cost savings to the Government.

2-10.7.4.3 Routine

This priority is assigned to proposed changes where “emergency” or “urgent” is not applicable.

2-10.7.5 Approval of Field Changes

Field changes to electronic equipment are developed for the purpose of improving the equipment’s performance and operational characteristics and maintenance, reliability, and safety features. Therefore, field changes are approved only after it has been determined that the effort and cost involved is warranted by the improved results achieved. Approval of field changes is given by the systems commands having cognizance of the equipment to be modified. The cognizant systems commands for shipboard electronic equipment are NAVSEA, and NAVELEX.

2-10.7.6 Authority for Accomplishing Field Chenges

An approved field change is the authority for accomplishment, but only on those installations, systems, and equipments as specified by the approving activity—the cognizant systems command. The applicability of field changes to specified installations, systems, and equipments is presented in each Electronic Field Change Bulletin and/or promulgated in advance by publication in the EIB or, in special cases, by letter or message from the cognizant systems command or project office.

Accomplishment of approved and applicable field changes is mandatory when they are available, and shall be performed at the earliest

opportunity in accordance with the accomplishment priorities assigned. (See Subsection 2-10.7.4, Accomplishment Priorities of Field Changes.

2-10.7.7 **Recording the Accomplishment of Field Changes**

The final procedure in the accomplishment of a field change is an important one, and must be performed even if it was not included in the field change bulletin. This procedure includes the following two steps:

a. Record the accomplishment of the field change on the 4790.2K Form (3 M).

b. Stamp the field change number (e.g., 4) on the Field Change Accomplishment Plate attached to the equipment or unit of which the field change bulletin is promulgated against. The plate should belong to the equipment or unit whose type designation matches, exactly, the type designation (e.g., AN/SPS-10D) of the field change bulletin (e.g., 4-AN/SPS-10D). If the equipment or unit does not have a Field Change Accomplishment Plate, put one on! They can be requisitioned using stock number 010264 -LP-085-0000 in accordance with Subsection 4-5, Requisitioning of Cognizance "I" Material.

2-10.7.8 **Reporting the Accomplishment of Field Changes**

The accomplishment of a field change is considered complete only when the actions listed below have been performed, at which time its accomplishment must then be reported to certain cognizant activities.

a. The field change has been installed in the equipment in accordance with the field change instructions, and installation accuracy and completion has been verified.

b. The equipment has been tested for proper operation in accordance with the field change instructions, and proper operation has been verified.

c. The field change number has been stamped on the Field Change Accomplishment Plate in accordance with subsection 2-10.7.7.2.

d. The field change must be reported on the Ship's Maintenance Action Form (2-KILO), OPNAV Form 4790/2K, in accordance with Volume 2 of the Ship's 3-M Manual, OPNAVINST 4790.4.

2-11 REGULATOR OVERHAUL PROCEDURES

All ships of the fleet are assigned regular overhaul periods for maintenance and improvement. These periods usually vary from 1 month for small ships to 3 months or more for the larger ships. During the overhaul period, work pertaining to repairing, docking, and altering ships is performed by the shipyard force. The interval of time between regular overhauls, varies from a year to five years, the interval being the maximum period consistent with keeping the ships in fighting trim.

An analysis of the problems of building, overhauling, or converting ships reveals that for all three periods, the following factors play essential roles:

a. The ship must be available for the uninterrupted accomplishment of yard work. Ship availabilities are explained in Subsection 2-8.4.1.

b. The contemplated work must be decided upon, arranged in order of priority of accomplishment, and actually authorized to be performed.

c. Funds must be available in sufficient amount to cover the cost of the work.

d. Material must be available.

e. Men to perform the work must be available.

2-11.1 **PROCEDURES PRECEDING OVERHAUL**

In order that the best use may be made of the time and funds available for an overhaul, planning for the repairs to be accomplished during the overhaul must be done in advance of the ship's arrival at the repair activity. Advance planning is required of both the ship and the repair activity.

About 60 days prior to the data set for entering the repair activity, the ship must submit to the repair activity, via the type commander a work list showing the repairs and alterations to be accomplished during the overhaul. The time for submitting the work list is designated by the fleet and type commander and must be such as to allow time for planning by the shipyard. The Type Commander's Administrative Manuals should be consulted.

The type commander, upon receipt of the work list, screens it for undesirable items and allots funds to cover the items to be accomplished. The approved list is then forwarded by the type commander to the repair activity. Work lists are submitted in two parts: (1) Naval shipyard work, and (2) ship's force work. In many cases, these lists contain items which can and should be accomplished by the technicians rather than yard personnel.

2-11.1.1 **Work Requests**

Ships submit work requests to shipyards, repair ships, and tenders in accordance with

current directives of the cognizant type commander. The Ship's Maintenance Action Form (2-KILO), OPNAV 4790-2K, is used to request assistance from naval shipyards, repair ships, and tenders. A copy of the work request becomes part of a work booklet prepared by the repair activity.

The work request should be carefully worded to enable the repair activity to conduct advance planning and estimating. The request should accurately describe existing conditions and symptoms which can be used to analyze the fault and determine the general extent of repair parts and work required. Such generalities as "requires complete overhaul" or "inspect and repair as necessary" are insufficient for proper analysis. Nameplate data and status, if known, of material required for the repairs should be included in appropriate spaces on the work request form. Approved alterations equivalent to repairs except those designated for accomplishment forces afloat, are included in the work requests.

The commanding officer (or the commanding officers representative) reviews and approves each work request before it is forwarded to the type commander. The heads of departments submit their work requests (in the rough) to the engineering officer, who must review them, ensure that they are in proper form, and arrange them in a tentative order of priority of accomplishment. Next, the commanding officer and executive officer meet with the heads of departments, and resign the ship's classification and priority number to each work request according to the overall relative importance of the work item.

The work requests are typed, signed by the commanding officer (or the commanding officer's representative), and submitted to the type commander (or other authority granting the funds) for approval. The work requests for an overhaul are accompanied by a work item list of work for shipyard accomplishment, arranged in order of the priority of work requested, and a work item list of work for ship's force accomplishment, arranged by departments.

The type commander or the type commander's designated representative may modify and approve or disapprove the work requests as deemed necessary, depending upon the importance of the work and the availability of the funds required. Following his screening action, the type commander forwards the approved requests to the appropriate repairing activity.

2-11.1.1.1 Review by Authority Allotting Funds

Preliminary determination of the nature and extent of the repair work to be performed on a ship during a regular overhaul is made by the authority allotting the funds to cover the cost of such work. This authority is usually the type commander who is in a position to consider the cost of your work requests in relation to the number of overhauls that must be funded during the fiscal year.

2-11.1.1.2 Review by Repair Activity

Upon receipt of a ship's work requests the naval shipyard or the Supervisor of Shipbuilding (SUPSHIP) investigates the work requested. If at this time, or during the course of the overhaul, conditions develop which render it inadvisable to do the work requested, the shipyard commander or SUPSHIP so informs both the commanding officer of the ship and the authority allotting the funds. If the scope of the work is greater than that originally determined, the shipyard commander or SUPSHIP may request additional funds from the allotting authority.

When a work request is approved and a job order is issued by the planning department of the shipyard or SUPSHIP, they may not agree in every detail. Modifications may be dictated by funds or nonavailability of plans and materials. In view of this, all job orders should be reviewed when they are received from the yard. Any uncertainties should be investigated so that the intention of the yard is known.

2-11.1.2 Work to be Accomplished by Ship's Force

In addition to the work list forwarded via appropriate channels to the shipyard, the commanding officer of the ship prepares a list of work to be accomplished by the ship's force during the availability. Normally this list also is forwarded to the shipyard commander to ensure proper scheduling of all work to be accomplished.

During an overhaul period (and certain restricted availabilities) a portion of the repair funds may be designated as an assist-ship's force fund. The fund, under the local control of the commanding officer, provides a means for ships undergoing overhaul to obtain minor shipyard assistance for accomplishing ship's force work which is beyond the technical capabilities of the ship's force. These jobs must be limited to those in

which the ship's force participates. Also, special tools may be borrowed from the shipyard's central toolroom; these tools can increase the capability of personnel and make jobs possible that could not otherwise be accomplished.

2-11.1.3 **Prearrival Inspection**

A prearrival inspection is heId, whenever possible, by appropriate personnel from the shipyard (naval or private) to determine (1) if available plans are applicable; (2) what design services, specifications, or other changes are necessary; (3) consonance between actual work required and preliminary estimates. This inspection is followed by a prearrival conference with the ship's force officers and the type commander's representative.

At the prearrival inspection, the personnel of the planning department gain an overall view of the work scheduled for accomplishment. Such knowledge is valuable, for it permits them to undertake necessary preliminary work. They assemble plans and materials required for the authorized work and, upon receipt of an approved work request from the appropriate authority, begin the prefabrication of needed materials.

2-11.2 PROCEDURES DURING OVERHAUL

During an overhaul the ship continues to have responsibility for the items scheduled for repair. Such responsibility includes a final review, jointly with repair activity personnel, of the repairs requested and inspections of the repairs during accomplishment and upon completion. The commanding officers of the ship and the repair activity also have certain responsibilities to each other, to the grantor of the availability, and to the authority allotting the overhaul funds.

The ship superintendent is the liaison between the ship and the naval shipyard, and coordinates all authorized work on a ship during its availability in the shipyard. During an overhaul the ship superintendent will be in daily contact with yard workers, civilian supervisors, and yard and ship officer personnel.

Electronics work is under the technical cognizance of the electronics superintendent. However, it is the responsibility of the ship superintendent to see that such jobs are satisfactorily completed, and therefore close cooperation with the specialists in the various phases is required.

2-11.2.1 **Arrival Conference**

The first important step of the actual overhaul is the arrival conference. When the ship arrives in the shipyard the ship superintendent will notify the commanding officer of the time and place of the arrival conference. New work is reviewed by the type commander and, if approved, is taken by the planning department for incorporation in the work schedule. One important subject at the arrival conference is the sequence in which various jobs should be undertaken. Some, by their very nature, should be undertaken first. For example, if a section of the ship's interior is to be sandblasted, this would have to be completed before other work in that area is begun.

2-11.2.2 **Use of Shipyard Facilities by Ship's Force**

In order to expedite the repairs and improvements to be undertaken by the ship's force, the commanding officer of the repair activity is responsible for seeing that, insofar as is practicable, the facilities of the shipyard are made available to the ship's crew.

2-11.2,3 **Information Furnished the Ship**

The commanding officer of the repair activity is responsible for keeping the commanding officer of the ship appropriately informed of the repair activity's action on all items of work; the costs thereof when determined; and the issue, closing, cancellation, or other changes in status, of job orders affecting the ship.

By copy of official communication to the authority allotting the funds or the grantor of the availability, the commanding officer of the repair activity informs the commanding officer of the ship when work cannot be accomplished within the funds allotted or witbin the time of the assigned availability.

If repairs to an article of equipage cannot be completed during the availability of the ship and the article is required for military efficiency or for the health and comfort of the crew, the commanding officer of the repair activity so advises the commanding officer of the ship in order that the latter may have the article surveyed and replaced.

2-11.2.4 **Inspections**

The commanding officer of the ship is responsible for inspecting the work accomplished by the repair activity for the ship. The commanding officer makes such inspections as may be necessary to determine that the work is satisfactory, both during its progress and when completed. To this end the commanding officer appoints such additional ship's inspectors as may be necessary to assist and act as the commanding officer's representative. The commanding officer and assistants confer frequently with the appropriate officials of the repair activity.

2-11.2.5 Weekly Conferences

The ship superintendent normaIIy holds a weekly meeting attended by key ship's officers to discuss progress of the overhaul and problems related to the work.

The shipyard Commander's Conference is usually attended by the commanding officers of ships in the yard. At this meeting the shipyard commander invites each commanding officer to speak of problems encountered.

2-11.2.6 Progress Report

During an overhaul period, the department heads must submit weekly progress reports to the commanding officer. These should include ship's force work as well as shipyard work. In order to submit these reports, as well as to keep themselves informed, ship's supervisory personnel must check on the status of work at all times. One of the best methods of keeping track of the numerous repair jobs is by means of a progress chart which can be obtained through the Navy Supply System. These charts have columns to show the percentage of completion for each job listed.

2-11.2.7 Unsatisfactory Work

In the event the commanding officer of the ship considers unsatisfactory any work done by the repair activity, and satisfactory adjustment cannot be obtained locally, when the circumstances warrant it, the commanding officer reports the facts directly to the Chief of Naval Operations, with copies to the type commander, the grantor of the availability, and the commanding officer of the repair activity. The commanding officer of the repair activity then immediately submits his recommendations in the matter to the Chief of Naval Operations.

2-11.3 PROCEDURES UPON COMPLETION OF OVERHAUL

Completing an overhaul requires a report on the completion status of all authorized items, plans for the cancellation or later accomplishment of uncompleted work, and readying the ship for its initial voyage after the overhaul.

2-11.3.1 Completion Report

Insofar as its material condition is concerned, a ship leaving a repair activity upon completion of its overhaul normally is ready for war service.

Upon completion of the overhaul, the commanding officer of the repair activity submits to the authorities concerned a report showing the completion status of each item of repair or alteration. This report includes a list of all items which were authorized but not undertaken.

2-11.3.2 Uncompleted Work

Except in unusual circumstances, job orders for uncompleted repair work are closed or canceled upon the ship's departure from the repair activity. Job orders for authorized alterations, however, are held open until the work is later completed or canceled by the systems command concerned.

In case of the departure of the ship when unfinished work is to be completed at another activity, all outstanding job orders are transferred to the latter activity together with all pertinent information and such material as has been assembled for the work.

ShouId work be desired later on job orders which have been closed or canceled, new requests must be made by the commanding officer of the ship.

2-11.3.3 Preparation for Sea

Readying a ship for sea, including its initial voyage after an overhaul, involves meticulous planning, persistent work, and determined followup to make certain that necessary actions or material are not omitted. The electronics material officer (EMO) must see that the division is in order and that allowances of equipment, tools, and repair parts are on board and property stowed. The reason for this is obvious, as negligence can make the ship a liability during crucial action. The EMO must impress the technicians and the operators with the importance of reporting to proper authority all defects, regardless of their apparent insignificance. When the division is reported ready for sea, or for getting underway, the commanding officer assumes that each equipment is in condition to give the performance required of it. The commanding officer can act accordingly if advised of the exact condition of the equipment on board, and to what extent the ship can or cannot meet its commitments.

2-12 INSPECTIONS OF SHIPS AND EQUIPMENT

Type commanders must ensure that the ships under their command are informed of and kept up to prescribed standards of maintenance and readiness. These standards are found in various directives stemming from fleet commanders, technical commands, and the Chief of Naval Operations (CNO). These directives may be in the form of regulations, letters, directives, or manuals. Most of these sources get fleetwide dissemination, but the material is so voluminous that it is not readily effective except for detailed reference. Consequently, type commanders issue

type instructions and type lettsrs in which pertinent material is quoted or summarized, thus reducing the general instructions to specific instructions peculiar to the type.

Not only must type commanders issue data aa to the standards required for their ships, they must also enforce these standards by means of inspections. The number and kinds of inspections are specified in Navy Regulations and CNO directives. Three types of inspections are mandatory–Administrative, Operational Readiness, and Material. The scheduling of inspections is baaed upon the operating cycles of the ships; that is, the periods between regularly scheduled shipyard overhauls.

Inspections of ships and aircraft squadrons are under the control of the fleet commanders who delegate this responsibility to the type commanders. The commanders of task forces or groups conduct, or direct the conduct of, such inspections aa are recommended by the type commanders and submit to the latter the appropriate reports. When requested, fleet training commands assist the type commanders in the conduct of administrative and operational readiness inspections. (Refer to Subsection 2-4.1.2), Shakedown and Refresher Training.)

The grade a ship receives on an inspection is baaed upon the readiness of its personnel and material to carry out its missions.

OPNAVINST 5040.7 establishes objectives of, assigns responsibility for, and prescribes procedures for conducting and reporting on the Naval Command Inspection Program.

2-12.1 ADMINISTRATIVE INSPECTION

An administrative inspection is an inspection of all the administrative methods and procedures normally employed by a ship to determine whether or not the ship is being administered in an intelligent and efficient manner, and whether the organization, methods, and procedures are directed toward keeping the ship prepared to perform its wartime mission. At least one administrative inspection is conducted in each training cycle and is divided into two categories, the ship as a whole and each department.

2-12.2 OPERATIONAL READINESS INSPECTION

An operational readiness inspection (ORI) consists of a demonstration on the part of a ship of its readiness and ability to perform the operations which might be required during war. Normally two such inspections are conducted during a training cycle.

As with administrative inspections, the conduct of an operational readiness inspection is the responsibility of the type commander who normally requests the assistance of the fleet training command. The inspection includes a battle problem prepared, conducted, and observed as specified by CNO in the publication, "Preparation, Conduct and Analysis of a Battle Problem, FXP3-2(B)". In addition, other operational exercises are prescribed by the type commander, including gunnery, damage control, engineering, CIC, communications, seamanship, and aviation.

The inspection is conducted under way except for those portions which are tasks normally conducted at anchor, or in getting under way and coming to anchor. The inspection lasts for a period of 24 hours during which the ship is rigged for battle to the maximum extent possible. The criteria for performance are (1) whether the ship aa a whole can carry out its operational functions and (2) whether the ship's company is well trained and competent in all phases of the evolutions.

2-12.3 MATERIAL INSPECTION

The purpose of a material inspection is to determine the actual material condition of a ship and its equipment in respect to ability to perform all functions for which the items were separately and interrelatedly designed, and to recommend repairs, alterations, changes, or developments that will ensure the material readiness of the ship to carry out the mission for which it was designed. Material readiness implies that the ship haa established routines for own force inspections, tests, and preventive maintenance; that there is effective utilization of facilities for repair and preservation; and that outstanding items of work have been correctly determined as within the capacity of the ship's force, repair ships/tenders, or naval shipyards, respectively.

The scope of material inspections is similar to that of inspections made by the Board of Inspection and Survey (InSurv). Since an InSurv inspection is required every 3 years, and since in most cases the period between overhauls is 18 months, the scheduling of a material and an InSurv inspection is alternated. One of the above inspections should be conducted a minimum of 3 months prior to a shipyard overhaul.

2-12.4 INSURV INSPECTION

Every three years, a material inspection is conducted by the Board of Inspection and Survey (INSURV) to determine the material readiness of electronic equipments and systems

and to establish work requests covering deficiencies. (See Article 2016-Navy Regulations.) Whenever practical the INSURV inspection is held in advance of the regular overhaul and in lieu of the material inspection.

2-12.5 ARRIVAL INSPECTION

Arrival inspections for electronic equipments and systems are conducted upon or before the arrival of a ship for overhaul. This inspection is authorized by the type commander and includes the determination of the condition of the equipment and system, and the preparation of a list of the repairs required to ensure effective electrical and mechanical operation.

2-12.6 POST OVERHAUL INSPECTION

Post overhaul inspections are for the purpose of furnishing the commanding officer of a ship a report on the condition, capabilities, and limitations of electronic equipment and systems. This inspection is normally made at a test and calibration facility and shall include new installations of equipment and systems, and those equipments and systems which were included in overhaul job orders. (Refer to the Naval Ships' Technical Manual, Chapter 094.)

2-13 MAINTENANCE REPORTS

Efficient administration requires exact and current knowledge of all matters under the cognizance of the administrator. In the case of the electronics material officer, this includes knowledge of the current operating status of all electronic equipment and systems for which the EMO has maintenance responsibility. It includes maintaining g proper records and compiling and forwarding to the applicable authority various reports necessary to logistically support naval electronic installations.

2-13.1 REPORTS PROGRAM

To increase the effectiveness of recurring reports and to avoid duplication, a program known as the Reports Program has been put into effect. The major objectives of this program are: (1) to develop effective new reports and reporting procedures; (2) to improve existing reports and related procedures in the light of current needs; (3) to ensure economy in paperwork, man-hours, and other costs by analyzing and simplifying reports and reporting procedures; and (4) to eliminate and prevent unnecessary of duplicate reporting.

The Reports Program is installed in the various Naval commands, in the Marine Corps, in each continental Naval district, and in selected major field activities. Direct responsibility for the program is vested in the Chief of Naval Operations. Periodically, the commands furnish this office with current listings of their required recurring reports. These listings are published in the following documents.

a. Consolidated List of Recurnng Reports Required by the Navy Department From the Naval Shore Activities.

b. OPNAVINST 5214.1, Consolidated List of Recurring Reports Required by Washington Navy Headquarters Organizations from the Operating Forces of the Navy.

The foregoing instructions are revised periodically to reflect changes made by the commands and the Chief of Naval Operations in their requirements for recurring reports. The commands will furnish reports information to individuals and other offices upon request.

The latest list should be used, as applicable, by the operating forces and shore activities to compare the reports required with those actually being submitted. To comply with existing directives and to ensure the elimination of unnecessary reporting, any requests for reports not listed in the instructions should be brought to the attention of the office or command making the request.

2-13.2 SURVEY REPORTS

A survey is the procedure required when Navy property is lost, damaged or destroyed, except in incoming shipments. The purpose of a survey is to determine responsibility for such property and to fix the actual loss to the Government. To make a true determination, the facts surrounding the loss or damage must be thoroughly researched. The survey should not be limited to verifying the statements of interested parties, but should be broad enough to ensure that the interests of the Government as well as the rights of the individual(s) or Navy activities concerned are fully protected. A thorough review of the facts collected is required to prove or refute statements of interested persons and is necessary to place responsibility where it belongs. As an EMO you will become involved with surveys involving equipment for which you have cognizance or involving equipment under the cognizance of some other department.

2-13.2.1 Expenditure of Material Without Survey

Material will be expended without survey on a Requisition and Invoice/Shipping Document (DD Form 1149) or DOD Single Line Item Release/Receipt Document (DD Form 1348-1), which will be annotated "Loss by survey" and will indicate the circumstances of the loss or darnages or the disposition authority, as applicable, under the following conditions:

a. Items determined to be scrap by an inventory manager

b. Losses of liquid oxygen (LOX) because of evaporation

c. Material cannibalized or otherwise unaccounted for in an overhaul and repair department

d. Residue of material cannibalized in an overhaul and repair department considered to have scrap value only

e. Samples of petroleum products sent to a laboratory for examination and test and not returned to stores

f. Medical material determined to be defective by the Field Branch, Bureau of Medicine and Surgery, and destruction of the material has been directed; also potency-dated material on which potency has expired and no additional approval or action is required by the Bureau of Medicine and Surgery

g. Material lost in transit due to enemy action

h. Discrepancies in material quantities transferred to disposal, provided that the value of the loss or shortage is less than $50.00 per line item and does not involve sensitive items

2-13.2.2 Other Survey Exceptions

A survey research action is not required when it is the opinion of the commanding officer or a designated representative that negligence is not indicated in the loss, damage or destruction of government property; or that, for reasons known to the commanding officer, negligence or responsibility cannot be determined and that research under those conditions would constitute an unnecessary administrative burden. Research action is not usually required when an individual accepts responsibility for loss, damage, or destruction of government property. At the discretion of the commanding officer or a designated representative, investigative reports required by other appropriate DOD component regulations may be used in lieu of the research when:

a. There is no death or injury

b. The total property damage does not exceed $200.00

c. There is no possible claim against the Government

2-13.2.3 Government Property Lost, Damaged, or Destroyed (GPLD) Survey Certificate (DD Form 2090)

The Government Property Lost, Damaged, or Destroyed (GPLD) Survey Certificate (DD Form 2090) is used if no personal responsibility is evident. The DD Form 2090 will normally be prepared by the person who conducted further research. A copy of the DD Form is shown in figure 2-5. Instructions for preparation, distribution and approval levels of DD Form 2090 are contained in Chapter Five, Part A, Section III of NAVSUP P-485 Afloat Supply Procedures.

2-13.2.4 Report of Survey (DD 200)

DD Form 200, Report of Survey, should be used if personal responsibility is evident, if the reviewing authority does not approve DD 2090, and if the commanding officer or higher authority so directs. If further research develops evidence of personal responsibility or criminal wrongdoing, a Report of Survey should be used to substantiate adjusting the stock record and provide relief from property accountability.

The criteria for performing further research on unresolved discrepancies are:

a. Sensitive items, e.g., drugs, precious metals-when any discrepancy occurs, regardless of dollar value

b. Classified items regardless of dollar value

c. Pilferable items–when discrepancy is $500 or more

d. Any discrepancy when there is an indication or suspicion of fraud, theft, or negligence

e. Arms/Ammunition—mandatory for all personal arms, whether or not pecuniary responsibility is admitted

f. Repetitive losses and the dollar value of the adjustment equals or exceeds projected costs or report of investigation

g. Bulk petroleum—loss exceeding stated allowance

h. Mandatory-Turn-in Repairable, including items that have been invoiced and shipped but not received.

i. Discrepancies over $50,000 (all items)

j. When requested by the accountable officer

k, Shortage in receipts from fleet issue ships when the value of the shortage is $100 or more per UNREP

1. Missing controlled equipage, including items that have been invoiced and shipped but not received; and all unserviceable controlled equipage that is beyond economical repair except chronometers

m. Presentation silver and other valuable gifts missing or destroyed

Instructions for DD Form 200, Report of Survey, preparation, distribution, and approval levels are contained in NAVSUP P-485, Afloat Supply Procedures, Chapter Five, Part A, Section III.

2-13.3 3-M REPORTS

Reports required in the maintenance and Material Management (3-M) System are explained in Subsections 2-7.1.

2-13.4 REPORTING OF QUALITY DEFICIENT MATERIALS OBTAINED THROUGH THE SUPPLY SYSTEM

The reporting procedures for quality deficient Navy Stock Account (NSA) and Appropriations Purchases Account (APA) materials, including warranty period failures and short life defects or failures, which are assigned to the Naval Supply Systems Command (NAVSUP) and are stored or used at Navy activities can be found in NAVSUPINST 4440.120E. This instruction nornxdly applies to materials which have been accepted into the supply system; however, in cases of danger to Navy personnel, those procedures may be applied to locally purchased non-standard materials. Reports to defective inventory control point (ICP) purchased non-standard material will be sent to the Fleet Material Support Office (FMSO) for forwarding to the cognizant technical ICP for a determination of the need for, and extent of, action to be taken. This also applies to quality deficient items reported through the ALERT/SAFE-ALERT portion of the Government Industry Date Exchange Program (GIDEP) which will be forwarded by FMSO, if appropriate, to the cognizant item managedinventory control point for corrective action. In addition, this applies to quality deficient items discovered during Government acceptance inspection at the receiving activity which will be reported in accordance NAVSEAINST 4855.7 and NAVMATINST 4355.73.

2-13.4.1 Quality Deficient Material Reports (QDRs)

Quality Deficient Reports (QDRs) SF 368, are used for reporting material not suitable for its intended use due to a deficiency in design, material, or procurement. These deficiencies can include chemical, electrical, functional or physical discrepancies noted in material, attributable to nonconformance to contractual or specification requirements. Also, it may include deficiencies attributable to ambiguous, improper, incorrect or omitted contractual requirements, including the procurement document or its referenced documents, that describe the technical requirements of the material. For more complete information refer to NAVSUPINST 4440.120E.

The following discrepancies are not to be reported via a QDR:

a. Discrepancies in preservation, packing, packaging, and marking.

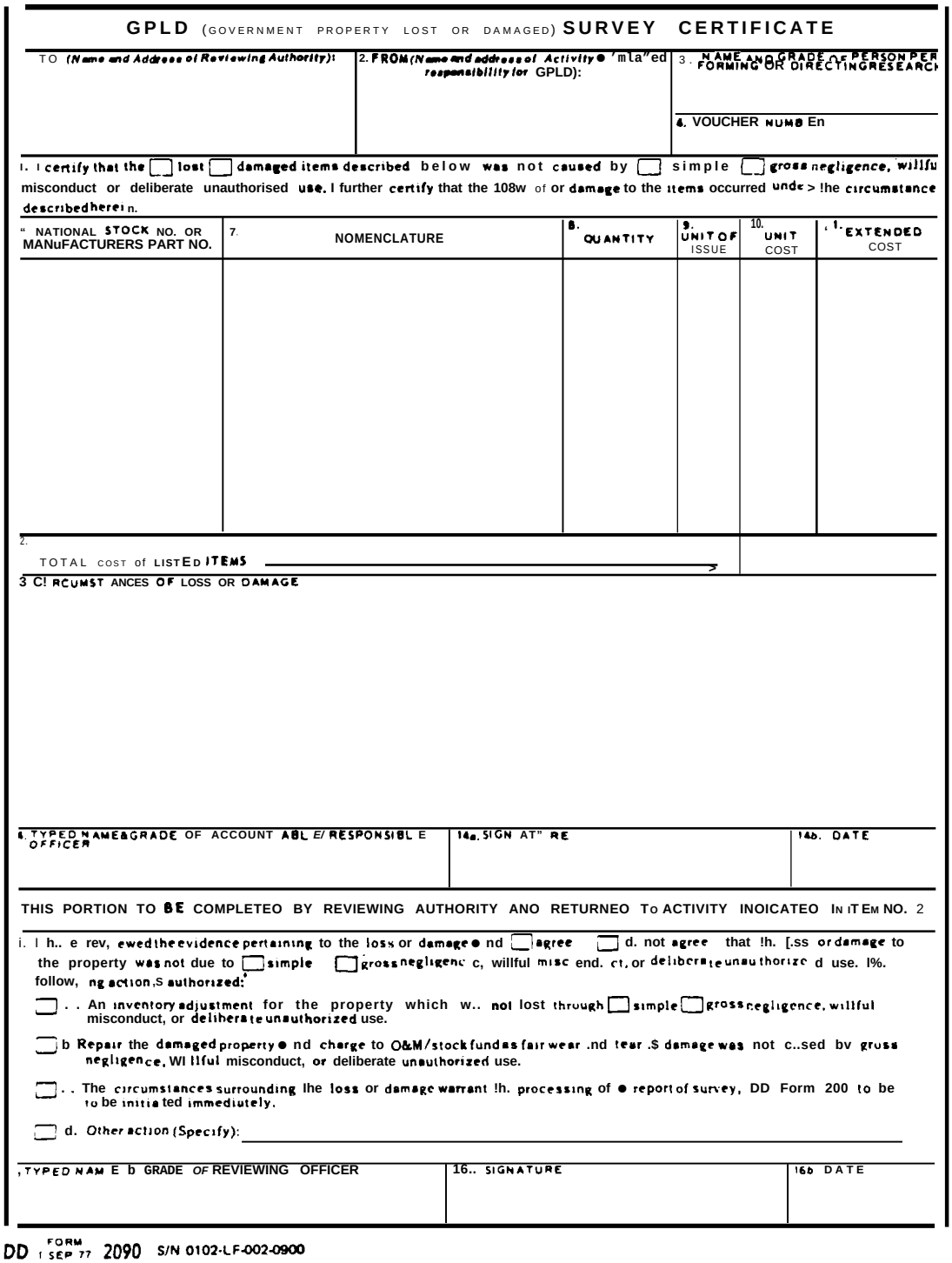
b. Discrepancies in shipments attributable to or the responsibility of shipping activities such as shortages, unacceptable overshipments, unacceptable substitutes, material shipped in error, unacceptable duplicate shipments and shipment of the wrong item, and missing or improperly prepared supply documentation. Also included are shelf-life items which were overage at time of issue or were issued with insufficient shelf life remaining.

c. Transportation type discrepancies in shipments received by a military installation or activity from any source, via all modes of transportation.

These discrepancies will be reported in accordance with NAVMATINST 4355.73 or NAVSUPINST 461 O.33B.

2-13.5 ADDITIONAL REPORTS

Type commanders and other authorities may require reports in addition to those required by the Navy Department. Instructions concerning such reports may be promulgated via letter, message, or other official means. The electronics material officer therefore must examine all official correspondence regarding electronics received in order to keep abreast of current instructions. Additional requirements for reports are contained in Chapter 090 of the Naval Ships' Technical Manual.



GPLD (GOVERNMENT PROPERTY LOST OR DAMAGED) SURVEY CERTIFICATE

TO (Name and Address of Reviewing Authority):	2. FROM (Name and address of Activity 'mla"ed responsibility for GPLD):	3. NAME AND GRADE OF PERSON PERFORMING OR DIRECTING RESEARCH 4. VOUCHER NUMBER

1. I certify that the ☐ lost ☐ damaged items described below was not caused by ☐ simple ☐ gross negligence, willful misconduct or deliberate unauthorised use. I further certify that the loss of or damage to the items occurred under the circumstance described herein.

" NATIONAL STOCK NO. OR MANUFACTURERS PART NO.	7. NOMENCLATURE	8. QUANTITY	9. UNIT OF ISSUE	10. UNIT COST	11. EXTENDED COST
12. TOTAL COST of LISTED ITEMS →					

13. CIRCUMSTANCES OF LOSS OR DAMAGE

14. TYPED NAME & GRADE OF ACCOUNTABLE/RESPONSIBLE OFFICER	14a. SIGNATURE	14b. DATE

THIS PORTION TO BE COMPLETED BY REVIEWING AUTHORITY AND RETURNED TO ACTIVITY INDICATED IN ITEM NO. 2

15. I have reviewed the evidence pertaining to the loss or damage and ☐ agree ☐ do not agree that the loss or damage to the property was not due to ☐ simple ☐ gross negligence, willful misconduct, or deliberate unauthorized use. I recommend the following action is authorized:

☐ a. An inventory adjustment for the property which was not lost through ☐ simple ☐ gross negligence, willful misconduct, or deliberate unauthorized use.

☐ b. Repair the damaged property and charge to O&M/stock funds as fair wear and tear. If damage was not caused by gross negligence, willful misconduct, or deliberate unauthorized use.

☐ c. The circumstances surrounding the loss or damage warrant the processing of a report of survey, DD Form 200 to be to be initiated immediately.

☐ d. Other action (Specify): _____

15a. TYPED NAME & GRADE OF REVIEWING OFFICER	15b. SIGNATURE	15c. DATE

DD FORM 1 SEP 77 2090 S/N 0102-LF-002-0900

Figure 2-5. Sample DD Form 2090, GPLD (Government Property Lost or Damaged) Survey Certificate.

NAVSEA (USER) TECHNICAL MANUAL DEFICIENCY/EVALUATION REPORT (TMDER)

NAVSEA 4160/1 (3-S2) (FRONTI
(Formerly NAVSEA 5600/2) (READ INSTRUCTIONS BE FORE FILLING IN PO RM. I(Use blank 8½", 11" il - space required.)

INSTRUCTIONS
1. us. this report to indicate deficiencies, user remarks, and recommendations relating to the publication.
2. Blocks marked with . are to be filled in by Contractor before printing.
1, For unclassified TMDER's, fill in your return address .. space provided . . label printed m back of this lam. fold on dotted li... staple. and mail t. Commandin g Ticer, Naval Ship Weapon Systems Engineering Station, Code S?00. Pus Huenome. CA 93043. Mark e nd mail classified IMOE S in accordance with OPNAVINST 5510.1 E.
4. For additional information. call Autovon 360-4805/5084 or Com'l. 805-982-4805/5084.

CLASSIFICATION OF THIS TMOER (Check Appropriate Block)
☐ UNCLASSIFIED ☐ C LASSIFIED (Specify) _____

1. NAVSEA NO.	1 VOLIPART	3. TITLE.
4. REV. OATE (TM. CHG)	5. SYSTEM/EQUIPMENT	S IDENTIFICATION/NOMENCLATURE (MK/MOD/AN)

7. USER'S EVALUATION OF MANUAL (Check Approonate Block(s)) ☐ Excellent ☐ Good ☐ Fair ☐ P o o l ☐ Complete ☐ Incomplete

S. GENERAL COMMENTS:

9. FIECOMMENOEO CHANGE(S) TO PUBLICATION

PA(IE NO.	PARA-GRAPH	LINE I NO.	FIGURE MO. ,	TABLE NO.	RECOMMENDED CHANGES ANO REASONS

10. ORIGINA1OR	11. RANK/RATE On GRADE ANO TITLE	13. OATE
13. WORK CENTER	14. TELEPHONE (AUTOVON/COM'L)	

15. SHIP HULL NO. AND/OR STATION ADDRESS (00 NOT ABBREVIATE)

1S. FOR NSOSA USE ONLY

a. Control No.	! b. COG ISEA	c. Date			d. Priority	e Transmitted 70:
		Rec	Fwd	O"*		

Figure 2-6. NAVSEA 4160/1: NAVSEA (User) Technical Manual Deficiency/Evaluation Report (TMDER) – Front

2-14 TECHNICAL AND MAINTENANCE, OVERHAUL AND REPAIR STANDARDS (TRS)

The Chief of Naval Material established the TRS program and requires that all new weapon-system and equipment acquisition programs provide for the development and publication of TRSS as a specific part of the documentation provided by the Integrated Logistic Support (ILS) effort.

NAVSEA implemented the TRS program for surface warfare systems and for submarine non-nuclear systems, equipment, and components.

TRSS were developed to provide standard requirements for the intermediate and depot level support of NAVSEA systems and equipment requiring overhaul or repair procedures that are not addressed in an approved NAVSEA technical manual. Information, procedures, and data developed for TRSS complement data published in corresponding technical manuals.

TRSS are to be used as a non-deviation standard in all appropriate cases where class B overhaul of NAVSEA-cognizant equipment is specified. (Reference NAVSEAINST 4160.2)

In addition to defining equipment repair standards, TRSS are important in standardizing estimates and improving overhaul communications and planning. TRS acceptance criteria and TRS shop test requirements are the sole acceptance or rejection standards used by overhaul, repair, and conversion activities for overhaul, repair, and restoration work authorized by the cognizant activity. No deviation from a certified TRS is allowable under Class B overhaul procedures unless a specific waiver is granted by NAVSEA or by the delegated authority of a NAVSEA field activity.

A NAVMAT standard Technical Manual Identification Number (TMIN) is assigned to each TRS, change, or revision.

A central NAVSEA library and archive for all NAVSEA TRSS was established by SEA 05L3 and is maintained by the Naval Sea Data Support Activity (NSDSA). The NSDSA compiles, consolidates, revises, and publishes a semiannual computer listing of TRSS, distributed as NAVSEA publication TOO IO-AA- IDX-000/TRS.

2-15 SHIP EQUIPMENT CONFIGURATION ACCOUNTING SYSTEM (SECAS)

The ability to accurately define the configuration of a ship and its systems is a critical factor in maintaining proper shipboard support. The Ship Equipment Configuration Accounting System (SECAS) was established to provide a single, standard source of accurate ship configuration data, and reduce Fleet reporting to a single requirement. The objectives of SECAS are as follows:

a. Collect, maintain and report the current configuration status of ships (i.e., the status of shipboard systemslequipment, including all changes to the systems/equipment);

b. Operate as a management information system to provide current shipboard systendequipment configuration data tA all Navy planners and managers to perform their functions relating to ship life cycle management; and

c. Provide the standards, requirements and policies for the collection, maintenance, and reporting of projected/actual ship configuration data prior to and during availabilities for generation of logistic support.

SECAS is an important part of the overall system for Fleet logistic and maintenance support. As the central, integrated source of ship configuration data, SECAS has the capability to eliminate the data inconsistencies common to independent systems. SECAS provides the accurate and current ship configuration data necessary for life cycle management of logistic and maintenance support for the ship.

2-15.1 ORGANIZATION RESPONSIBILITIES

The following responsibilities have been assigned for SECAS:

a Naval Sea Systems Command. The Commander, Naval Sea Systems Command (NAVSEASYSCOM) has been designated as the Naval Material Command coordinating authority for SECAS.

b. Naval Sea Support Center Detachments (NAVSEACEN DETs). The field offices of the NAVSEASYSCOM. NAVSEACEN DETs (Atlantic and Pacific), execute the majority of NAVSEA'S SECAS operational functions. Maintenance of the SECAS data base by the

NAVSEACEN DETs includes update of the central file through onsite total ship validations performed by the NAVSEACEN DETs and the processing of configuration change information submitted by Ship"s Force personnel to the NAVSEACEN DETs during the ship's operating period. NAVSEACEN DETs also provides technical expertise in the accurate maintenance of the configuration data in the WSF.

c. Naval Supply Systems Command. The Commander, Naval Supply Systems Command (NAVSUPSYSCOM) has been designated by the Chief of Naval Material (CHNAVMAT) to provide a central repository for the SECAS data. This central repository is the Weapon Systems File (WSF) located at the Navy Ships Parts Control Center (SPCC), Mechanicsburg, PA. The WSF contains the total ship configuration status, (i.e., HM&E, Electronics and Ordnance). As the central ship configuration status file, the WSF produces all configuration status reports provided to users. It is also the file from which the COSAL is produced; therefore, it also contains data concerning supply support. Consequently, the accuracy of the WSF directly impacts the accuracy of the COSAL, as well as, all other documents that depend on the WSF configuration status products.

d. FIeet and Type Commander. The Type Commanders (TYCOMS), under the direction of the Fleet Commanders, have primary responsibility for the support and utilization of SECAS in the Fleet.

e. Ship's Force. Each ship is responsible for the accurate maintenance of its own configuration status in SECAS. To achieve this, Ship's Force is responsible for:

(1) Reporting all configuration changes as they occur;

(2) Reviewing NAVSEACEN DET feedback on configuration change forms. Errors listed in the feedback shall be corrected promptly;

(3) Responding to NAVSEACEN DET questions on configuration change forms; and

(4) Providing assistance and support to SECAS Validation Teams during the performance of a validation on the ship.

2-15.2 SECAS PROGRAM MANUAL

The SECAS Program Manual consists of eight separate volumes, each a stand-alone document tailored to specific areas of interest or functions within the SECAS Program. Ships will be required to utilize only one volume, NAVSEA T0752-AA-MAN-0401 SECAS; which addresses the SECAS Program and the operation thereof, as it affects the individual ship.

This volume has been written for both supervisory and working level personnel. It provides step-by-step instructions, including detailed illustrations of the various forms and reports involved.

2-15,3 SECAS CONFIGURATION DATA

SECAS is a key ingredient in the overall fleet logistic and maintenance support program. Ship configuration data available from SECAS is the basic element used by shore activities to determine the types and degree of logistic and maintenance support required by a ship for its complex systems/equipment. Accurate and current ship configuration data is necessary for the onboard availability of all applicable technical manuals, repair parts, and other logistic support to perform required maintenance and repair actions. SECAS provides ship configuration data to, and interacts with, the other elements of the overall systems. Through this interaction, and as the central, integrated source of ship configuration status data, SECAS directly impacts:

a. Onboard repair part support to installed/in-use equipment and, therefore, COSAL accuracy and comprehensiveness;

b. Planned Maintenance System (PMS) and technical manual [TM) support;

c. Ships Portable Electronic Test Equipment Requirements List (SPETERL);

d. Budget planning;

e. Maintenance and overhaul planning;

f. Operational planning; and

g. Special improvement and interest programs.

The individual ship is the ultimate recipient of the enhanced logistic and maintenance support that SECAS makes possible.

The individual ship is also the prime contributor to the maintenance of SECAS; and, therefore, it is in great part a master of its own logistic and maintenance support destiny. Ship's Force personnel contribute significantly to the success of a SECAS validation through the assistance they provide to Validation Teams. By reporting configuration changes during operating periods, Ship's Force personnel ensure that the WSF continuously reflects accurate and current ship configuration status data. Only through such dedicated involvement by the ship can the validity of the configuration data base be ensured.

2-15.3.1 CONFIGURATION CHANGE REPORTING

Configuration change reporting is even more crucial to the success of the SECAS Program than is the validation effort. Proper reporting of configuration changes is the primary method of maintaining an accurate, up-to-date configuration data file.

A central configuration file without an adequate and efficient means for update, as changes occur, results in a stagnant file with little useful purpose. The configuration change reporting system haa been designed to accomplish this updating requirement.

A configuration change occurs whenever any system, equipment, component or unit is installed, removed, modified, or relocated. The accomplishment of any action prescribed by an alteration directive (e.g., Ordnance Alteration (ORDALT), Ship Alteration (SHIPALT), Field Change (FC), Engineering Change, etc.) that results in a configuration change.

Incident to the review of a SECAS report an error or omission in the configuration data for an equipment may be detected in the ship's COSAL (including Indexes), or any other such document baaed on the ship's configuration file. Such errors and omissions must immediately be corrected if the ship is to be provided proper logistic and maintenance support for the applicable equipment.

A single form (OPNAV Form 4790/CK) provides all the required configuration change data. This form significantly reduces the Fleet workload in the reporting of configuration changes and obtaining logistics support. For example, a separate Ship's Maintenance Action Form (OPNAV 4790/2K) is no longer appropriate to report the accomplishment of a maintenance action that results in a configuration change. Separate Planned Maintenance System Feedback Reports (OPNAV 4790/7Bs), Technical Manual Deficiency/Evaluation Reports (NAVSEA 5600/2s) and Configuration Change Reports (NAVSUP 122001s) are no longer to be used to obtain updated PMS, technical manual and supply support, respectively, incident to a configuration change. However, it should be noted that the OPNAV Forms 4790/2K, 4790/7B, NAVSUP Form 1220-2 and NAVSEA Form 5600/2 are still used for other technical actions.

Only that data that is available on the ship has to be reported; data that is available in the shore systems, (i.e., SCAT), does not have to be reported.

The importance of reporting configuration changes cannot be overemphasized. The quality and currency of information recorded in the data base directly determines the quality of support to the Fleet. If configuration changes are not reported, vital support elemente such as repair parta, Technical Manuals, PMS requirements and related allowance documente will not be on hand when needed. Without such support, the material readiness of a ship is adversely affected. Furthermore, the Naval Manpower and Material Analysis Center (NAVMAC) requires reliable configuration information upon which to base personnel and training require ment. Considering their impact on shipboard support systems, all configuration changes must be as promptly and accurately reported as possible. Therefore, the responsibility for identifying and documenting configuration changes must rest at@ levels of the ship's internal command, from the Commanding Officer on down.

2-15.4 SECAS VALIDATIONS

The SECAS validation updates the ship's configuration baseline in the Weapon Systems File (WSF) through visual inspection, Configuration data existing in the WSF is periodically verified against the actual configuration of onboard systems/equipment. Since logistic (e.g., the Coordinated Shipboard Allowance List (COSAL)) and maintenance support for the ship is based upon configuration data in the WSF, validations are conducted to ensure that the WSF contains current and accurate data for all onboard systernslequipment. A shipboard validation is currently performed prior to an overhaul to provide an accurate configuration baseline for overhaul planning.

Validation is a systematic method of verifying or recording the configuration of the ship through onsite, detailed visual inspection of systems, equipment, and components (to the lowest unit level); precisely locating the identified items; verifying accomplishment of specific equipment alterations (e.g., Field Changes (FC), SHIPALTS, ORDALTS) and confirmmg or documenting descriptive, characteristic information for verification and entry to the SECAS data base. The ship validation includes HM&E, ORD and ELEX systems and equipments as follows:

a Hull, Mechanical and Electrical (HM&E) Validations. The onsite verification of selected hull, mechanical and electrical systems and equipment including any special purpose test equip ment not covered in ELEX or ORD validations;

b. Ordnance (ORD) Validations. The onsite verification of nonexpendable ordnance and related fire control systems and equipment, including associated ordnance electronic equipment, ordnance special purpose test equipment and applicable Ordnance Alteration (ORDALT) status: and

c. Electronics (ELEX) Validation. The onsite verification of electronics systems and equipment (less ordnance electronics); general and special purpose electronic test equipment; and equipment alteration status such as applicable field change, crypto equipment modification and engineering change.

2-15.4.1 **TYPES OF VALIDATION**

Full Team Validation, Directed Validation and Self-Help Validation are the descriptive titles assigned to the three methods of validation which may be employed in the SECAS Program. Although the same functions occur in each type of validation, the source of personnel for their accomplishment varies. The three types are as follows:

a FULL TEAM VALIDATION. Full Team Validations are managed by a NAVSEACEN DET Representative and are accomplished by a trained Validation Team consisting of NAVSEACEN DET and Validation Agent members. Assistance by Ship's Force personnel during the validation will be limited to opening/operating equipment and providing access to spaces and/or equipment located in security or hazardous areas; and to provision of necessary escort service, technical documentation, and other support efforts. To ensure that the validation is completed in a timely manner, it is essential that assigned Ship's Force personnel provide dedicated assistance, as requested, until released by the NAVSEACEN DET Representative.

b. DIRECTED VALIDATION. Directed Validations are conducted by Ship's Validation Teams under the direction of SECA%mined validat.ors provided by the Validation Agent and directed by a NAVSEACEN DET Representative. Depending on the availability of SECAS validation personnel and level of validation effort, the ratio of NAVSEACEN DET validators to ship's validators will range from 1:1 to 1:4. The applicable ratios of personnel required and work centers involved will be determined by systemlequipmentlcomponent population and the validation time frame. Each member of the Ship's Validation Team, as directed by the Ship's Liaison Officer, will report to the NAVSEACEN DET validator to whom he is assigned. It is essential that the assigned Ship's Validation Team be dedicated to the validation effort until completion of individual assignments and release by the NAVSEACEN DET Representative.

c. SELF-HELP VALIDATION. Self-Help Validations are conducted by Ship's Force personnel under the direction of a Ship's Validation Control Officer designated by the CO. A NAVSEACEN DET Representative will review the validation aids and other materials required for accomplishing the validation and ensure their delivery tQ the ship requesting the validation. Dependent upon availability of NAVSEACEN DET manpower resources, NAVSEACEN DET will provide one or more personneI to act as the NAVSEACEN DET Representative and provide procedural training and guidance to the Ship's Validation Team. The NAVSEACEN DET Representative may personally deliver the validation package and, prior to commencement of the validation, give a presentation to the Validation Control Officer and Validation Team describing validation procedures and techniques. Completion of the validation within the required time, and return of the completed validation package to the applicable NAVSEACEN DET by the date specified, are the responsibility of the ship's CO.

2-15.4.2 **VALIDATION SCHEDULE**

The NAVSEACEN DETs are responsible for coordinating with the appropriate Type Commanders and the ships to establish ship validation schedules. The current objective is to conduct a validation 15-21 months prior to the start of overhaul (sOH) to allow timely input of configuration change data to the WSF. This will ensure that updated configuration accounting status data is available to all activities involved in the overhaul process in sufficient time (not later than 12 months prior to the SOH) to provide accurate configuration data support for overhaul and logistic plarming efforts. Attainment of this scheduling objective is a critical factor in establishing adequate post-overhaul logistic support of the ship.

2-15.4.3 **PRE-VALIDATION**

Prior to performance of the validation, Ship's Force personnel shall assist in the preparation efforts by:

a. Coordinating with the Validation Scheduler to deterrnine the schedule for performance;

b. Identifying Ship's Force personnel to assist in the validation on a dedicated basis. Although the number and types of personnel required will vary with the type of validation being performed, the following will always be required:

(1) Liaison Officer, to be the single point of contact for the ship,

(2) Certifying Officer, who may be the same individual as the Liaison Officer, to review and approve for the ship, all proposed "deletes" for which there is no replacement equipment;

c. Designating working space for use by the Validation Team;

d. Providing to the Validation Team all configuration change forms (CCF) for which NAVSEACEN DET response has not been received, or which have not been included in previous SECAS reports; and

e. Participating in the F%Validation briefing which outlines the validation process, ensures common understanding of all elements by all participants, and provides or schedules any required training of the Ship's Force personnel.

2-15.4.3.1 **SECAS VALIDATION TEAM**

The SECAS Validation Team is made up of technical specialists who have been trained and are experienced in configuration validations on certain broad categories of shipboard equipments. The accuracy of the validation of the systemslequipments is based on this technical expertise, not merely the reading and recording of nameplate data. The validators also utilize technical data which allows them to assess the true configuration of the onboard equipments. For example, for each Equipment Alteration validated, a "Key Checkpoint Sheet" is used to deterrnine the status of the Equipment Alteration accomplishment. This data is important because the installation of a certain Equipment Alteration may result in a change to the Type Designation of the Equipment on which it has been installed. In some cases, the nameplate on the equipment has not been updated to reflect this situation.

2-15.4.3.2 **SHIP'S FORCE RESPONSIBILITIES**

During the actual performance of the validation, Ship's Force persormel will contribute to the efforts by:

a Providing tQ the Validation Team, upon their arrival, a copy of the ship's most recent Metrology Automated System for Uniform Recall and Reporting (MEASURE) inventory and a list of all equipment "off-ship" (e.g., being repaired at a tender, being calibrated at a cal lab);

b. Providing any requested technical documentation;

c. Providing escort services, access to spaces and/or equipment located in security or hazardous areas, operation of equipment, opening of equipment for Equipment Alteration status verification;

d. Providing tQ the Validation Team all CCFS prepared during the validation (Note: The ship will continue tQ forward a copy of each to the 3-M System);

e. Providing ship's existing configuration data as requested, for equipments that cannot be validated for some reason; i.e., equipment operating, spaces secured, safety hazard, etc.;

f. Alerting the Validation Team of any equipment that they observe within a space that has been validated without a SECAS validation marker. This procedure is particularly necessary to assure validation of portable equipment, such as test equipment, that may be moved during the validation. Any equipment that is stQred in a location that the validation team would not normally validate, should also be brought to the attention of the team.

Occasionally, it may be impossible to validate equipment which is operating (on-line), offship for repair, temporarily inaccessible, etc. Forms todocument the validation of such equipment may be left onboard tQ be completed by Ship's Force personnel and returned to the NAVSEACEN DET within 30 days.

2-15.4.4 **POST-VALIDATION**

Upon conclusion of the validation, the NAVSEACEN DET Representative will conduct a briefing to apprise the ship of the preliminary results of the validation. Subsequent to the validation, the ship will also receive official notification of all equipment "adds" (equipment onboard but not in the existing configuration file) or "deletes" (equipment in the existing configuration file but not found onboard by the Validation Team and for which no replacement can be found). Action should be taken by the ship to obtain immediate repair part support for each "add." Procedures for doing so are provided in the COSAL Use and Maintenance Manual (SPCCINST 4441.170), Chapter 5 and additionally, for ships only, in the Afloat Supply Procedures (NAVSUP Pub 485) paragraph 2104, and Chapter 4. It is not necessary for the ship to submit CCFS for these changes. The existing ship's COSAL, annotated in accordance with these procedures, will be used until an updated COSAL is received from SPCC approximately four months after the overhaul. The Certifying Officer, in conjunction with the appropriate Department Head, will be allowed thirty days to officially comment to the NAVSEACEN DET on equipment "deletes." Within approximately ten days, a letter will be forwarded to the ship with the copies of validation aids for all "adds" and

"deletes" (without replacement). The ship is requested to review these items and certify their accuracy or update the "valaids" with the correct information and respond to the NAVSEACEN DET. In this way, the ship maintains control over its configuration status file.

2-15.5 SECAS REPORTS

An explanation of the standard summary and informational SECAS reports prepared for the use of commands throughout the Navy can be found in NAVSEA TO 752-AA-MAN-o40/sEcAs.

2-15.5.1 USES OF SECAS REPORTS

As the documents which provide the configuration of the ship, the SECAS reports should be used for various purposes. All systemsl equipments identified in SECAS reports as onboard ship should be reflected in the Coordinated Shipboard Allowance List (COSAL), the Ships Portable Electronic Test Equipment Requirements List (SPETERL), the Publications Allowance List (PAL), and the Maintenance Index Page (MIP) Index. Each systemlequipment should be adequately supported by ships personnel with the proper expertise to operate and maintain the equipment.

2-15.5.1.1 COSAL

All systems/equipments requiring supply support must be included in the COSAL. It is equally important that the COSAL no longer supports systems/equipment which have been removed from the ship. The COSAL is a dynamic document that must be continuously updated by the ship to reflect changing configuration of onboard equipment. Errors in data contained in the WSF will result in errors in the COSAL and other logistic support. These can be detected and corrected at the shipboard level and are the respom sibility of both technical and supply personnel. To ensure that the ship's COSAL reflects the ship's configuration, a determination is made that the systernlequipment configuration data common to both the COSAL and the reports are the same. It should be noted that configuration records contained in SCAS reports are not always included in the COSAL and vice versa. Examples of inconsistencies that may occur when comparing COSAL to the SECAS report are:

a. Some electronics equipment will be identified in the WSF by a series of ten nines (9s) in the APL field. SECAS reports will include these items with 9s, whereas the COSAL will n@ include these items. When the 9s are in the APL field, it is because the equipment was not mechanically matched to an APL/RIC. The items with 9s require manual research by SPCC technical personnel to assign the proper APL/RIC or develop a new APL for the item. The COSAL only contains items with an APL/RIC assigned.

b. Both the COSAL and SECAS reports will include "Supply Support Only" (SS0) configuration records. However, SS0 items are "non-hardware." Therefore, there will be no actual onboard equipment against which the configuration data in the COSAL/SECAS reports can be verified. The SECAS report will identify these items with an "L" or "M" Installation Status Code.

c. Unaccomplished Field Changes (FCS) will be reflected in SECAS reports, but not in the COSAL.

d. HM&E equipment onboard may not be in either the SECAS reports or the COSAL, if no APL/RIC has been assigned by SPCC.

e. Occasionally, equipments are changed from one type of support to another, i.e., HM&E to Electronics, or vice versa. Therefore, if an equipment is not found in one section of the COSAL, it may be found in another section.

f. The CNO has directed that the use of Manufacturer's Designating Symbols (MDS), i.e., CAQI, be discontinued in favor of the Federal Supply Code for Manufacturers (FSCM). Therefore, equipment nameplates may include an MDS, but SECAS reports and the COSAL may not contain them. To differentiate between model numbers that appear the same, the FSCM must be identified. FSCMS for commercial equipment are listed in Index C of the COSAL. During the transition period, the MDS may continue to appear in the nomenclature fields of SECAS reports and the COSAL. It is not necessary for the ship to take any corrective action in this situation.

2-15,5.1.2 SPETERL

All electronics general purpose test equipment requirements are listed in the SPETERL and are based on the prime equipments contained in the WSF. Therefore, an error in the WSF prime equipment configuration data can adversely affect the test equipment allowance. In addition, test equipment is maintained in the WSF. Inaccuracies in the test equipment configuration will impact excesses and deficiencies of test equipment based on the allowance for the ship. The test equipment should therefore be verified as accurate in the SECAS reports (502.lB and 502.lC) by matching SCAT codes.

2-15.5.1.3 PAL

Each onboard equipment should have an applicable Technical Manual (TM) available;

therefore, the PAL should include the necessary TMs for each equipment in the SECAS reports.

2-15.5.1.4 **MIPs**

Each equipmentlsystem onboard should also be covered by a MIP for performance of planned maintenance, if applicable.

2-15.5.2 **REFERENCE DOCUMENT**

SECAS reports are ready reference documents for:

a. Identification elements such as EIC, APL/AEL, equipment nomenclature, etc., which serve to simplify generation of future OPNAV Form 4790/CK, 4790/2K and other reports requiring configuration data;

b. Shipboard training aids and reference documents for the orientation of new ship's personnel;

c. Determination of equipment alteration status (those requiring installation as well as those previously installed);

d. Comparison with the ship's Metrology Automated System for Uniform Recall and Reporting (MEASURE) reports to ensure consistency between systems and to ensure that all test equipment is included in the MEASURE system. However, it is to be noted that not all equipment in the MEASURE system is configuration worthy. SECAS Reports 502.lB and 502.lC should be used for this comparison;

e. Comparison with local shipboard configuration related documents to ensure consistency and complete coverage of all systems/ equipment;

f. The true configuration status of the ship (nameplate data is not always accurate);

g. Test equipment configuration status when advised by the TYCOM to redistribute excesses, and for identifying and requisitioning shortages; and/or

h. Availability of test equipment listed on Bills of Material required to perform PMS.

2-15.5.3 **SECAS REPORTS PROVIDED TO SHIPS**

SECAS reports are grouped by Hull, Mechanical and Electrical (HM&E) Reports; Electronics (ELEX) Reports; and Ordnance (ORD) Reports.

2-15.5.3.1 **HM&E REPORT**

The Ship Integrated Configuration Report, SECAS Report V02-CAIL, is a Ship Work Authorization Boundary (SWAB) oriented configuration report which lists a ship's onboard hull, mechanical and electrical equipment in SWAB sequence.

Since the structure of the V02-CAIL is based on the SWAB, the listing of an onboard HM&E system will also include each of its major subsystems, equipment and components. The report provides technical HM&E equipment identification data such as the Service Application Code (SAC), APL/AEL, equipment nomenclature, the quantity of such equipment onboard the ship, the EIC, location, etc.

2-15.5.3.2 **ELEX REPORTS**

Each of the 502, 503 and 506 series SECAS reports contain essentially the same information but in different sequences and for different categories of electronic equipment. These reports, collectively, were designed as a ready reference and management tool for identification of both the hardware itself and its applicable major support elements such as category (CAT) and subcategory (SCAT) codes, equipment identification codes, WC codes and APL numbers. A brief description of each report follows:

REPORT NR.	DESCRIPTION
502.lA	Lists all of a ship's onboard ELEX equipment less test equipment. The report also provides Field Change (FC) Status.
502.lB	Lists all of a ship's onboard ELEX/electrical general purpose test equipment.
502.lC	Same as the 502.lB except the items are sorted in Sub-Category (SCAT) sequence to match the Ships Portable Electronic Test Equipment Requirements List (SPETERL).
502.lR	Lists all of a ship's onboard ELEX equipment with its applicable Equipment Alteration Status. The report is available on microfiche only.
503.1	Lists all of a ship's onboard ELEX equipment. Immediately, following each listed location, the report itemizes, in type designation sequence, all the ELEX equipment contained in that location (LOC).

506.1 Lists all of a ship's onboard ELEX equipment structured in systems as they are configured on the ship. The report also provides Equipment Alteration Status, where applicable for equipment listed.

506.2 Lists all of a ship's onboard prime ELEX equipment in alphanumeric sort by category code.

2-15.5.3.3 **ORDNANCE REPORT**

The Ship Armament Installation List (SAIL), SECAS Report EOO1O, provides the configuration status of all nonexpendable ordnance (ORD) systems/equipment onboard a ship and includes the applicable Ordnance Alterations (ORDALTS). The ORD equipment is listed in Configuration Accounting Number (CAN) sequence. The report provides technical ORD systems/equipment identification data such as the CAN, nomenclature, the MARK and MOD, location, the status of applicable ORDALTS, etc.

2-15.5,4 **OTHER SECAS REPORTS**

Other available SECAS reports are Fleet, rather than ship, oriented. The versatility of the SECAS retrieval program provides for the production of tailored reports to meet specific customer needs. If a desired report format is not available, it can be obtained (within the confines of the data elements currently maintained in the file) by request from NAVSEA 0411. The request/ recommendation shall be forwarded via the chain of command.

2-15.6 **DISTRIBUTION OF SECAS REPORTS**

The above listed reports will be automatically sent to validated ships. If more copies, other reports, or copies on other report mediums such as microfiche are required, make a special request to one of the following SECAS Validation Field Offices:

Commanding Officer
Naval Sea Support Center, Pacific
P.O. Box 80548
San Diego, CA 92138

Officer-in-Charge
Naval Sea Support Center
Atlantic Detachment Code 933
St. Juliens Creek Annex,
Portsmouth, VA 23702

2-16 ALLOWANCE LISTS AND REPAIR PARTS SUPPORT

The kinds, amounts and parts of equipment to be carried by naval operating forces are established by allowance lists developed in accordance with the concept that naval ships must be self-sufficient to the maximum possible extent and that a ships own storeroom is its first echelon of supply support. These allowance lists itemize the operating equipment of each ship and the repair parts and equipage necessary to support the equipment.

2-16.1 COORDINATED SHIPBOARD ALLOWANCE LIST (COSAL)

The Coordinated Shipboard Allowance List (COSAL) is the heart of the shipboard supply system in that it consolidates all repair parts required to support all shipboard equipment. It establishes quantities of on-board repair parts, equipage, and material for direct support of all departments. Each ship has a COSAL tailored specifically for the equipment installed.

The COSAL is comprised of an Introduction, Part I, Part II, and Part III. Competent usage of the COSAL requires careful review of the Introduction. Parts I, II, and III are briefly discussed following.

2-16.1.1 **COSAL PART I**

The Summary of Effective Allowance Parts/Equipage Lists (SOEAPLS) list shows the document number only of all Allowance Parts Lists (APLs) and Allowance Equipage Lists (AELs) included in the COSAL compilation. Part I, Section A is an alphanumeric name to APL/AEL number list and Part I, Section B is an alphanumeric name to APL/AEL number within service application of all equipments support by the COSAL.

An individual APL, AEL, or Preliminary APL exists for each equipment listed in Part I of the COSAL when the last two digits of the Allowance Support Code in Part I are "AA" or "AB".

2-16.1.2 **COSAL PART II**

Part II includes, in APL number sequence, Section A of the APLs included in the COSAL computation. The APL Section A is a cross-reference from part number to National Item Identification Number (NIIN) or Activity Control Number (ACN) of repair parts which are candidates for allowance.

Certain equipments (e.g., electronic test equipment) and special tools are considered

equipage-non-consumable articles that are portable and not altered by use. These may be itemized in an AEL. Section C of Part II of the COSAL consists of applicable AELS, in AEL number sequence.

2-16.1.3 **COSAL PART III**

Part III of the COSAL, the Stock Number Sequence List (SNSL), is a consolidated listing in NIIN sequence of allowance repair parts/items. The SNSL actually consists of two lists-one for Store-room Items (Section A) and one for Operating Space Items (Section B).

Repair parts allowed onboard are necessarily limited by space, weight, and cost. Allowances are computed by a complex process which considers failure rate, criticality, etc. to provide optimum repair parts within specified constraints.

2-16.1.4 **COSAL Feedback Program**

The COSAL Use and Maintenance Manual (SPCCINST 4441.170) supplied to all ships contains instmctions for use and submission of FCFBR (Fleet COSAL Feedback Report) forms. These forms provide a direct, informal channel for shipboard technicians to notify NAVSSESDETMECH of technical problems encountered in using any equipment APLs (Allowance Parts Lists).

2-16.2 FINDING A NATIONAL STOCK NUMBER (NSN)

Usually we are concerned only with the NSN when it is necessary to obtain a part from supply to effect a repair. The method used to obtain the correct NSN for the part needed is best explained by way of example.

In working on the ANISPS-00, it was discovered that R21 was defective. The first step would be to look in Section B of the AN/SPS-00 APL, which lists the repair parts in Reference Symbol Number (RSN) sequence to identify the part number of R21. The second step would be to look in Section A to obtain the National Stock Number (NSN) of R21. The final step would be to order the part from supply using the DD1150 form.

NOTE

APL Section B is not part of the COSAL but is available by hard copy or microfiche. Section B is in RSN sequence and crosses to part number. Section A is part of the COSAL but may also be available by hard copy or microfiche.

There will be aboard, occasionally, an item of equipment for which there is no APL; or more rarely, which is not supported by the COSAL. In either case, the procedure for obtaining the correct NSN is a little more involved. The first step would be to check the parts list of the equipment technical manual for a manufacturer's identification. The identification number can then be cross-referenced to an NSN in The Master Cross Reference List, Part I.

There are several other avenues open which are more involved and used so seldom that it is not necessary to go into them here. The number of times that a part cannot be referenced to an NSN are actually very few. It is during such rare occurrences, however, that a good working relationship with the supply department pays off. Supply personnel have all the latest supply publications readily available; they are experienced in their use; and they can be of great assistance in obtaining the necessary information.

2-16.3 WORKSHOP STORES OF REPAIR PARTS

Certain parts may require replacement so often that there may be a tendency to consider them as a part of shop stores. In such a case, an improvement of design may leave the shop store with a 6-year stock of obsolete parts rather than a 90day supply of improved parts. For this reason alone it is desirable to keep shop stores to a minimum. Furthermore, if a large quantity of a particular item is built up in shop stores, requisitions for this item are likely to be forwarded to the

supporting supply officer for electronics on only an annual or semiannual basis rather than on a monthly basis. The supply officer for electronics, however, determines the future requirements on the baais of quarterly or monthly demand. Since, for a long period of time, no requisitions have been forthcoming for this particular item, the supply officer naturally assumes that the demand is not great. This information is transmitted to higher echelons of supply by means of a quarterly requisition or a transaction report. When the quantity of this item in the shop store finally becomes low and a requisition is submitted, the supply officer may not have a sufficient quantity on hand to fill the request and must submit an emergency requisition for action.

Often, excess stocks are built up to ensure that sufficient material will be available at all times without immediate recourse to the supply system. The electronics distribution system is so organized that it can supply the material in a minimum of time only when (1) no more than a 3-month supply is maintained in ship loads, (2) requisitions for material are submitted at monthly intervals, and (3) planned future requirements are submitted in sufficient time and detail to permit the supply officer for electronics to obtain materiaIs from a higher echelon of supply.

2-17 EQUIPMENT NOMENCLATURE

Nomenclature for an electronic equipment is assigned by one of three systems: the Joint Electronic Type Designating System (JETDS) in accordance with MIL-STD-196, the Mk-Mod nomenclature system in accordance with MIL-STD-1661, or commercial nomenclature system.

2-17.1 JOINT ELECTRONIC TYPE DESIGNATING SYSTEM (JETDS)

Electronic material are identified in the Joint Electronics Type Designation System (JETDS), formerly the Joint Army-Navy (or "AN") Nomenclature System, which is administered by the U.S. Army Electronics Command. The "type designation" is that part of nomenclature consisting of a combination of letters and numerals arranged in a specific sequence to provide a short significant method of identification. The other part of a complete nomenclature assignment is the "item name". See Figure 2-6 for examples of the basic structure of nomenclature assignment.

2-17.2 MK-MOD NOMENCLATURE

The Mk-Mod nomenclature consists of the item name of the equipment and sequence of "Mk-Mod" numbers and letters as shown in the example contained in Figure 2-7. Unlike the JETDS type designating system, the item name must always be included with the Mk-Mod designation to specifically identify an item of equipment. The Mk-Mod designations are assigned in alpha-numeric sequence within each equipment type. The item name may be spelled out, but the accepted letter-group abbreviations (e.g., SINS, DRAI, SAISAC, MSR, WDE, WDS, etc.) are preferred for lengthy item names.

2-17.3 COMMERCIAL NOMENCLATURE

Commercial nomenclature assigned to an item of electronic equipment consists of the manufacturer assigned name or the Defense Supply Agency assigned Federal Supply Code for Manufacturers (FSCM) and the manufacturer assigned model number. (See Figure 2-8.) Commercial nomenclatures are assigned only to commercially manufactured "off-the-shelf" items of electronic equipment which have not been assigned either JETDS or MK-Mod identification.

The FSCM consists of five characters, generally all numeric.

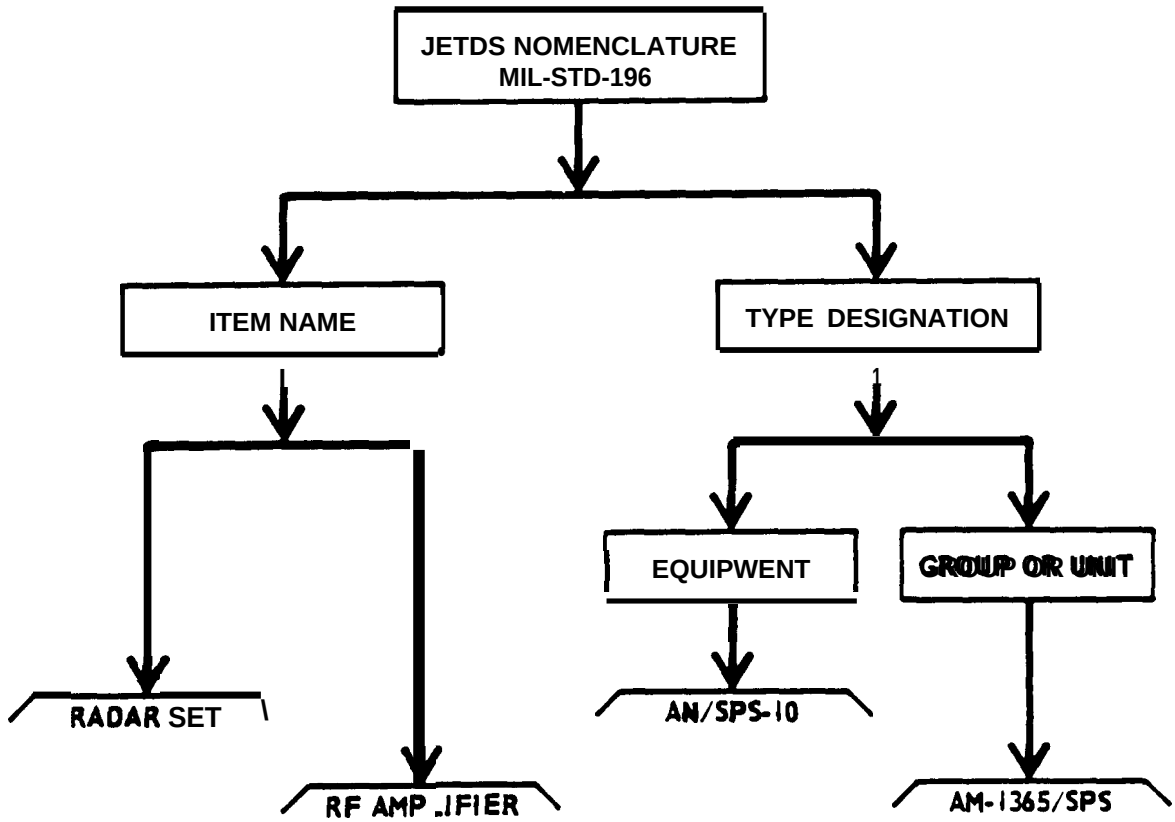


Figure 2-6. Basic Structure of JETDS Nomenclature Assignment

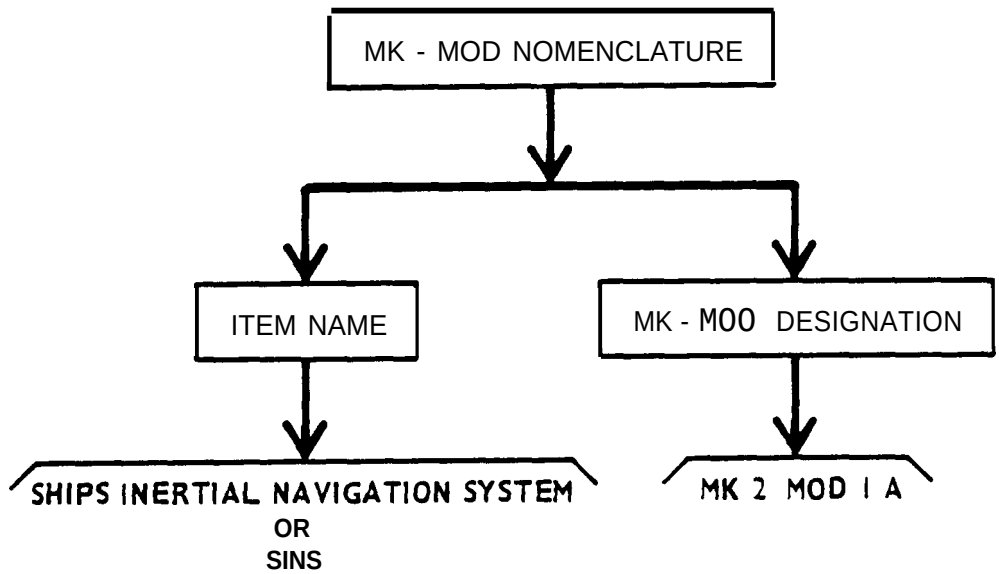


Figure 2-7. Basic Structure of Mk-Mod Nomenclature Assignment

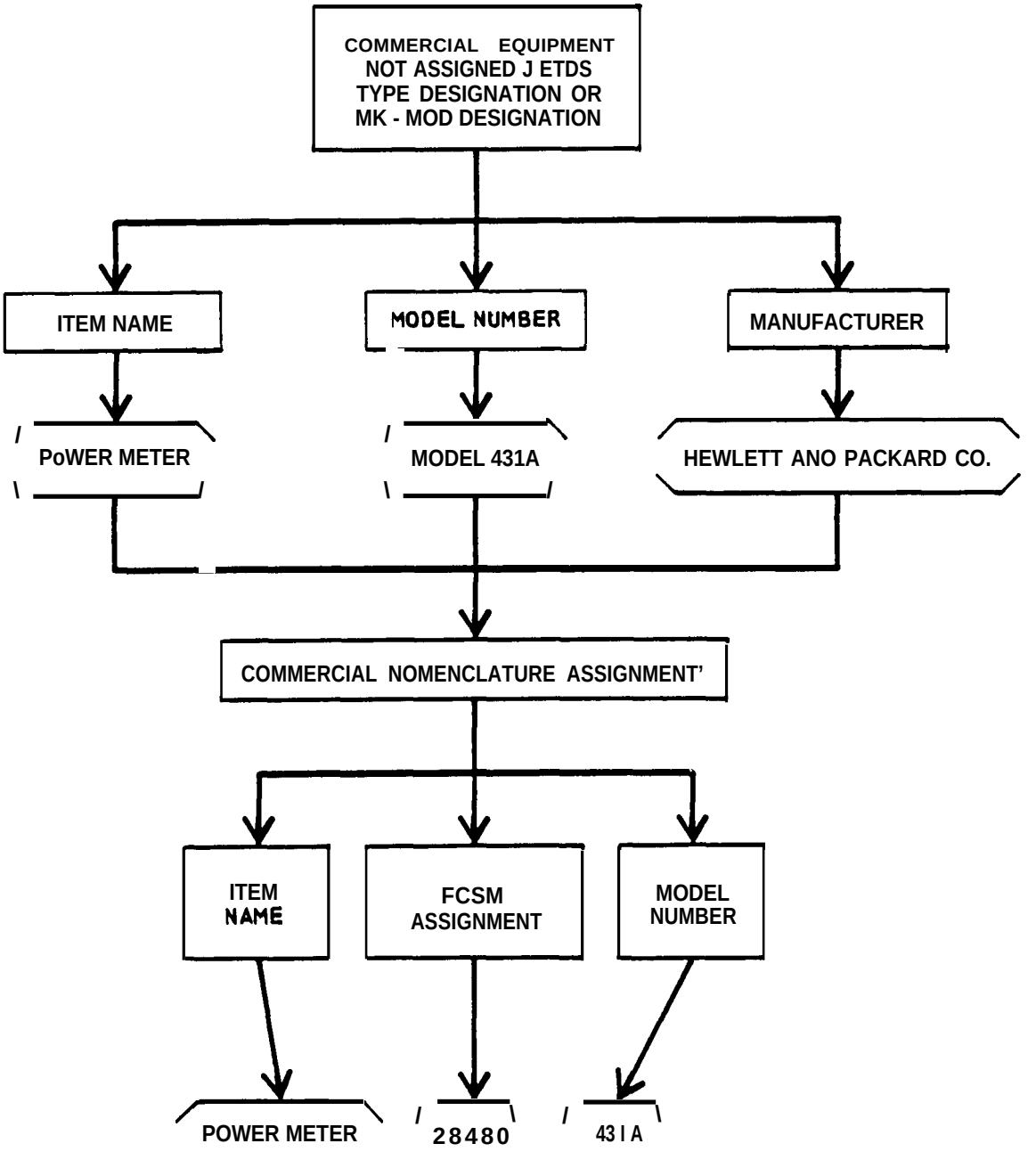


Figure 2-8. Basic Structure of Commercial Nomenclature Assignment

SECTION 3

SAFETY AND ACCIDENT PREVENTION

3-1 INTRODUCTION

Because safety is one of those subjects about which many volumes can be written, and since the purpose of the EIMB series handbooks is to cover subjects that are of interest to electronics and maintenance personnel, the safety and accident prevention information contained herein is limited to material dealing with the safety of personnel aboard ships and ashore. However, every effort has been made to cover the different possible types of hazards that could endanger life or damage equipment, and to recommend practices for prevention and elimination of such hazards and thus reduce the cost of accidents.

3-1.1 CAUSE AND EFFECT OF ACCIDENTS

Most accidents are preventable. However, through ignorance or misunderstanding, there is a common belief that they are the inevitable result of unchangeable circumstances or fate. This belief is untrue because it fails to consider the basic law of "cause and effect" to which accidents are subject. In other words, accidents do not occur without a cause; most accidents are the direct result of some deviation from prescribed safe operating procedures.

A preventable accident maybe traced to causes as basic as the heredity and early environment of the individual. These causes may be revealed in the form of personal characteristics which permit the individual to perform an unsafe act or permit a hazardous condition to exist; when an accident results, the "cause and effect" sequence is completed.

One purpose of safety rules is to remind the individual of the dangers inherent in the work. Training in the observance of safety precautions can be instrumental in avoiding preventable accidents and in maintaining a work environment which is conducive to accident-free operation. Operating procedures and work methods adopted with hazard prevention as a specific criteria do not expose personnel unnecessarily to injury or occupational health hazards. Accidents which are about to happen can be prevented if the "cause" is detected and appropriate remedial action is taken.

3-1.2 RESPONSIBILITY

Responsibility for the safety of personnel is vested in the commanding officer. The commanding officer may delegate authority to the safety officer and other subordinates to ensure that all prescribed safety precautions are understood and strictly enforced. The commanding officer ensures that the personnel are instructed and drilled in applicable safety precaution; requires that adequate warning signs be posted in dangerous areas; and establishes a force to see that such precautions are being observed. It is the responsibility of supervisory personnel to see that precautions are strictly adhered to in their own work area, since they are responsible to the commanding officer. Furthermore, individuals concerned should strictly observe all safety precautions applicable to their work or duty. Thus, it is obvious that accident prevention is the business of every individual–not just a delegated few.

As an individual, you have a responsibility to yourself and to your shipmates to do your part in preventing accidents. You must always be alert to detect and report unsafe work practices and unsafe conditions so that they may be corrected before they cause accidents.

Each individual must:

a. Observe all posted operating instructions and safety precautions.

b. Report any condition, equipment, or material which is considered to be unsafe. (See Subsection 3-16, Reporting Unsafe Conditions.)

c. Warn others whom are believed to be endangered by known hazards or by their failure to observe safety precautions.

d. Wear protective clothing or use protective equipment of the type approved for the safe performance of their work or duty. (See Subsection 3-19, Safety Equipment.)

e. Report to their supervisor any injury or evidence of impaired health occurring in the course of their work or duty.

f. Exercise reasonable caution as appropriate to the situation in the event of an emergency or other unforeseen hazardous condition.

Post-accident investigations have revealed that the majority of accidents result from

unsafe practices or acts, most of which are known beforehand to be unsafe and in violation of safety practices, rules, regulations, or directives. Other human factors found to be the cause of accidents include fatigue, monotony, preoccupation at a critical moment (inattention), mental and/or physical problems, improper supervision, lack of motivation and such. Because of various factors, individuals do not always act (or react) as they were trained, instructed, or directed to act. Results of this condition, most probably, will be an accident because of "human error".

Human error includes all the actions or inactions of an individual having a bearing on an accident or on an unsafe practice that can lead to an accident. To reduce human error as a predominant cause of accidents, it is the responsibility of all individuals to acquaint themselves with the environmental hazards surrounding them and they should condition themselves to be alert, both mentally and physically, so that they can protect themselves and others by not foolishly or unnecessarily exposing themselves to hazards.

Accidents do not happen without a cause; when each individual can be made aware of the hazards involved with his work, fewer accidents will result. Accident prevention must be a continuous effort in which each individual gains experience and knowledge through day-to-day association with coworkers who are aware of the hazards of their environment.

Remember! As an individual, you have a responsibility to yourself and to your sbipmates. You must always be alert to detect and report hazardous work practices and conditions so that they can be corrected before they cause accidents. In all cases, when working on or near electrical or electronic equipment, learn to respect your equipment's potential for accidental damage and injury.

3-2 ELECTRIC SHOCK

Fundamentally, current rather than voltage is the criterion of shock intensity. The passage of even a very small current through a vital part of the human body will cause death. The voltage necessary to produce the fatal current is dependent upon the resistance of the body, contact conditions, the path through the body, etc.

It is imperative to recognize that the resistance of the human body cannot be relied upon to prevent a fatal shock from 115 volts or even lower voltages—fatalities from as low as 30 volts have been recorded. Tests have shown that body resistance under unfavorable conditions may be as low as 300 ohms and possibly as low as 100 ohms from temple to temple if the skin is broken. Volt for volt, DC potentials are normally not as dangerous as AC as evidenced from the fact that reasonable safe "let-go currents" for 60 hertz alternating current is 9.0 milliamperes for men and 6.0 milliamperes for women while the corresponding values for direct current are 62.0 milliamperes for men and 41.0 milliamperes for women. d

3.2.1 SYMPTOMS OF ELECTRIC SHOCK

In the event of severe electric shock, the victim is usually very white or blue. The pulse is extremely weak or entirely absent, unconsciousness is complete, and bums are usually present. The victim's body may become rigid or stiff in a few minutes. This condition can be caused by muscular reaction to shock, and it shall not, necessarily, be considered as rigor mortis. Therefore, artificial respiration shall be administered immediately, regardless of body stiffness, as recovery from such a state has been reported. Consequently, the appearance of rigor mortis should not be accepted as a positive sign of death.

3-2.2 RESCUE OF VICTIMS

The rescue of electric shock victims is dependent upon prompt administration of first aid.

WARNING

Do not attempt to administer first aid or come in physical contact with an electric shock victim before the power is shut off, or, if the power cannot be shut off immediately, before the victim has been removed from the live conductor.

When attempting to administer first aid to an electric shock victim, proceed as follows:

a. Shut off the power.

b. If the power cannot be deactivated, per Step a, remove the victim immediately, observing the following precautions.

(1) Protect yourself with dry insulating material.

(2) Use a dry board, belt, dry clothing, or other available non-conductive material to free the victim (by pulling, pushing, or rolling) from the power-carrying object. DO NOT TOUCH the victim.

c. Immediately after removal of the victim from the power-carrying object, administer artificial respiration, as described in Subsection 3-21, Resuscitation and Artificial Respiration.

3-3 SHIPBOARD UNGROUNDED ELECTRICAL DISTRIBUTION SYSTEMS ARE DEADLY

The following article appeared in the Naval Sea Systems Command Technical News, of March 1970, Volume 19, Number 3, NAVSEA 0900 -LP-OOO-2060, and was written by G.C. Janzen of the Naval Sea Systems Command.

For reasons given in the following paragraphs, all electrical systems can be potential killers. Shipboard '(ungrounded" electrical systeme are actually capacitively grounded to the extent that lethal currente can flow through a persons body if a live conductor is touched while in contact with ship's ground. The capacitance which causes this electrical ground leakage current to flow is inherent in the design of equipment and cable, and can not be eliminated by practical technical means. All personnel should be aware of the potential hazards; those who work on electrical equipment or systeme should be completely knowledgeable of the hazards, precautions, first-aid techniques, and theory of electric shock.

3-3.1 REASON FOR USING AN UNGROUNDED SYSTEM

Ungrounded electrical distribution systems of both 450 and 120 volts AC are provided on naval ships to achieve maximum system reliability and continuity of electrical power under combat conditions. If one line of the distribution system is grounded, due to battle damage or deterioration of system insulation resistance, the circuit protective devices (circuit breakers, fusee, etc.) will not de-energize the circuit having the ground and electrical power will continue to be delivered to vital load equipment without further damage to the system. Frequent and proper use of the system ground detectors provided on the ship-service switchboards and certain power panels will allow maintenance personnel to locate the ground and make repairs to remove the ground from the systems as operating conditions permit. The primary advantage of an ungrounded system is that power can be maintained to a piece of vital load equipment (such as fire control equipment) during a battle condition, even when a ground occurs on one line of the electrical circuit supplying power to the equipment. If the system was designed as a grounded system, the abovementioned ground on one power line would result in immediate tripping of the circuit protective devices, possible de-energizing a piece of vital equipment when it is most needed.

3-3.2 MISCONCEPTIONS OF A SHIPBOARD UNGROUNDED SYSTEM

Many personnel believe that since the electrical syetem is supposed to be ungrounded, it is possible to touch one bare conductor without danger, since there will be no electrical path for current to flow and, therefore, no electrical shock hazard. This can be a very deadly belief. The misconception arises when we consider the question; what is an ungrounded system? How do we measure or determine that an electrical system is ungrounded? How much electrical current does it take to kill a person? For purposes of discussion, a perfectly ungrounded single-phase, two-wire distribution system is shown in Figure 3-1. The system consists of a generator, distribution cable, and load equipment.

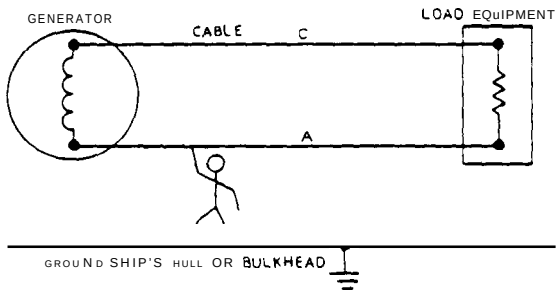


Figure 3-1. Perfect Ungrounded System

By a perfect ungrounded system we mean one in which the insulation is perfect on all cables, switchboard, circuit breakers, generators, and load equipment; that no Radio Frequency Interference (RFI) filter capacitors are connected from ground to any of the conductors, and that none of the system's equipment or cables have any inherent capacitance-to-ground. If all these conditions were met, there would not be a path for electrical current to flow to ground from any of the system conductors. Figure 3-1 shows that if a person touches a live conductor at point A while standing on the deck or ground at point B, there is no completed path for current to flow from conductor A to conductor C through the persons body, and thus there is no danger for electrical shock. However, shipboard electrical power distribution

systems do not and can not meet the above definition of a perfect ungrounded system. If we examine a typical shipboard "real" ungrounded system (see Figure 3-2) there are additional factors which must be considered, some of which are not visible.

These additional factors can be grouped into two categories: resistance and capacitance. The resistance consists of $\mathbf{R_g}$ which is the generator insulation resistance, $\mathbf{R_c}$ which is the electric cable insulation resistance, and R_l which is the load insulation resistance. These resistances, when combined in parallel, form the insulation resistance of the system. Insulation resistance is periodically measured by the crew using a 500 volt DC megger. The reading obtained is an indication of the integrity or quality of the insulation. These resistors, ($\mathbf{R_g}$, R_c, R_l) can not be seen as physical components, but are representative of small current paths through equipment and cable electrical insulation. The values of these resistances are measured in ohms; the higher the resistance, the better the system insulation and consequently, less current flow between conductor and ground. Typical values would be,

$\mathbf{R_g}$ = 500,000 ohms*
R_c = 50,000 ohms* for large system
R_l = 1,000,000 ohms* or greater

The capacitance, shown in Figure 3-2 consists of $\mathbf{C_g}$ which is the capacitance of the generator to ground, C_c which is the capacitance of the distribution cable to ground, and C_l which is the capacitance of the load equipment to ground. As mentioned before, these capacitances can not be seen, since they are not actually physical components, but are inherent in the design of electrical equipment and cable. As an example, if we consider an electrical conductor surrounded by insulation, mounted on a metal bulkhead, we have two pieces of metal separated by an insulating material. Then, since on shipboard systems a potential difference (voltage) will exist between the conductor and the metal bulkhead or ground, we have established, in effect, a capacitor as shown in Figure 3-3.

The value of the capacitance thus generated between the conductor and ground is determined by the radius of the conductor, the distance between the conductor and the bulkhead, the dielectric constant of the material between the two, and the length of the cable. Similar capacitance exists between the generator winding and ground, and between various pieces of load equipment and ground. Since capacitors ideally have an infinite impedance to DC current, their presence can not be detected by a megger or insulation resistance test.

* These values are typical of a large operating system but can vary widely depending on the size of the ship and the number of electrical circuits connected together.

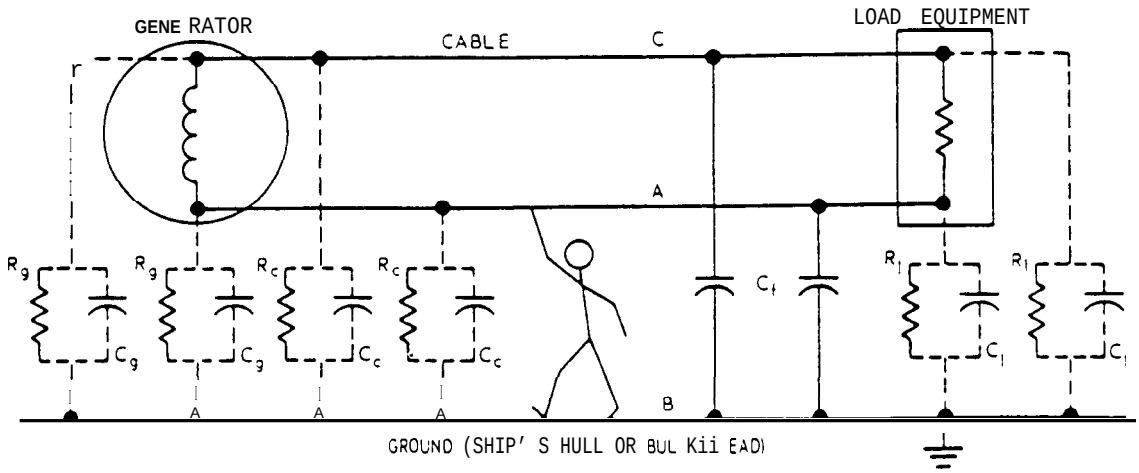


Figure 3-2. Typical Shipboard "Real" Ungrounded System

Figure 3-2. Typical Shipboard "Real" Ungrounded System

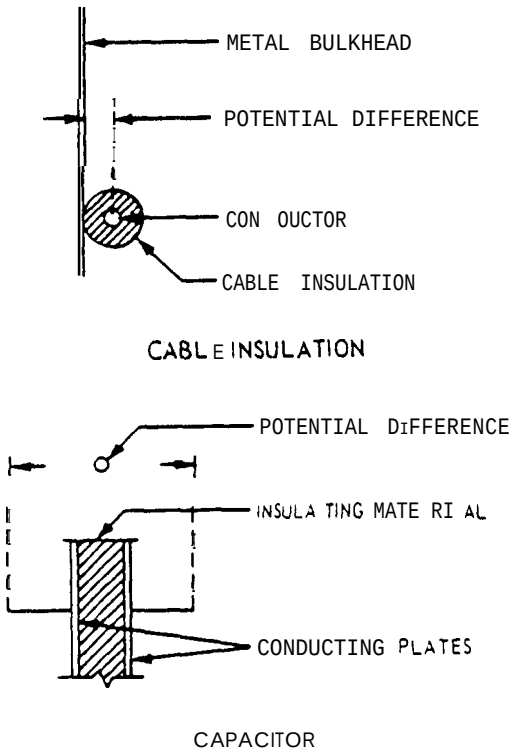


Figure 3-3. Capacitance of Cables

In addition to the non-visible system capacitance, typical shipboard electrical systems contain Radio Frequency Interference (RFI) filters which contain capacitors (C_f) connected from the conductors to ground. These filters may be a part of the load equipment or mounted separately, and are used to reduce interference to communications equipment. The impedance of this capacitance to electrical current flow, also measured in ohms, is determined by the relation:

X_c = Capacitive Reactance in Ohms

$$= \frac{1}{2\pi (\text{Frequency})(\text{Capacitance in Farads})}$$

Typical values of X_c are:

X_g = 26,000 ohms* (C_g = 0.1 pF/phase)

X_c = 1,060 ohms* (C_c = 2.5 pF/phase)

Xf = 53 ohms* (C_f = 50 pF/phase)

X_l = Very high unless equipment contains filter capacitors

If we re-examine Figure 3-2, we will notice that the capacitances (C_g, C_c, C_f, C_l) are in parallel with the system insulation resistances (R_g, R_c, R_l), and form an additional path for electrical current flow from the conductors to ground (ship's hull or bulkhead). Therefore, if a person accidentally touches a conductor at point A, current will flow through the body to ground at point B and back through the system resistances and capacitances to the other conductor at point C, thus completing the electrical circuit, and presenting a serious shock hazard.

3-3.3 RESISTANCE VERSUS CAPACITANCE

If we were to megger the system of Figure 3-2, and obtain a system value of insulation resistance of approximately 50,000 ohms, we would conclude rightly that no low resistance grounds exist on the system and wrongly that the system is "perfect" ungrounded system. Perhaps, we have forgotten the system capacitance which exists is parallel with the resistance. If we look at the typical values of system capacitances given above, we will see that if the system contains many RFI filters, the capacitive reactance of the system to ground may be as low as 50 ohms, while, even without these filter% the inherent capacitance of generators and distribution cable would result in a capacitive reactance of approximately 1,000 ohms. What does this mean to the person who is careless and touches a live electrical conductor? Figure 3-4 shows a simplified circuit assuming no RFI filters are connected to the system. If we assume a person's body resistance of 600 ohms, possible under work conditions when hands are wet from sweat, and combine the total system insulation resistance (R) in parallel with the system capacitive reactance (XC) we obtain the system impedance (Z) to ground, as in the following formula:

* Data obtained from measurements made on the CVA-20 in 1955.
# Data obtained from measurements made on the CG-10 and CG-12 in 1969.

$$Z = \frac{(R)(X_c)}{\sqrt{R^2+X^2_c}} = \frac{(50{,}000)(1{,}000)}{\sqrt{(50{,}000)^2+(1{,}000)^2}}$$

= Approximately 1,000 ohms

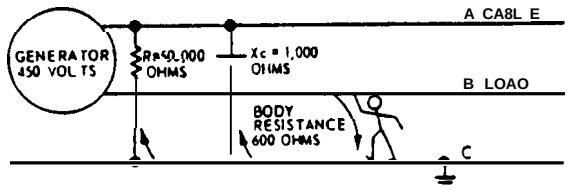


Figure 3-4. Ground (Ship's Hull or Bulkhead)

If the person touches conductor B, the current will flow through the body (600 ohms) to ground, then through the system impedance Z (1,000) ohms, and back to conductor A completing the electrical circuit. The total opposition to this current flow is the square root of the quantity $10002 + 600^2$, or 1166 ohms. The amount of shock current which would flow is given by Ohm's Law;

$$I_s = \frac{450 \text{ volts}}{Z_T} = \frac{450 \text{ volts}}{1166 \text{ ohms}} = .386 \text{ amps}$$

How much current does it take to kill a person? The following general guidelines are taken from NAVSEA O9OO-LP-OO7-9O1O "Electric Shock-Its Causes and Its Prevention".

a. At 1.0 mA, shock is felt.

b. At 10 mA, a person may be unable to let go.

c. At 100 mA, shock is fatal if it lasts for one second or more.

Thus, even if no RFI filters were connected to the system, even if a megger test showed the system to be ungrounded, a current of almost four times the current required to kill a person would flow through the body, and death would result. The aforementioned system capacitance (C_g, C_c, C_l) can not be eliminated since it results from inherent laws of electrical theory associated with the practical design of electrical equipment and cable. This condition existed on all previous ships constructed with AC distribution systems, exists on all present ships, and will exist on all future ships. However, unlike the system insulation resistance, the system capacitance will not change with time (unless equipments containing capacitors connected to ground are added) since it is a function of equipment and cable design. Therefore, no need exists to periodically measure capacitance as we measure the insulation resistance.

The addition or elimination of RFI filter capacitors connected to the system makes no difference from a safety standpoint. It only makes no difference from a safety standpoint. It only takes so much current to kill you, and there is more than enough without RFI filters. Remember:

a. Never touch a live conductor of an electrical circuit, "ungrounded" or grounded.

b. High system insulation readings from a megger test do not make the system safe to touch–nothing does.

c. Insulation resistance tests are made to ensure that the system will operate properly, not to make the system safe.

d. Know and follow the electrical safety instructions contained in Naval Ships Technical Manual Chapter 300.

3-3.4 ISOLATED RECEPTACLE CIRCUITS

To reduce the inherent hazard of these leakage currents on receptacle circuits where portable tools or applicants are plugged in and out, and personnel are more likely to receive an electric shock, isolated receptacle circuits are installed on all new-construction ships. These circuits are individually isolated from the main power distribution system by transformers and each circuit is limited to 1,500 feet in length to reduce the capacitance to an acceptable level. This design is intended to limit ground leakage currents to 10 mA which produces a non-lethal shock. To maintain this low level of leakage current and provide personnel safety, it is extremely important that the isolated receptacle circuits be maintained free of all resistance grounds.

Ships already in the fleet were provided information for installation of either fixed or portable isolation transformers in the receptacle circuits in 1960.

The use of isolated receptacle circuits, and equipment design improvements, have materially reduced the hazards encountered when using portable tools and appliances. However, the best safety device is respect for the deadly hazards present in all electrical systems, grounded or ungrounded, low or high-voltage, AC or DC; for they all are potential killers of the careless or the inexperienced. Each crewmember should be

familiar with the electrical safety precautions contained in the following publications.

a. Naval Ships Technical Manual, NAVSEA S9086-KC-5TM-000/CH-300 RI Chapter 300

b. Electric Shock-Its Causes and Its Prevention, NAVSEA O9OO-LP-OO7-9O1O (formerly NAVSHIPS 250, 660-42)

3-4 GENERAL SAFETY PRECAUTIONS AND POLICIES

Electronic equipment in the Fleet today has become exceedingly complex and sophisticated. It includes such areas as radars, sonars, radios, power amplifiers, antennas, satellite communications and navigation equipment, electronic warfare equipment, missile and fire control equipment, computers and associated control equipments.

Safety from the viewpoint of the technician requires a full appreciation of the various factors and hazards involved in the maintenance of these equipments. Adequate safety features, such as the use of suitable enclosures, provision for grounding, protective interlocks, etc., are required for electronic equipments. Electronic installations require similar protective features or additional features such as the installation of approved insulating deck covering on deck areas adjacent to electronic equipments.

Regardless of efforts made during design and installation, however, safety depends on the user being continually aware of hazards and being alert to guard against them.

Personnel must always remember that the removal of a unit or part from the normal location and the energizing of the unit or part, while it is outside the normal enclosure, removes the protective features such as interlocks, grounds and enclosures. Since these safety features then no longer exists, special precautions and safety measures must be taken.

Some of these basic, but vital safety precautions pertaining to the proper handling of electronic equipment circuits, are compiled in this subsection. These safety precautions, together with those contained in equipment technical manuals and Maintenance Requirement Cards, comprise a nucleus for the promulgation of detailed instructions for accident-free installation, maintenance, and operation of electronic equipment and facilities ashore and afloat.

3-4.1 INTENTIONAL SHOCKS ARE FORBIDDEN

Intentionally taking a shock at any voltage is always dangerous and is STRICTLY FORBIDDEN. Whenever is becomes necessary to check a circuit to see if it is alive, a test lamp, a voltmeter, or some other appropriate indicating device shall be used. The indicating device employed shall be suitable for obtaining the desired check without jeopardizing personnel, and if necessary, it should be used in conjunction with authorized safety devices. (See subsection 3-19, Safety Equipment.) Never implicitly trust insulation material: treat all wiring as though it were bare of insulation. Insulating material has failed before and may fail again-be on the alert!

3-4.2 NEVER WORK ALONE

Never work on electronic equipment by yourself; have another person (safety observer) qualified in first aid for electrical shock present at all times. The safety observer should also know which circuits and switches control the equipment, and should be given instructions to pull the switch immediately if anything unforeseen happens.

3-4.3 AUTHORIZED PERSONNEL ONLY

Because of the danger of fire, damage to material, and injury to personnel, no person should be assigned to operate, repair, or adjust any electronic equipment unless that person has demonstrated a practical knowledge of its operation and repair and of all applicable safety regulations, and then only when duly authorized by the head of department having cognizance over such equipment.

3-4,4 ENERGIZED ELECTRONIC EQUIPMENT

Personnel should not reach within or enter energized electronic equipment enclosures for the purpose of servicing or adjusting except when such servicing or adjusting is prescribed by official applicable technical manuals (instruction books) and then only with the immediate assistance of another person capable of rendering adequate aid in the event of an emergency. Personnel shall be warned to exercise extreme caution when reaching into the enclosures of equipment having internal exposed high voltage points. The metal shielding shell of some capacitors, kylstrons, cathode-ray tubes, and other components are at high potentials above ground.

3-4.4.1 Loose Metal Parts, Tools, and Liquids

In addition, be careful with loose metal parts, tools, and liquids. No person shall take loose metal parts, tools or liquids near or above a starter box or above open electric or electronic equipment. No person shall be permitted above open electric or electronics apparatus with loose metal objects attached to clothing. Stowage or insertion of tools or other foreign articles in or near switchgear, control appliances, panels, etc., is strictly forbidden.

%4.4.2 ESTABLISHED SAFETY PRECAUTIONS

Records indicate that most of the fatalities caused by electric shock have been the result of working on energized circuits and equipments. Post-accident investigations have also shown that these accidents could usually have been prevented by adherence to established safety precautions and procedures. Among the established safety precautions are the following:

a. If it is necessary to work on energized circuits, such works shall be performed only with the specific permission of the Commanding Officer.

b. Electrical equipment is a great source of danger. The Commanding Officer is responsible for electrical safety, a responsibility which can not be delegated. Energized electrical equipment shall not be disassembled or have any corrective maintenance performed on it without first obtaining the approval of the Commanding Officer. The only exception to this policy is where approved instructions issued by higher authority permit opening or inspecting equipments coincident to performing preventive maintenance, routine testing, measurements and adjustments for which the equipment is required to be energized. (See subsection 3-4.5 Repsir of Energized circuits.)

c. Carefully study the schematic and wiring diagrams of the entire circuit, noting which circuits must be de-energized in addition to the main power supply.

d. When making measurements or tests, always keep one hand out of reach of circuitry. In addition, when measuring voltages over 300 volts, follow the procedures outlined in Subsection 3-4.6 Measuring Voltages Over 300 volts.

e. When working on energized circuits or equipments, follow those additional safety precautions outlined in Subsection 3-4.5 Repair of Energized Circuits.

3-4.5 REPAIR OF ENERGIZED CIRCUITS

Corrective maintenance, or any other type of repair work, shall not be performed on energized circuits except under emergency conditions which are considered essential by the commanding officer. (See also, Subsection 3-4.9 Tag Out Procedures.) In such an emergency, the corrective maintenance of energized circuits shall be accomplished under the supervision of an experienced electronic technician or officer, and every care shall be taken to observe the following safety precautions:

a. Provide ample light of illumination.

b. Remove loose clothing and metallic objects such as bracelets, rings, etc., from the worker.

c. Insulate the worker from ground with sheets of phenolic insulating material or a suitable rubber mat, depending upon conditions involved.

d. Cover metal tools with insulating rubber tape as directed in Subsection 3-4.22 Insulating Hand Tools.

e. Use only one hand, if practical, in accomplishing the work.

f. Rubber gloves shall be worn on both hands if at all possible. If not possible, a rubber glove shall be worn, at least, on the hand not used for handling tools. (See also, Subsection 3-19.5, Rubber Gloves.)

g. Have personnel stationed by circuit breakers or switches so that the circuit or switchboard can be de-energized immediately in case of emergency.

h. A person qualified in first aid for electric shock shall be present during the entire period of repairs.

i. If equipment must be energized after removal from its normal rack or mounting, make certain that all parts, normally at ground potentiaI, such as chassis-to-frame ground terminals, are securely grounded.

3-4.6 MEASURING VOLTAGES OVER 300 VOLT

Voltages in excess of 300 volts shall not be measured by probing or holding the test probe in the hands. Whenever measurements are

necessary on equipment employing potentials in excess of 300 volts or where rubber gloves cannot be worn, the following precautions and procedures shall be observed:

a The equipment (or circuit) shall first be de-energized.

b. High voltage capacitors shall be discharged with a suitably insulated shorting or grounding bar. (Refer to Subsection 3-19.3 Safety Shorting Probe.) Since capacitors may not be completely discharged when first shorted, this operation should be repeated several times to make sure capacitor is discharged.

c. Technicians shall ascertain that test equipment controls are set correctly for testing high voltage.

d. Test leads capable of carrying high voltage shall be secured on the desired test points by the technician.

e. Technicians shall withdraw from the equipment under test making sure they are free from leads and are in a good position for making correct meter readings.

f. Equipment shall be energized by an assistant standing by the power switch.

g. After the necessary reading is made, and prior to removing the test leads, the equipment shall be de-energized and the high-voltage capacitors shall be discharged, as in the preceding Step b.

h. For each measurement, Steps a through g shall be repeated as applicable.

3-4.7 OPERATING CIRCUIT BREAKERS

While opening or closing circuit breakers:

a Use only one hand.

b. Keep your hands clear of parts other than operating handles.

c. Touch only one breaker handle at a time.

d. In cases where positive and negative breakers have two handles, close one breaker at a time.

e. Cloee the breaker first and then close the switches.

f. Trip circuit breakers before opening switches.

g. Never disable a circuit breaker.

h. Keep your face turned away while closing circuit breakers. Wearing of safety goggles is recommended while opening or closing non-enclosed types of circuit breakers and switches. (See Subsection 3-19.6, Safety Goggles.)

i. Never stand over a circuit breaker while power is on.

34.8 OPERATING POWER SWITCHES

As a general rule, use only one hand for switching. Keep the other hand clear. Only one switch should be touched at one time by one person. Before closing a switch, make sure that:

a The circuit is ready and all parts are free.

b. Personnel near moving parts are notified that the circuit is to be energized. This is particularly important in cases where rotating antennaa are energized.

c. Proper fuses are installed for protection of the circuit.

d. Circuit breakers are closed.

When opening and closing switches, ease the lever or knob to a position where safe and quick action can be made, and then make the final motion positive and rapid. For switches carrying high current, the break must be poeitive and rapid.

For switches enclosed in watertight cases, such as snap switches and multiple rotary switches, it is important to make sure that the switch has been operated to the position actually intended. Reports have been received indicating that switch handles were not moved far enough when transferring circuits from one station to another. Consequently, the switch contacts were left in an "in-between" position and the circuit was actually open, leading to possible casualty. The cause was traced to excessively tightened gland rings on the switch shafts which prevented the action of the switch detent mechanisms from being readily felt by the operators.

Maintenance personnel should check all watertight rotary switches used as "safety" switches on rotating and transmitting devices to ensure that each is operated to its proper positions and that none are sticking in an "in-between" position.

3-4.9 TAG OUT PROCEDURES

A tag-out procedure is necessary because of the complexity of modem ships and the cost, delays and hazards to personnel which could results from improper operation of equipments. The Ship's Organization and Regulation Manual (OPNAVINST 3120.32) article 630.17 provides procedures to be used to prevent improper operation when a component, equipment, system, or portion of a system is isolated or in an abnormal condition. Type Commander Directives further

amplify the provisions of this procedure. Tag-out procedures are mandatory.

3-4.10 DISCHARGING DE-ENERGIZED CIRCUITS

The electrical charge retained by electrical machinery and electronic circuits when de-energized is, in most cases, sufficient to cause a lethal shock. This hazard shall be considered before performing any type of maintenance on any electric or electronic circuit or before making connections to a seemingly dead circuit or machine. Be safe-discharge and ground all high-voltage capacitors and exposed high-voltage terminals, leads, and the like by using only an authorized shorting probe as directed in Subsection 3-19-3. Repeat discharge operations several times to make sure that all high-voltage terminations are completely discharged.

Extreme caution shall be used prior to working on or near de-energized circuits which employ large capacitors and pulse-forming networks. Short circuit the terminals to ground using only au authorized safety shorting probe or built-in grounding bar for this purpose.

3-4.11 WORKING ALOFT ON SHIPBOARD ANTENNAS

There is potential danger to personnel working aloft near energized antennae. Only when rotating antennas have been de-energized and when it has been definitely determined that RF dangers do not exist, shall personnel be allowed to go aloft. This will prevent casualty due to involuntary relaxation of the hands which might occur if a small spark is drawn from a charged piece of metal or section of rigging. The spark itself may be quite harmless, but the "surprise" may set up a dangerous reflex action. The spark may result in RF bums which can be quite painful and slow healing. (Refer to Subsection 3-12, Electromagnetic Radiation, for information concerning RF bums.) RF voltages induced in a ship's structure or section of rigging, can cause RF bums to personnel or produce open sparks when contact is broken between metallic objects. Personnel of the deck force or others working on rigging shall be warned regarding the hazards which may exist and the precautions to be observed. Safety harnesses shall be employed when working aloft to guard against falls. (See Subsection 3-19.4, Safety Harnesses and Fall Prevention Devices.)

The above precautions should be observed also when "other" antennae in the immediate vicinity are energized by electronic transmitters unless it is definitely known that there is no danger. "Other" antennas maybe interpreted to mean those aboard another ship moored alongside, or those across a pier or at a nearby shore station.

There is serious danger to personnel aloft from falls caused by radar or other antennas which rotate or swing through horizontal or vertical arcs. Motor switches controlling the motion of radar antennas shall be tagged open before personnel are allowed aloft within dangerous proximity to such antennas. Detailed Safety Precautions for personnel working aloft are contained in the Ship's Organization and Regulation Manual (OPNAVINST 3120-32) Article 720.16.

3-4.12 HIGH-SPEED ROTATING ANTENNAS

High-speed rotating antennas such as those used for TACAN, shall not be braked manually. Such antennae, which do not have built-in dynamic braking features, require considerable time to stop rotating because of the very high inertia created by the antenna elements revolving at a high rate of speed. Manual braking of the antenna, by applying handforce or hoMing objects against the moving or revolving elements, cau cause serious or fatal injuries to personnel and can result in costly equipment darnage.

Once the antenna has coasted to a complete stop, make sure that the "safety" switch on the pedestal or the "power" switch at the control station is positioned so as to prevent accidental energizing of the antenna servo system. If a "safety" switch is not installed on or adjacent to the antenna pedestal, all remote switches that can energize the antenna servos shall be de-energized and tagged in accordance with OPNAVINST 3120.32 Article 630.17.

3-4.13 WHIP ANTENNAS

No portion of an MF/HF transmitting whip antenna shall be within a person's reach. Operating stations, guard rails, and normal personnel thoroughfares shall be designed to provide at least a 4 foot horizontal and 8 foot vertical clearance from MF/HF transmitting antennas. Wherever conformance with this design requirement is impractical, a protective screen shall be installed to prevent personnel from physical contact with any portion of the antenna.

3-4.14 SUBMARINE ANTENNAS

The following precautions are necessary to avoid certain hazards on submarines:

a. Do not raise or lower antenna masts until assured that all personnel are clear.

b. When work is being performed on retractable and/or trainable electronic masts, tag or lock open controlling electric switches and/or hydraulic manifolds.

Complete and detailed safety precautions regarding submarines antenna installation are contained in Naval Ships Technical Manual, Chapter 022 and Chapter 585.

3-4.15 POWER LINE GROUNDS

Power shall be immediately removed from an equipment when the power line shows a ground, except in installations where local power conditions require a grounded line for normal operating conditions. Power shall not be re-applied until the ground is cleared. Keep all electrical circuits which are not intentionally grounded, free from grounds. Refer to Subsection 3-3 concerning the hazards of shipboard ungrounded electrical distribution systems and the reasons why shipboard power lines must not be grounded.

3-4.16 FUSES

CAUTION

Never Bypass a Blown Fuse By Shorting It Out.

Fuses should be removed and replaced only after their associated circuits have been completly de-energized. A burned-out fuse shall be replaced with a fuse of the same amperage and voltage rating. Do not use replaceable link-type fuses. When practical, a circuit should be checked before replacing a burned-out fuse as such trouble is usually indicative of a circuit fault. Nonconducting fuse pullers shall be used when removing knife or cartridge-type fuses from fuse holders. Refer, also to the Naval Ships Technical Manual, Chapter 300, Electric Plant-General.

3-4.17 PROTECTIVE ENCLOSURES

All fuse boxes, junction boxes, lever-type boxes, and wiring accessories shall be habitually kept closed, except when necessary to be opened for service. Care shall be exercised to ground effectively and to maintain such protective grounds on all metal enclosures for electrical and electronic equipment in accordance with Subsection 3-7 Grounding of Non-Portable Power Tools and Equipment.

3-4.18 INTERLOCKS

Almost all modern electronic equipments are provided with various built-in safety devices (such as interlock switches) to prevent technical and maintenance personnel from accidently coming into contact with electrical potentials in excess of 70 volts RMS or DC. (See also, Subsection 3-19.8, Equipment Built-in Safety Devices.) However, some of these protective devices are removed or destroyed by personnel who tamper with, block open, or otherwise "override" them. The foregoing practices are actions which must n@ be performed, unless the commanding officer has directed as such for operational reasons and, as a result, the equipment is properly tagged to notify personnel of the condition.

Interlocks, and other safety devices such as overload relays and fuses, shall not be altered or disconnected, except for replacement; also, safeguard circuits shall not be modified without specific authority from the cognizant systems commend. Periodic test and inspections shall be made to ensure that the above safety devices are functioning properly.

3-4.19 REPLACING ELECTRON TUBES

Whenever replacing electron tubes, the following precautions shall be observed:

a. Do not use bare hands to remove hot tubes from their sockets; use a tube puller.

b. Before replacing high voltage tubes, ensure that the plate cap (anode) has been properly discharged.

c. When replacing, or working close to, radioactive tubes, ensure that special precautions are observed. (Refer to Subsection 3-11.8, Radioactive Electron Tubes, for details.)

3-4.20 REPLACING CATHODE-RAY TUBES

Cathode-ray tubes (CTRS) are highly evacuated and shall be handled with extreme care, because they can implode. (Refer to Subsection 3-11.5 Cathode-Ray Tubes, for associated hazards.) The face of a CRT, particularly the rim, shall not be struck, scratched or subjected to more than moderate pressure.

Whenever replacing CRTs the following precautions shall be taken:

a Always wear safety glasses (goggles) and protective gloves when handling a CRT.

b. Avoid scratching or striking the face.

c. DO NOT use excessive force when removing the CRT from or replacing it in its deflection yoke or its socket.

d. DO NOT try to remove an electromagnetic type CRT from its yoke until you make sure that the high voltage has been discharged from its anode connector (hole).

e. Never hold the CRT by its neck.

f. Always set a CRT with its face down on a thick piece of felt, rubber, or smooth cloth.

g. Always handle the CRT gently. Rough handling or a sharp blow on the service bench may cause the tube to implode or the electrodes within to be displaced resulting in faulty operation.

3-4.21 USE OF STEEL WOOL AND EMERY

The use of steel wool or emery for cleaning within electronic equipment spaces is harmful to the normal operation of electronic equipment. Steel wool or emery, in any form, shall not be used on or near electronic equipment. In Chapter 430 of the Naval Ships Technical Manual, comments on the maintenance of electronic contacts are as follows: "Emery paper or cloth or steel wool must never be used to clean contacts. " Tbis same paragraph then makes the following statements, indicating that steel wool particles are a menace: "Ventilation currents distribute them where they do the most harm." and, "Magnetic materials, often being present, will collect ferrous particles."

Another publication considering the harmful effects of using steel wool in electronic equipment spaces is the Handbook of Cleaning Practices, NAVSEA O936-LP-OO3-7O1O. In Chapter 5, under the paragraph entitled "Soil Removal from Aluminum," the handbook states: "The use of steel wool on electronic equipment is not permitted, since residual particles of steel may cause a short circuit." Additionally, in Chapter 7 of the same handbook, the paragraph entitled "Electrical Contacts" directs: "clean with silver polish, fine sandpaper, or burnishing tools. Do not use emery or steel wool. Use vacuum to remove dust."

The above statements are clear and to the point: When cleaning electronic parts, DO NOT USE STEEL WOOL OR EMERY.

3-4.2? INSULATING HAND TOOLS

Cover working, metal, hand-held tools with an electrical insulating material. Taping Method: Cover the handle and as much of the shaft of the tool as practical. Use two layers of rubber or vinyl plastic tape, half lapped. Coating Method: Coat tools with plastisol; see instructions in Naval Ships Technical Manual, Chapter 631.

3-4.23 MEASURING UNGROUNDED ELECTRICAL POWER SOURCES

Instances have been reported of maintenance personnel removing the power cord's safety ground pin or using a power cord adapter when it is necessary to adapt certain test instruments for measuring voltages of ungrounded electrical power sources. These methods of adaptation are not only unauthorized, but they are also potential killers. Subsection 3-8.1 Portable Cables, Plugs, and Convenience Outlets, states the policy concerning safety ground connections of portable power cables for the test instruments.

Shipboard electrical distribution power sources, synchro and resolver power sources, and any other alternating current power source originating from the ship's generators are "ungrounded" for the reasons explained in Subsection 3-3, Shipboard Ungrounded Electrical Distribution Systems are Deadly. Electrical measurements of such "floating" or "above ground" power sources require that both test leads of the test instrument be isolated from ground. This isolation shall be achieved only by one of two methods: by use of a shorting bar, but only with those test instruments provided with this feature; or by use of an isolation transformer between the test instrument signal-input test terminals and the power source to be measured. Both of these methods are explained in the following subsections.

3-4.23.1 Shorting Bar Method

The chassis of some electronic test instruments are electrically connected to the instruments' metallic cases with shorting bars (removable ground straps), and the cases are grounded to the ship's hull through the portable power cables. The shorting bar is connected between the "common" signal-input test terminals

and the instmment case. Disconnecting the shorting bar will then isolate both the chassis and the signal-input test lead terminals from ground, but will not remove the required safety ground connected to the instrument's case. The shorting bar feature will permit the test instrument to be used for the measurement of "floating" or "above--ground" power sources without jeopardizing personnel safety.

An example in the use of a shorting bar is contained in the Test Equipment EIMB Handbook, NAVSEA SEOOO-OO-EIM-040

3-4.23.2 **Isolation Transformer Method**

In instruments where the chassis and metallic cases are electrically and permanently connected together, it will be necessary to use an isolation transformer in the test-lead circuitry to achieve the desired location. The isolation transformer will prevent the grounded test lead from influencing a ground on the "floating" electrical power source being measured. One such isolation transformer is the CCAP-ST-213 (or the CCAP-ST-200F). Federal Stock Number 4G6625-916-3122. The specifications of the CCAP-ST-213 model are as follows: (EIB 846)

a. Turns Ratio-1:1

b. Frequency Range-50 Hz to IOkHz

c. Input Voltage-O.35f (350 V max)

d. Input Impedance-Greater than 250,000 ohms at 400 Hz (with secondary circuit open)

e. Open Circuit Ratio Accuracy-0.005% at 400 Hz

f. DC Resistance-10 ohms (approximate)

g. Insulation-500-V test

h. Open Circuit Phase Error-Less than 0.30 milliradians at 400 Hz

i. Terminations-Binding Posts

j. Potting Material-Epoxy

k. Shielding-Electrostatic

1. Intershield Capacitance-350 pF (approximate)

3-5 ADDITIONAL SAFETY PRECAUTIONS WHILE SHIP IS IN PORT

3-5.1 GENERAL SAFETY PRECAUTIONS

During overhaul and repair, local safety officials of a Navy yard or repair facility will normally notify the commanding officers of ships when electronic safety measures are required. Among the standard safety measures are the precautions listed below. These general safety precautions shall be observed, and adhered to, while a ship is in drydock, yard, or repair facility.

a. The electronic equipment of a ship may be energized only with the express permission of the docking officer, and then, only when the ship's hull is adequately grounded.

b. Excitation is not to be applied to sonar transducers unless properly immersed.

c. Sonar hoist mechanisms are to be operated only after it has been definitely ascertained that adequate clearance exists for the moving elements within their full limit of travel, and that mechanical damage will not be incurred by such operation. This determination is to be made as soon as practical after the dock is dewatered; if insufficient clearance exists, positive action shall be taken to prevent accidental lowering of the transducer by gravity, manual operation, or power operation.

3-5.2 TRANSMITTING EQUIPMENT

During any in port period the ship's electronic transmitting equipment shall be secured whenever:

a. Overhead cranes are operating in close proximity of the transmitting antennas.

b. Personnel are installing/removing rigging or structures aloft.

c. Transporting, loading, or unloading operations (of aircraft, ammunition, volatile liquids, or explosive gases) are in progress on the adjacent dock or on other ship's barges nearby.

3-6 PRECAUTIONS IN THE HANDLING AND CHARGING OF BATTERIES

The safety precautions contained in this subsection involving the handling, storage, maintenance and charging of batteries shall be observed.

3-6.1 NICKEL-CADMIUM BATTERIES

WARNING

Nickel-Cadmium Batteries or Cells Must be Charged only in Series, Never in Parallel. Cell Imbalances Cause Different Resistances Which Vary the Charging Rates of the Cells when Charged in Parallel. This May Cause a "Thermal Runaway".

Nickel-cadmium batteries have exploded while being charged, resulting in injury to personnel. This was probably due to not using the proper precautions when charging the battery, rather than a defective battery.

WARNING

Higher Than Recommended Charging Rates or Voltages May Result in Gas Evolution of Hydrogen and Oxygen-An Explosive Mixture which is Easily Ignited.

The manual charging rate for a nickel-cadmium battery is cI1O, where "c" is the ampere-hour capacity of the battery. This is the recommended constant current charging rate at the ten-hour rate. For example: the charging rate for a 4.0-ampere-hour nickel-cadmium battery or cell would be 0.4 amperes at a maximum voltage of 1.5 volts per cell. A completely discharged battery requiree 14 to 16 hours of charging. With properly designed batteries, gassing due to over-charging is practically nil under these conditions. Constant voltage charging is not recommended.

All nickel-cadmium sealed cells can be "floated" or "trickle-charged" to maintain a fully charged condition in standby for emergency power applications. The usual trickkcharge rate is c/100 unless the manufacturer recommends otherwise. To obtain optimum life and performance, care should be taken to maintain a nickel-cadmium battery as near room temperature as practical. The nickelad.mium battery may be used over a wide temperature range. It may be discharged at about O"F to 100"F, stored at approximately -40"F, and even discharged at a maximurn temperature of 160"F or a minimum of -60° F for a short time, if necessary. However, at temperatures over 11O"F, degradation of the battery increases rapidly.

Nickel-cadmium batteries should never be replaced near other heat producing components. In high-rata discharge applications the battery should be ventilated, because high current discharges result in high temperatures which may cause cell damage. Care should also be taken to prevent short-circuiting.

Battery shops for nickel-cadmium batteries should have their own tools and service area, separated from those used for lead-acid batteries, to reduce the possibility of contamination problems.

In summary, the following precautions are recommended:

a. Charge nickel-cadmium batteries or cells in series, only; never charge them in parallel.

b. Use the proper constant current charging rate of cI1O (or cI1OO for trickle or float charge) at 1.5 volts per cell.

c. Maintain the battery temperature below 113"F, if possible.

d. Avoid possible short circuits.

e. Have separate tools and service area for nickel-cadmium batteries. (EIB 760)

3-6.2 MERCURY BAITERIES

Under certain conditions, mercury dry-cell batteries will explode. However, the possibility of explosion exists mostly in the misuse of this type of battery, and is not usually present during ordinary usage. An explosion, however, may be caused by excessive heat or by ignition of hydrogen gas.

When a mercury battery is subjected to a temperature of 400"F or above, it will explode. This high temperature may easily be a direct result of a battery cell short. Hydrogen-gas evacuation from individual cells, within a multi-cell battery, usually occurs when such cells are forced to pass current after the expiration of their useful life. This is a dangerous condition and may occur when one or more individual cells are weaker than the rest. If this compressed gas is subjected to sufficient heat or to a spark, an explosion occurs.

Additional hazards associated with mercury are discussed in subsection 3-11.6, Mercury.

To minimize the possibility of having a mercury-cell battery explode, the following precautions should be taken:

a. Never discharge a mercury-cell battery after its voltage has fallen below 70 percent of its normal voltage, or after it fails to operate the equipment in which it is used.

b. Never place a direct "short" on the mercury-cell battery.

c. Never leave the battery switch "on" when the equipment is not in use, or after the battery fails to operate the equipment.

d. Never retain exhausted mercury-cell battsries; discard them as soon se possible at the first shore installation. Exhausted cells should be temporarily stored under water in a suitable container. The jacket of the batteries should not be purposely darnaged prior to submergence for temporary storage or prior to shore disposal.

e. Store the batteries in an adequately ventilated, preferably cool, fireproof area.

3-6.3 LITHIUM BAITERIES

WARNING

Lithium Batteries or Cells are Potential Hazards if Misused, Tampered with Before, During or After Discharge. Lithium Batteries have Exploded while Rapidly Discharging and up to 30 Minutes After Discharge. Whether Fresh or Discharged, Lithium Batteries shall not be Pierced, Crushed, Burned, Intentionally Dropped, Cannibalized, Dismantled, Modified or Otherwise Carelessly Handled nor shall They be Short Circuited, Charged or Used in any Other Equipment than Specified.

The number of safety incidents dictates that caution must be exercised in all areas concerned with the handling of lithium batteries. Only lithium batteries which have been approved as safe for a specific use shall be procured and then solely for that application.

Lithium cells and batteries shall be stored in their original shipping containers in a cool, well ventilated shelter. The storage area is to be isolated from other hazardous and combustible material.

Since most of the documented safety incidents have occurred with partially or fully discharged lithium batteries, these shall be removed from their associated equipment upon completion of their useful life. The exposed terminals shall be insulated to prevent short circuits and batteries turned in for appropriate disposal. When possible, agencies licensed to dispose of hazardous materials should be utilized; if this is not possible then:

a. At sea — discharge overboard in water over 500 feet deep outside of the 50 mile limit. Do not store for shore disposal.

b. Shore – batteries shall be buried in a controlled hazardous waste land fill. See Naval Environmental Support Office NESO 20.2-011 Hazardous waste disposal Guide.

Additional Guidelines for design acquisition, packaging, use, transport and disposal of Lithium Batteries are outlined in NAVSEA INSTRUCTION 931O.1A

3-7 GROUNDING OF NON-PORTABLE POWER TOOLS AND EQUIPMENT

The possibility of electrical shock can be reduced by ensuring that all motor and generator frames, cases, metal bases, and other structural parts of electrical and electronic equipment are at ground potential. Normally, on steel-hull vessels, such grounds are inherently provided because the metal cases or frames of the equipment are in contact with one another and with the metal structure of the vessel. In some instances where such inherent grounding is not provided by the mounting arrangements, such as equipment supported on shock mounts, suitable ground connections must be provided. The conductors employed for this purpose are generally composed of flexible material (copper and aluminum) that provides sufficient current-carrying capacity to ensure an effective ground. In this manner, equipment cases and frames which are not intended to be above ground potential are effectively grounded, and the possibility of electrical shock to personnel coming in contact with metal parts of the equipment is minimized.

3-7.1 MAINTENANCE OF GROUND CONNECTIONS

An important function of grounds is the maintenance of service continuity between separately mounted equipments that have a common ground return, as well as improvement of operation. Faulty ground returns are detrimental to normal operation and can cause interruption of service, intermodulation and noise, excessive voltage build-up, false signals, signal distortion, and other undesirable effects that may result in equipment damage.

A satisfactory ground connection, regardless of the application, must meet certain requirements as described in MIL-STD-131O, in Chapter 300 of the Naval Ships Technical Manual, and in MIL-E-16400. Their requirements are tested by the manufacturer of the equipment or by Naval development laboratones, and therefore, maintenance of ground conductors and connectors is primarily, preventive.

In all instances, where equipment grounding is provided, certain general precautions and preventive maintenance measures must be taken to ensure that all bonding surfaces (connection points or metallic junctions) are securely fastened and free of paint, grease, or other foreign matter that could interfere with the positive metal-tu-metal contact at the ground connection point. A few of these precautions are given below:

a. Periodically, clean all strap and clamp-type connectors to ensure that all direct metal-to-metal contacts are free from foreign matter.

b. Check all mounting hardware for mechanical failure or loose connections.

c. Replace any faulty, rusted, or otherwise unfit grounding strap, clamp, connection, or component between the equipment and the ground to the ship's hull.

d. When replacing a part of the ground connection, make certain that the metallic contact surfaces are clean, and that electrical continuity is m-established.

e. After the foregoing steps have been completed, recheck to ensure that the connection is securely fastened with the correct mounting hardware, and then paint the ground strap and hardware in accordance with MIL-STD-131O.

3-7.2 TAGGING OF TEMPORARY PROTECTIVE GROUNDS

All circuits over 750 volts shall be grounded, for protection of personnel engaged in repair work. Such grounding points should be located in the vicinity of the working party and shall be properly secured to prevent accidental removal. However, if the grounding points can not be located in the immediate vicinity of the working party, the tagging procedure indicated in Subsection 3-4.9 shall be followed with the working of the tags suitably revised to cover the applicable conditions.

3-7.3 GROUNDING OF WHIP ANTENNAS

Whip antennas shall be grounded before any maintenance is performed on them. The ground shall be attached to the ship's structure first and then to the antenna.

3-7.4 GROUNDING OF EQUIPMENT AND METAL FITTINGS ON NON-METALLIC HULL SHIPS

All metal fittings and electronic equipment installed on non-metallic hull ships shall be grounded in accordance with MIL-STD-131O, Shipboarding Bonding, Grounding, and Other Techniques for Electronic Compatibility and Safety. Mating surfaces of metal fittings and ground straps must be cleaned to remove dirt and paint. After fittings are secured in place, the grounding contacts shall be sealed against the entrance of moisture to prevent corrosion. 4

3-8 GROUNDING OF PORTABLE ELECTRICAL TOOLS AND EQUIPMENT

Improperly wired electrical tools, portable electrical and electronic equipment, test equipment, etc. are extremely hazardous: especially when they are powered by the ship's 115-volt, 60-hertz, single-phase power. The safety precautions involving the use of portable electrical tools and equipment and the policies regarding certain wiring procedures are contained in the subsections which follow. These safety procedures and policies shall be practiced by all personnel. 4

3-8.1 PORTABLE CABLES, PLUGS, AND OUTLETS

WARNING

Never use any metal-cased portable equipment, appliance, or power tool, or any cable or extension cord unless you are absolutely sure that it is equipped with a properly connected grounding conductor.

Portable cables, plugs, and convenience outlets used to supply 115 volts 60 hertz single-phase power to portable equipment, test equipment, power tools, and appliances must have a safety ground conductor when used aboard Navy vessels. For shipboard application, it is obvious that a safety ground conductor is imperative for personnel safety since neither side of the 115-volt 60-hertz single-phase power source is at ground (or hull) potential. (Refer to Subsection 3-3. Shipboard Ungrounded Electrical Distribution Systems are Deadly.)

3-8.2 PLASTIC CASED PORTABLE TOOLS

Certain portable tools and equipment are exempt from the requirement that they be

equipped with a properly connected safety ground conductor. One exemption applies to plastic-cased (sometimes referred to as "double insulated") portable electric tools, which do not require a safety ground conductor. With these tools, the two-prong plugs and cords are authorized for use aboard ship and may be inserted in bladed type receptacles even though they are labeled "WARNING: INSERT 3-PRONG GROUNDED PLUGS ONLY". Other exemptions involve privately-owned portable equipment which are explained in Subsection 3-8.4, Privately-Owned Portable Equipment.

3-8.3 PORTABLE CABLE ASSEMBLIES

Portable cable assemblies used with portable electronic test equipment shall be an eight-foot, 3-conductor flexible cord conforming to MIL-L-28777 (EC). The wires of this type of cable have insulations which are color-coded white, green, and black.

To ensure that the safety factors incorporated in cables and connectors are in serviceable condition and safe for use, the following precautions and inspections must be performed.

a. Inspect the phenolic pin-guide insert of the receptacle to see that it is held firmly in place and that the guide pin is not bent or damaged.

b. Check the wiring terminals and connections of the plug. Loose connections and frayed wires on the plug surface must be corrected and all foreign matter removed before the plug is inserted into the receptacle.

c. Check for spliced cables. Spliced portable cables are extremely dangerous and shall not be used.

Do not attempt to insert a grounded-type plug into a grounded receptacle without first aligning it properly. For MS/AN connectors, always rotate the plug so that its groove is aligned with the polarity pin or notch inside the receptacle.

3-8.4 PRIVATELY-OWNED PORTABLE EQUIPMENT

Shipboard 115-volt 60-Hz lighting and receptacle circuits are ungrounded. In s-n ungrounded system both conductors of the 115-volt system are above ground potential and are a shock hazard. For this reason personal electrical equipments, which are normally designed to operate on 115-volt 60-Hz grounded systems (the normal residential system), are discouraged from being used aboard ship. In much of this equipment, the chassis forms a part of the circuit and the exposed metal parts are energized thereby creating the danger of shock to personnel touching them. Moreover, grounding these metal parts to the ship structure would place a ground on the 115-volt system jeopardizing continuity of power.

OPNAVIST 3120.32 and 5100.19 plus Naval Ships Technical Manual Chapter 300 provide detailed guidance and establishes requirements for administrative control of privately owned portable equipment programs.

3-8.5 PORTABLE EXTENSION LIGHTS

Only those portable extension lights which conform to Military Specification MIL-F-16377 are authorized for use aboard Navy vessels. These authorized types of portable extension lights are listed in the following chart:

Description	Mil Spec & Symbol	NSN
Incandescent, 100 watts, 120 volts	MIL-F-16377/52A Symbol 286	9G6230-OO-701-2947
Fluorescent, 8 watts, 115 volts, 60 hertz	MIL-F-16377/49 Symbol 306.2	9G6230-OO-244-3996
Fluorescent 4 watts, 120 volts, 60 hertz	MIL-F-16377/68 Symbol 163	

Maintenance and operation instruction for portable extension lights are contained in Chapter 330, Lighting, of the Naval Ships Technical Manual.

3-8.6 VOLTAGE TESTERS

The following voltage tester is authorized for shipboard use where a hand-held visual indicator is required.

Voltage Tester NSN	Description	Function
lN6625-OO-132-1196	MIL-I-23830B	28 to 440 VAC, 28 to 500 VDC, DC polarity, and 60 and 400 Hz

3-8.7 FUSE PULLERS

Certain hazardous fuse pullers and voltage testers remain in use in the fleet. Only the following fuse pullers are authorized for shipboard use; all others should be destroyed. (EIB 799)

Fuse Puller NSN	Description	Diameter of Fuse (in)
9Q5120-OO-224-9453	W-P-796, **Class** A, Size 1	0.25 to 0.50
9Q5120-00-224-9456	W-P-796, **Class** A, Size 2	0.35 to 1.00
9Q5120-OO-243-2776	W-P-796, **Class** A, Size 3	1.40 **to** 2.50

Fuse pullers in frequent use may become contaminated with dirt and perspiration from handling. This may accumulate on the edges of the material and may eventually cause arcing or tracking. Periodic inspection, and if necessary, replacement with a new puller will prevent any shock hazard from occurring.

3-9 PORTABLE POWER TOOL PRECAUTIONS

The hazards associated with the use of portable power tools are electrical shock, bruises, cuts, particles in the eye, falls, explosions, and such. Safe practice in the use of these tools will reduce or eliminate such accidents. Listed below are some of the general safety precautions that **shall** be observed when your work requires the use of portable power tools.

a. Ensure that all **metal-cased** portable power tools are grounded in accordance with Subsection 3-8.1 Portable Cables, Plugs, and Convenience Outlets.

b. Do not use spliced cables unless an emergency warrants the risk involved.

c. Inspect the cord and plug for proper comection. Do not use any power tool that has a frayed cord or broken or damaged plug.

d. Make sure that the **on/off** switch is in the off position before inserting or removing the plug from the receptacle.

e. Always connect the cord of a portable power tool into the extension cord before the extension cord is inserted into a live receptacle.

f. Always unplug the extension cord from the receptacle before the cord of the portable power tool is unplugged from the extension cord.

g. See that all cables are positioned so that they will not constitute a tripping hazard.

h. Wear eye protection when working where particles may strike the eyes. (Refer to Subsection 3-19.6 Safety Goggles.)

i. Wear hearing protection (ear plugs or circumaural type muffs which cover the entire outer ear) when working with noise producing tools or in the area of such work.

j. After completing the task requiring the use of a portable power tool, disconnect the power cord as described in Steps d and g and stow the tool in its assigned location.

3-1o SOLDERING IRON PRECAUTIONS

CAUTION

Transformer Type Soldering Guns Shall not be Used

When using a soldering iron, always remember the following:

a. To avoid bums, always assume that a soldering iron is hot.

b. Never rest a heated iron anywhere but on a metal surface or rack provided for this purpose. Faulty action on your part could result in fire, extensive equipment damage, **and/or** serious injuries.

c. Never use an excessive amount of solder, because drippings may cause serious skin or eye bums and/or short circuits.

d. Do not swing an iron to remove excess solder. Bits of hot solder that are removed in **this** manner can cause serious skin or eye bums, or bits of hot solder may ignite combustible material in the work area,

e. When cleaning an iron, use a cleaning cloth but DO NOT hold the cleaning cloth in your hand. Always place the cloth on a suitable surface and wipe the iron across it to prevent burning your hand.

f. Hold small soldering jobs with pliers or a suitable clamping device to avoid bums. Never hold the work in your hand.

g. Do not use an iron that has a frayed cord or damaged plug.

h. Do not solder electronic equipment unless the equipment is electronically disconnected from the power supply circuit.

i. After completing the task requiring the use of a soldering iron, disconnect its power cord from the receptacle and, when the iron has cooled off, stow it in its assigned storage area

3-11 HAZARDOUS EQUIPMENT AND MATERIALS

This subsection provides information pertaining to hazards and hazardous items of equipment that may cause injury and, in severe cases, death. It is the purpose of this subsection to supply electronic and maintenance personnel with information pertaining to these hazards and to provide sufficient safety practices which, when faithfully enforced, will aid in the elimination of accidents.

3-11.1 TRANSFORM ERLESS COMMERCIAL EQUIPMENT

Many of the "transformerless" type television and radio sets that have been manufactured commercially are the "hot chassis" type. That is, one side of the 115-volt, 60-hertz, single-phase input power line is connected to the chassis for series tube filament and "B" supply return. Aboard ship, this arrangement creates a DEADLY shock hazard; in addition, it presents an undesirable source of RF radiation. Moreover, grounding of the chassis to the ship's structure places a ground on the 115-volt power system, jeopardizing the continuity of power. Why is the continuity of power jeopardized? Refer to Subsection 3-3.1, Reason for Using an Ungrounded system, and learn why.

Privately-owned portable equipment, such as television receivers, radio receivers, record players, wire or tape recorders, electric shavers, lights, fans, power tools, and hobby equipment shall not be used aboard ship unless they satisfy the conditions stated in Subsection 3-8.4, Privately-Owned Portable Equipment.

3-11.2 CLEANING SOLVENTS

The technician who smokes while using a volatile cleaning solvent is inviting disaster. Unfortunately, many such disasters have occurred. For this reason, the Navy does not permit the use of gasoline, benzine, ether, or like solvents for cleaning purposes, since they present potential fire or explosion hazards. Ordy, non-volatile solvents shall be used to clean electrical or electronic apparatus.

In addition to the potential hazard of accidental fire or explosion, most cleaning solvents can darnage the human respiratory system, in case of prolonged inhalation. The following list of "DO NOT's" will serve as an effective reminder to technical personnel who must use cleaning solvents:

a. DO NOT work alone in a poorly ventilated compartment.

b. DO NOT use carbon tetrachloride. This is a highly toxic compound.

c. DO NOT breathe directly over the vapor of any cleaning solvent for prolonged periods.

d. DO NOT spray cleaning solvents on electrical windings or insulation.

e. DO NOT apply solvents to warm or hot equipment since this increases the toxicity hazard.

The following steps are positive safety precautions which shall be followed when cleaning operations are underway.

a Use a blower or a canvas wind chute to blow air into a compartment in which a cleaning solvent is being used.

b. Open all usable port holes and place wind scoops in them.

c. Place a fire extinguisher close by, ready for use.

d. If feasibIe, use water compounds instead of other solvents.

e. Wear rubber gloves to prevent direct contact with solvents.

f. Use goggles when a solvent is being sprayed on permissible surfaces.

g. Hold the nozzle close to the object being sprayed.

Where water compounds are not feasible, inhibited methyl chloroform (1,1,1, Trichloroethane) shall be used instead of the dangerous carbon tetrachloride. Methyl chloroform is an effective cleaner and as a safe as can be expected when reasonable care, such as adequate ventilation and observance of fire precautions, is exercised. When using inhibited methyl chloroform, avoid direct inhalation of the vapor.

The Chief of Naval Material, by ltr MAT 0413.JM of 22 June 1970, prohibited the use of natural (pure) ethanol as a shipboard cleaning and decreasing agent and approved the use Of isopropyl alcohol as a replacement. Isopropyl alcohol may be requisitioned in the following quantities using the Federal Stock Numbers listed.

Quantity	NSN
8-ounce container	9G681O-OO-753-4993
lquart container	9G681O-OO-983-8551
l-gallon can	9G68104O-286-5435
5-gallon can	9G681O-OO-855-6I6O

For additional information on the safety precautions to be observed when using

solvents, see Articles 300-2.30 thru 33;300 -4.29 thru 34 of the Naval Ships Technical Manual, Chapter 300. In addition, refer to Chapter 670 of the Naval Ships Technical Manual for information pertaining to the handling and storage of cleaning compounds.

3-11.3 AEROSOL DISPENSERS

NOTE

Aerosol dispensers are not permitted aboard nuclear submarines. Refer to the Nuclear Powered Submarine Atmosphere Control Manual, NAVSEA 0938-LP-011-4010.

Deviation from prescribed procedures regarding the selection, application, storage, or disposal of aerosol dispensers containing industrial sprays can result in serious injury to personnel because of toxic effects, fire, explosion, and so on. Specific instructions concerning the precautions and procedures that must be observed to prevent physical injury cannot be given in this article because of the multiplicity of available industrial sprays. However, all personnel concerned with the handling of aerosol dispensers containing volatile substances should clearly understand the hazards involved and the importance of exercising protective measures to prevent personal injury. Strict compliance with the instructions printed on the aerosol dispensers will prevent many of the accidents which result from misapplication, or improper storage of industrial sprays.

The basic rules which must be observed to ensure safety in the use of aerosol dispensers are:

a. Carefully read and comply with the instructions printed on the container.

b. Do not use any dispenser that is capable of producing dangerous gases or other tQxic effects in an enclosed area urdess the area is adequately ventilated.

c. If a protective coating must be sprayed in an inadequately ventilated space, either an air-line respirator or self-contained breathing apparatus should be provided. However, fresh air supplied from outside the enclosure by use of exhaust fans or portable blowers is preferred. Such equipment will prevent inhalation of toxic vapors.

d. Do not spray protective coatings on warm or energized equipment, because to do so creates a fire hazard.

e. Avoid contact of your skin with the liquid contained in the dispenser. Contact with some of the liquids being used may result in bums, while milder exposures may cause only rashes.

f. Do not puncture the dispenser, because it is pressurized. Injury can result from this practice.

g. Do not discard used dispensers in wastebaskets that are to be emptied into an incinerator; an explosion of the dispenser may result.

h. Keep dispensers away from direct sunlight, heaters, and other sources of heat.

i. Do not store dispensers in an environment where the temperature is above the temperature limits printed on the dispenser case. Exposure to high temperature may cause the container to burst.

3-11.4 FUNGUS-PROOFED AND FIBERGLASS-INSULATED WIRES

Handling fungus-proofed, fiberglass-insulated wire requires certain precautions to prevent skin irritation. Insulation stripped from this type of wire should be placed in containers to keep it off floors, benches, and clothing. Insulation "dust" (small particles of insulation shed during stripping or flexing of the wire) should be collected with a vacuum cleaner. Compressed air shall never be used to remove "dust" from benches, equipment, or floors.

After stripping or handling fungus-proofed wire, the hands and arms should be washed thoroughly with soap and water. If an itching sensation is experienced, a good hand cleaner should be used tA remove the remaining particles of fiberglass. Scratching of the affected area shall be avoided. If skin irritation persists, medical advice shall then be sought.

3-11.5 CATHODE-RAY TUBES

Cathode-ray tubes (CRTs) are, potentially, extremely hazardous items. the phospor coating on their internal faces is toxic and the large physical size of their glass envelopes can create violent implosions, if broken. Their glass envelopes are highly evacuated and, consequently, their large surface areas are subjected to considerable force by atmospheric pressure. For example, the total force exerted on the overall surface of a 10-inch CRT is nearly 2,000 pounds, of which 1,000 pounds is exerted on the face alone. When a CRT breaks, the high external pressure causes the tube to implode (burst inwards) and, as a result, the inner metal parts, glees fragments, and toxic phospors are violently expelled.

The precautions which are to be followed when replacing CRTs are contained in Subsection 3-4.20, Replacing CathodeRay Tubes.

Extreme care shall also be taken whenever disposal of CRTs is necessary. All defective tubes shall be stored in such away that injury to personnel will be avoided. When a CRT is removed from a unit, it should not be allowed to remain exposed to damage or shock on work benches, etc., but should be immediately placed in the container provided for that purpose or in the container that held the replacement tube, until disposal.

WARNING

The Phospor Coating on the Internal Face of the Crt is Extremely Toxic. When Disposing of a Broken Tube be Careful not to Come into Contact with this Compound. If Contact is Made, Consult a Medical Officer Immediately.

Before a CRT is discarded, it should be made harmless by breaking the vacuum glass seal. To accomplish this, proceed as follows:

a Place the tube that is to be discarded in an empty carton, with its face down.

b. Make sure that goggles are worn.

c. Carefully brake off the locating pin from its base. (See Figure 3-5.)

d. With a small screwdriver or probe, break off the tip of the glass vacuum seal.

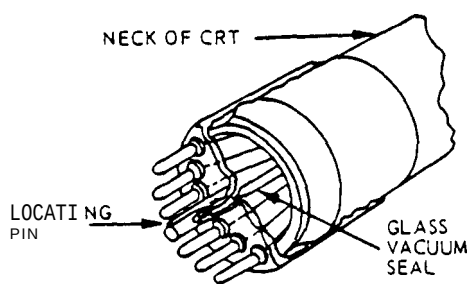


Figure 3-5. Cathode-Ray Tube Base Structure

3-11.6 MERCURY

CAUTION

Personal hygiene is of utmost importance in working with and handling mercury. Since mercury can be absorbed through the skin, extreme care shall be taken not to handle mercury or mercury contaminated components directly. Exposed skin shall be thoroughly washed with soap and water or suitable hand cleaner following clean-up procedures. Persons coming in contact with mercury shall not smoke until hands are washed. Clothing on which mercury has been spilled shall be cleaned of visible mercury, then removed, double bagged, and disposed of as a mercury waste.

The proper handling of mercury is essential for personnel safety. Mercury is an extremely toxic material and should be handled with great care. It is much more volatile than is generally supposed, and is especially dangerous since its presence is not easily detected by the human senses. The vapor concentration at equilibrium and normal room temperature is 200 times the safe amount. When mercury is spilled, it becomes finely divided, lodges in tiny pores and crevices in the floor, and gives off vapor more readily because of the large area exposed. It is absorbed into the body in three ways; by inhalation of vapor, by ingestion from contaminated hands when eating or smoking, aud by direct absorption through the skin when finely divided.

Mercury and many mercury compounds are particularly hazardous when heated due to the production of toxic vapors. BUMEDINST 6270.3 establishes a threshold limiting value of 0.05 milligrams per cubic meter (mg/m3) over an eight (8) hour period. Unprotected exposure exceeding this value may lead to acute or chronic physiological changes, depending upon the exposure pattern. Therefore extreme care is required whenever mercury or mercury compounds are handled.

Mercury may be damaging to materials and equipment. Mercury and its compounds are especially corrosive to certain nonferrous metals and their alloys, e.g., silver, copper, aud ahuninum.

Mercury is a severely damaging environmental pollutant and is toxic to fresh and salt water marine organisms. OPNAVINST 6240.3 prohibits overboard discharge of mercury or mercury compounds and requires disposal ashore. Mercury has been found to be toxic at a level of 0.05 parts per million (ppm) for some forms of sea life, and any amount in the marine life food chain may subsequently be toxic to man. Detailed Guidance for the handling of mercury is found in NAVSEAINST 5100.3.

3-11.7 GASEOUS DIELECTRIC FOR WAVEGUIDES

The development of high-power microwave transmitting equipment haa reached the point where the power levels available for radiation exceed the power-handling capabilities of ordinary waveguide transmission lines. Therefore, it is necessary to develop means by which the power-handling capability of waveguides can be increased.

Waveguides for use with moderate-power equipments enploy dry air as the dielectric medium. Since the power-handling capability of a typical air-dielectric waveguide can be increased approximately as the square of the pressure, the power-handling capability of this type of waveguide can be increased by increasing the pressure of the gas (air) within the waveguide. However, there is a practical limit to this approach, because the increased internal pressure of a waveguide may require considerable strengthening of the guide, and the use of pressurized seals, and windows. Consequently, when thick, solid dielectric materials are used to withstand the increased pressure in the waveguide, problems of impedance matching, possible dielectric losses, and narrowed transmission bandwidths are encountered. Therefore, an increase of the pressure in the waveguide system is not always the answer to an increase of the power-handling capabilities of the transmission line.

One solution to the problem has been the use of a gas, other than dry air, having a dielectric strength greater than air. However, the dielectric strength of a gas is influenced by its nature, purity, and density, and is subjected to large variations caused by the introduction of impurities in the form of small amounts of foreign gases. These impurities may either decrease or increase the dielectric strength of the predominant gas by as much as 50 percent.

3-11.7.1 Dielectric Properties of Gasses

Nitrogen, which has a relative dielectric strength slightly greater than that of dry air, and Freon, which has a relative dielectric strength several times that of dry air, have been used as gas dielectric media in waveguides. Although Freon has a greater relative dielectric strength than dry air or nitrogen, its vapor pressure varies considerably with changes in temperature. For this reason, if an arc-over or a breakdown occurs in the waveguide, Freon decomposition products are highly corrosive and deposit undesirable carbon particles on the waveguide inner surfaces.

Presently, a gas used with much success as a dielectric medium in waveguides, is Sulfur Hexafluonde (SF6). This gas has a high dielectric strength; chemically, it is essentially inert; biologically, it possesses a wide operating temperature range and does not leave carbon tracks on waveguide surfaces after breakdown. Additionally, it permits ahnost 8 to 10 times greater power to be transmitted through the waveguides, at microwave frequencies, as compared to the power permitted to travel through similar dry-air filled waveguides.

In many applications, microwave transmission lines are quite long and are subject to leak when pressurized. Present standards for waveguides used in ground radar equipments specify that the leakage rate for a 30-psig system must not exceed 1.25 psi per hour. The waveguide, originating at a transmitter, usually passes through areas accessible to, and possibly occupied by, personnel. Therefore, the toxicity factor of a gas used to pressurize the waveguide must be known, especially when a leak occurs in a closed space, to safeguard personnel against toxic effects from leeks in the waveguide. Adequate ventilation, provided by exhaust fans, maybe required to keep the concentration of escaping gas well below a tolerable percentage in closed spaces occupied by personnel.

The use of either Freon or Sulfur Hexafluoride as a dielectric medium for pressurizing waveguide systems, does not permit an increase of the power-handling capability of the waveguide system; in the event of an arc-over or a chemical breakdown, both gases will be subjected to decomposition. Freon is not likely to be used in low-temperature applications because of its comparatively high condensation temperature (a Freon-filled system operated under low-temperature con-

ditions special treatment to keep the temperature of the gas above the condensation temperature.) However, it is important to note that after chemical breakdown, one of the decomposition products of Freon is Phosgene, which is a highly toxic gas and extremely dangerous to personnel.

Sulfur Hexafluoride, in its pure state, is essentially inert and nontoxic and has found use in medical applications as a therapeutic agent for rehabilitation of damaged lungs. In tests on humans, the gas in its pure state has been found to be non-toxic when inhaled in gaa-Oxygen mixtures containing es much as 80-percent Sulfur Hexafluonde. However, when arc-over occurs in a waveguide filled with this gas, the decomposition products that are produced constitute a dangerous personnel hazard in the form of several toxic gases, including Fluorine. These toxic gases are colorless, cannot be detected by odor, and may not irritate the skin. When inhaled, however, they will cause severe lung irritation and hemorrhaging. In animal experiments, conducted in the laboratory, samples of Sulfur Hexafluoride and its decomposition products produced by arcing proved fatal to mice and rats when small percentages of the gaseous compounds were introduce into the air chamber containing the experimental animals. Autopsy revealed extensive hemorrhaging in the lungs of the animals.

3-11.7.2 Recommended Safety Precautions

The effects of a short exposure to a high concentration of Sulfur Hexa.fluonde, which has been subject to arcing, are not fully known at this time. Tests are being conducted to determine the most practical means of maintaining the concentration of toxic products in operational equipment below a hazardous level, and to devise a system which is completely safe, foolproof, and practical for field use.

When a breakdown occurs witbin a waveguide system, the voltage-standing-wave ratio in the transmission line will, likely, increase. Depending upon the individual radar system, an increase in the voltage-standing-wave ratio may cause arcing in the magnetron transmitter, and this in turn may actuate power "rundown" control circuits to stop the transmitter until the arc is extinguished. However, arcing may take place periodically until the system fails completely, or at least until the system performance drops below an acceptable minimum. Therefore, should a maintenance technician open the waveguide while repairing the system, highly toxic gases (resulting from dielectric breakdown) would be released into the area in which the work is taking place.

The possibility of inhaling a concentrated mixture when the pressure in the system is released, by opening the system, represents a serious hazard to personnel, especially in closed work spaces. Since results of tests have indicated that the decomposition products of Sulfur Hexafluonde are definitely haaardous to personnel, the foIlowing safety precautions are recommended in installations where this gas is used to pressurize waveguide systems:

a. The portion of the waveguide system which originates at the transmitter and passes through confined areas shell be well sealed and made as gas-tight as is possible.

b. A room ventilation system shell be provided in confined areaa where leakage from the waveguide is possible. The room exhaust fan shell provide a complete change of air every several minutes to pervent concentration of toxic gases.

c. Consideration shall be given to the incorporation of an escape valve in the waveguide system, at a point external to any closed area or equipment shelter, to allow continuous leaking of the gas to the open atmosphere. The purpose of such a pressure leak is to keep the gases moving through the system which expels decomposition products, resulting from electrical breakdown, to the open atmosphere where the gases will be diluted and dissipated harmlessly. The rate of flow through the escape valve shall require adjustment to a rate which is economically feasible. A flow rate of 2.25 liters per hour has been suggested; at this rate, a 100 pound tank of Sulfur Hexafluoride connected to a typical waveguide system should maintain system pressurization continuously for approximately 5 months.

d. An alternate to the recommendation given in the previous paragraph (Paragraph 3) is to provide a gas recirculating system, to circulate the gases from the waveguide through a scrubbing column of soda-lime, for absorption of the toxic gases, and to return the purified gas back to the waveguide. (If necessary, an absorption column containing activated alumina may be used in series with the soda-lime scrubber.) However, the scmbbing agent would require replacement after losing its effectiveness; therefore, the scrubbing columns of such a system should be opened periodically for removal of the spent absorbing agent and replacement.

e. Infrared spectrograms have been made to obtain information on the nature of the toxic by-products resulting from the decomposition of Sulfur Hexafluoride. Baaed upon these data, respiratory protective devices are recom-

mended for maintenance personnel working on pressurized waveguides employing Sulfur Hexafluoride. However, the use of such respiratory devices shall be confined to emergency or intermittent exposure conditions and shall not be relied upon as the sole safety measure for controlling the personnel toxicity hazard.

3-11.8 RADIOACTIVE ELECTRON TUBES

Electron tubes containing radioactive material are commonly used in microwave and radar systems. These tubes are known as TR,ATR, PRE-TR, spark-gap, voltage-regulator, gas-switching, cold-cathode gas-recifier tubes and such. Some of these tubes have dangerous radioactive intensity levels and, therefore, are labeled in accordance with MIL-STD-1458. The majority of these tubes contain radioactive cobalt (Co-60), radium (Ra-226), or carbon (C-14); several contain nickel (ni-63); and relatively few contain cesium-barium (Cs Ba-137). A complete listing of radioactive electron tubes is contained in the Consolidated Hazardous Item List (CHIL), NAVSUP Publication 4500.

As long as an electron tube, containing any of the previously listed radioactive materials, remains intact end is not broken, the danger from radioactivity is negligible. However, when the tube breaks, allowing the radioactive material to be exposed or to escape, a potential hazard exists. The concentration of radioactivity, in an average collection of electron tubes at maintenance shops, does not approach a dangerous level and, therefore, the hazards of injury from the exposure are slight. However, at major supply points, the storage of large quantities of radioactive electron tubes, in a relatively small area, may constitute a potential hazard. For this reason, all personnel working with equipments employing electron tubes containing radioactive material, or who are in areas where a large quantity of radioactive tubes are stored, should read, and become thoroughly familiar with, the safety practices contained in the Radiation Health and Protection Manual, NAVMEDP-5055. Strict compliance with the prescribed safety precautions end procedures of this manual will help avoid accidents, end help maintain a work environment conducive to good health. Some important instructions and precautions pertaining to proper handling of radioactive tubes are provided below:

a Radioactive tubes shall not be removed from their cartons until immediately prior to actual installation.

b. When a tube containing a radioactive material is removed from an equipment, it should be placed immediately in an appropriate carton to prevent possible breakage. d

c. A radioactive tube shall never be carried in a manner that may cause it to break.

d. If a radioactive electron tube breaks, immediately notify the cognizant authority and obtain the services of qualified radiological personnel.

e. The immediate affected area shall be promptly isolated to prevent other personnel from possible contamination and exposure.

f. Follow the established procedures set forth in NAVMED P-5055.

g. Do not expose any part of your body to contaminated material.

h. Avoid breathing any vapor or dust released by tube breakage.

i. Wear rubber or plastic gloves during cleanup and decontamination procedures.

j. Use forceps to handle the larger fragments of a broken radioactive tube. The remaining small particles can then be removed with a vacuum cleaner, using an approved disposal collection bag. If a vacuum cleaner is not available, use a wet cloth to wipe off the affected area. In this case, be sure to make one stroke at a time; Do not use a back-and-forth motion. After each stroke, fold the cloth in half, always using the clean side of the new stroke. Dispose of the cloth in the manner stated in Subsection 3-11.10, Disposal of Items Containing Radioactive Material.

k. No food or drink shall be brought into the contaminated area or near any radioactive material.

1. Immediately, after leaving a contaminated area, personnel who have handled radioactive materials in any way shall, first, remove all contaminated clothing and, then, thoroughly wash their hands and arms, or any other pert of their body that may have come in contact with radioactive materials, with soap and water followed with a thorough rinse with clean water.

m. If a wound is sustained by a sharp radioactive object, a medical officer shall be notified immediately. If a medical officer cannot reach the scene immediately, mild bleeding should be stimulated by pressure about the wound and by used of suction bulbs. Do not use the mouth.

n. When cleaning a contaminated area, all debris, cleaning cloths, end collection bags, shall be sealed in a container such as plastic bag, heavy wax paper, or glass jar, and placed in a

steel can until disposed of in accordance with existing instructions.

o. Decontaminate all tools and implements used to remove a radioactive substance by use of soap and water and thorough rinsing. Monitor the tools and implements for radiation with an AN/PDR-27( ) Radiac Set, or any other such instrument with equivalent sensitivity; they should emit less than 0.1 mR/hr at the surface.

3-11.9 RADIOACTIVE SOURCES FOR RADIAC EQUIPMENT

There is a large variety of types and sizes of radioactive material used in calibrating or checking radiac equipments. The use of large radioactive sources is restricted to authorized radiac repsir facilities. Prior to using a new source assigned to such a facility, the individual in charge of the facility, shall review its installation and operational procedures with local cognizant health ardor safety personnel and receive their permission to install and use the new source. Areas where these sources are used shall be restricted to authorized persomel only and shall be adequately marked. Smaller radioactive sources, although also of possible danger, are supplied with Radiac equipments for the purpose of field-checking the equipments. Normally, the instructions for the proper use and handling of these sources are contained in the technical manuals for the equipments with which they are supplied. If these instructions, however, do not cover the proposed use of the source under consideration, local health ardor safety authorities should be consulted. Radioactive materials, even in storage, may harm personnel and may expose unprocessed photographic and radiographic films and papers. Precautions must, therefore, be exercised constantly to protect personnel and vulnerable materials from these radiations. More detailed information on the handling and storage of radioactive material and the safety precautions to be observed is contained in Section 1 of the Radiac EIMB handbook, NAVSEA-SEOOO-OO-EIM-050, and in NAVMAT P-51OO, Navy Safety Precautions for Shore Activities.

3-11.10 DISPOSAL OF ITEMS CONTAINING RADIOACTIVE MATERIAL

The Radiation Health Protection Manual, NAVMED P-5055, requires disposal of radio-active waste by transfer to an activity licensed by the Nuclear Regulatory Commission (NRC). A number of experienced commercial organizations which meet these requirements are licensed by the NRC or by certain states to dispose radioactive wastes. NAVSUPINST 5101.9B details procedures for disposal of these wastes.

Military commodities which contain radioactive material (including electron tubes) are marked with the standard radiation symbol, in accordance with MIL-STD-129. Items which are marked as containing radioactive material, and which are to be disposed of, shall be sealed in a sturdy leakproof container. The container shall then be marked to indicate the radioactive content of the material sealed within.

NAVSUPINST 5101.6 contains procedures for requisitioning, labeling, handling, storage, and disposal of certain items which contain radioactive by-product material. The items covered by this instructions are:

a. Submersible wrist compass, NSN1H6605-OO-079-OO07

b. Submersible wrist watch, NSN2H6645-OO-752-8638

c. Wrist depth gauge, NSN 2H 4220-00-639-8999

d. Lensatic compass, NSN IH 6605-00-846-7618

e. Lensatic compass, NSN IH 6605-00-151-5337

f. Gas and smoke detector, NSN 2H 6605-00-937-3143

g. Gas and smoke detector, NSN 2H 6605-00-937-3144

h. Tritium water standard, NSN IH 6665-00-878-0490

3-11.11 RADIOLUMINESCENT MATERIALS

Radiohuninescent material is that material which Iuminesces (emits light) while being bombarded by nuclear radiation if, and only if, the source of nuclear radiation (radioactive material) is contained within the material. Devices, such as clocks, compasses, depth-gauges, and wrist watches, which contain radioluminescent material constitute a potential health hazard. Although the direct radiation from this material is of little consequence, its radioactive particles may constitute a serious radiation hazard if taken into the body. Another potential hazard is the inhalation of "radon daughtter" products, when a radioactive luminescent material is displaced in an enclosed atmosphere. For example, experience on submarines has indicated that a watch with an unbroken crystal and with a radium dial and radium hands

can produce airborne particulate radioactivity levels greater than the permissible limit, because of radon-222 decay. Continuous exposure to the released radon gas will result in personnel radiation exposure greater than the safety limit of 0.5 remlyear. Damaged or deteriorated radioh.uninescent materials or devices containing this radon material may contaminate local areas with radioactive particles which can then circulate air or be gathered on the hands and clothing of personnel. Also, ventilation filters and electrostatic precipitators will collect, and concentrate, these particles which may become radiological hazard. The above conditions can lead to the ingestion or inhalation of radioactive particles. These hazards, however, are frequently ignored because the physiological effects of unsafe exposure to small amounts of radioactivity are not immediately apparent; they may take months, or even years, to appear and they may never be traced to the initial cause.

In order to guard against the hazards of radioluminescent materials, the precautions listed in the following paragraphs shall be implemented. These precautions apply to all radioluminescent material whether government property or privately owned.

a Take appropriate action to inform all hands of all hazards associated with radiohuninescent materials.

b. Make visual inspections and conduct monitoring to detect the presence of radioluminescent materials. Monitoring should include periodic checks of areas where the work might involve the handling of components containing these materials. Any material exhibiting a radiation level of more than one tenth of one milliroentgen per hour (0.1 mR/hr) above background at a distance of approximately one inch from the material should be treated as radioactive. (Radiac Set AN/PDR-27( ), or an imstrument of equivalent sensitivity, with the detector end window open is a suitable radiacmeter for detecting this radioactivity.)

c. Remove all radioluminescent devices, including repair parts, which are not operationally essential.

d. Insure that modification or repair of all items or components containing radioluminescent material is performed only by organizations qualified for such work, in accordance with NAVELEXINST 5100.2 Radioluminescent Material, Control of. A statement by the repair facility that is so qualified shall be sufficient evidence thereof.

e. Do not handle components bearing radioluminescent material any longer than necessary. When handling is necessary, wear rubber or plastic gloves to prevent contamination of the hands.

f. Refrain from smoking or eating while handling radioactive material. Keep radioactive material away from personal property and foodstuffs.

g. Excessive special care when handling any equipment on which the radioluminescent material is flaking or dusting. When this condition is observed, isolate or cover the item until it can be removed.

h. Prohibit handling of broken or damaged items containing radioluminescent materials without wearing rubber or plastic gloves. Broken or damaged items should be placed in leak-proof containers, marked as radioactive, and trausferred to the nearest naval supply activity for ultimate disposal in accordance with NAVSUP Publication 488.

i. Clean all areas suspected of being contaminated so as to prevent inhalation or ingestion of the material or the spread of contamination. All radioactive material removed, including contaminated liquid waste and solid waste, such as rags used in cleaning, should be collected and promptly sealed in leak-proof containers, marked as radioactive, and transferred to the nearest Radiac Repair Facility for ultimate disposal. Cleaning operations shall be so conducted as to minimize contaminated waste.

j. Contaminated ventilation filters should be disposed of as in Paragraph h, above. Washdown of contaminated electrostatic precipitators should be followed by liberal flushing of any affected areas to remove residual contamination.

3-11.12 INSTRUCTION FOR CLEANING RESIDUES FROM LEADS IN SMALL CAPACITORS

These instructions apply to the cleanup of residues resulting from leaks in capacitors which originally contained three pounds or less of polychlorinated biphenyl (PCB) dielectric fluid. PCB dielectric fluid is defined as a dielectric fluid containing more than 50 parts per million by weight of polychlorinated biphenyls. Cleanup of leaks from capacitors containing more than three pounds of PCB fluid, or other devices such as transformers containing any amount of PCB fluid, shall be in accordance with Navy Environmental Support Office document NESO

20.2-028, "PCB Compliance, Assessment, and Spill Control Guide."

WARNING

Dielectric fluids containing polychlorinated biphenyls are suspected of causing cancer and other diseases after prolonged exposure. Gloves shall be worn when handling leaking capacitors and their residues. Avoid getting dielectric fluid on the skin or in the eyes. Rinse from the eyes with water and obtain medical as sistance promptly. Wash from skin promptly with soap and hot water.

a. Labels, technical manual information, or local methods of testing for PCB may be used to determine if the dielectric fluid contains more than 50 parts per million of PCB. If a concentration of less than 50 part per million cannot be verified, treat the dielectric fluid as PCB. Dielectic fluids that are free of PCB may be treated as oily waste.

b. Locate and remove the capacitor which is leaking and place it in a metal container such as empty paint can, food container, or any other sealable metal container.

c. Using a clean, dry cloth dampened with kerosene, Freon PCA (Freon 113 or Freon FT) or other suitable solvent, wipe clean the PCB from all surfaces on to which it has leaked. Observe the precautions associated with cleaning with a solvent, section 3-10.

d. Place the used cleaning cloths and gloves in the container with the capacitor, securely seal the container, and discard it as solid waste.

3-12 ELECTROMAGNETIC RADIATION

Electromagnetic radiation (also referred to as RF radiation) can be neither seen nor easily sensed. Therefore, its presence must be measured by use of special sensitive instruments, or by theoretical calculations, so that the safety of personnel involved in various activities within the electromagnetic environment will be assured. A discussion of the various methods used to sense the presence of electromagnetic energy is beyond the scope of this section. However, the importance of remaining alert to the danger of overexposure to electromagnetic radiation as well as to the dangers of other radiation hazards is emphasized.

3-12.1 BIOLOGICAL EFFECTS OF MICROWAVE ELECTRO-MAGNETIC ENERGY

The energy impinging on an object in an electromagnetic field may be reflected or absorbed. Only the absorbed energy constitutes a biological hazard. The amount of penetration of energy into the body and its absorption depends upon the physical dimensions of the body, the electrical properties of the tissues, and the wavelength of the electromagnetic energy.

For any significant effect to occur, the physical size of the object must be equivalent to at least one tenth the wavelength of the radiated energy. Neglecting other physical measurements of the human body, a man's height determines at what wavelength the electromagnetic energy will be most hazardous to him. As the wavelength decreases, the man's height represents an increasingly greater number of electrical wavelengths. Inversely, as the wavelength increases, the man, therefore, becomes a less significant object in the radiation field. Consequently, the likelihood of the occurrence of biological effects on human body increases as the wavelength decreases (or frequency increases). Additionally, as the wavelength becomes progressively shorter, the dimensions of parts and appendages of the human body become increasingly more significant in terms of the number of equivalent electrical wavelengths. Briefly, the effects from microwave electromagnetic radiation on the human body increase in proportion to frequency of the radiated energy. The higher the frequency the greater the absorption by the human body and, consequently, the greater the danger from exposure to electromagnetic radiation.

When electromagnetic energy is absorbed by tissues of the body, heat is produced in the tissues. If the organism cannot dissipate this heat energy as fast as it is produced, the internal temperature of the body will rise, resulting in damage to the tissue and, if the rise is sufficiently high, in destruction of the organism. The body's ability to dissipate heat successfully depends upon many related factors, such as environmental air circulation rate, humidity, air temperature, body metabolic rate, clothing, power density of the

radiation field, amount of energy absorbed, and duration of exposure.

Certain organs of the body are considered to be more susceptible than others to the effects of RF radiation. Organs, such as the lungs, the eyes, the testicles, the gall bladder, and portions of the gastrointestinal tract, are not cooled by an abundant flow of blood through the vascular system. Therefore, these organs are more likely to be damaged by heat resulting from excessive exposure to radiation. Information presently available and experience indicate that, of the orgaus just mentioned, the eye and testicles are the moat vulnerable to microwave radiation. Therefore, the possibility of becoming partially blind or temporarily sterile is most likely.

3-12.2 EXPOSURE LIMITS TO ELECTROMAGNETIC RADIATION

The Bureau of Medicine and Surgery has established safe exposure limits of humans in an electromagnetic field based on the power density of the radiation beam and the time of exposure in the radiation field, as follows:

Personnel shall not be exposed to a power density which, when averaged over any 0,1 hour period, exceeds 10 mWlcm2 in the frequency domain of 10 MHz - 100 GHz. Neither the root mean squared electric field strength (E) nor the root mean squared magnetic field strength (H) may exceed the following values when averaged over any 0.1 hour period:

$$E = 200 \frac{\text{Volts}}{\text{Meter}}$$

$$H = 0.5 \frac{\text{Ampere-turns}}{\text{Meter}}$$

(These are the electric and magnetic field strengths roughly corresponding to electromagnetic waves in free space to which a value of power density of 10 mW/em2 may be assigned). For a condition where exposure is not regular in time or continuous in level over the 0.1 hour period, the equivalent energy fluence level of 1 mW-hrlem2 may be used as the limit of exposure for auy 0.1 hour period. In situations where measurement of two or more quantities are available the most restrictive shall be used as the limiting factor.

All areas, in which the RF-energy levels exceed the safe limits, shall be considered hazardous.

3-12.3 RADIATION HAZARD ZONES

During early applications of radar in the Navy, the danger of injury to personnel from electromagnetic radiation was generally negligible, because the power densities (expressed in watte/square centimeter) were relatively low and the radiation patterns were generally directed above personnel work areas. However, with the more powerful "high performance" radars in use in today's Navy, extremely high power densities are achieved, through the use of high values of average power and more concentrated radiation patterns. When such concentrated radiation patterns can be positioned in elevation as well as in azimuth, as are fire control radars in aircraft and aboard ships, extreme caution is required to keep the beams directed away from personnel.

Shipboard radar antennae are normally located high on the superstructure and are well removed from general working areas, and, under most circumstances, RF radiation from their beams do not present a serious hazard. However, care must be exercised against hazards introduced by energized antennae on nearby ships, which, because of differences in ship types, may violate the minimum safe clearance distances.

The Naval Sea Systems Command is responsible for determining hazardous shipboard areas and ensuring that the possibility of biological injury to personnel from electromagnetic radiation is minimized or nonexistent. Theoretical calculations and power density measurements are used to establish the distances from radar antennae within which it is not biologically safe for personnel to enter, This information, together with additional power density measurements, if necessary, is then used to determine if and where RF radiation hazard zones exist. Specific RF radiation hazard zones of radars and the maximum exposure times allowed for personnel to remain in these zones, are listed in the Radiation Hazards Manual, NAVSEA 0900-LP-005-8000.

While every effort must be made to protect personnel from harmful exposure to RF radiation, it is not considered necessary or desirable that blanket restrictions on ship antenna radiation be imposed to achieve safety. The existence of such policy will tend to restrict maintenance and checkout procedures, which can otherwise be carried out safely, providing certain precautions are taken to keep personnel clear of

hazardous areas. These precautions include the following:

a. Visual inspection of feed horns, open ends of waveguides-or any other opening emitting electromagnetic energy shall not be made unless the equipments are definitely secured for the purpose of such an inspection.

b. Make sure that all radar antennas, which normally rotate, are rotated continuously or are trained (and/or elevated) to a known safe position while radiating.

c. Train and elevate non-rotating antennas away from inhabited areas, ships, piers, dry docks, pier cranes, and such, while radiating.

d. Aircraft, employing high-power radars, shall be parked (or their antennas shall be oriented) so that the beams are directed away from personnel work areas.

e. Where the possibility of accidental exposure might exist, maintenance personnel are required to have a man stationed topside! within view of the antenna (but well out of the beam), and in communication with the operator, while the antenna is radiating.

f. Ensure that radiation hazard warning signs are properly posted. (Refer to Subsection 3-20-3, Radio FrequencY Radiation Hazard Warning Signs.)

g. when operating or servicing a shipboard radar, operation and maintenance personnel shall observe all RF radiation hazard signs posted in the operating area to ensure that the radar is operating in such a manner that personnel on deck or in the superstructure of the ship as well as personnel working on nearby pier or personnel operating pier or deck cranes are not subjected to hazardous levels of RF radiation.

h. All personnel shall observe RF hazard warning signs which point out the existence of RF radiation in a specific location or area

3-12.4 RF BURN HAZARDS

An RF bum occurs when a person comes into contact with a source of RF voltage in a manner that allows RF current to flow through the area of contact. Resistance of the skiII to the current flow at the area of contact causes heat. The effect of the heat on a person at the point of contact ranges from a noticeable warmth to a painful bum. The sensations of RF bums are solely a result of concentrated heating of the skin; shock and local muscle spasm normally associated with contacting 60-hertz AC or high DC power-source voltage are not present.

Mild Rf bums are usually accompanied by small white spots on the skin; the odor of scorched skin may also be detected. More severe burns, while not necessarily large in area, may penetrate deeply into the flesh and produce painful and slow-healing injuries.

Numerous fleet reports on RF voltages being present on crane hooks have been received. These voltages, of sufficient potential in some instances to cause RF bums, are induced in crane structures and wire ropes by transmitting antennas operating in the vicinity of the ship's crane.

Some crane/antenna problems can be eliminated by relocation of antennas, but each installation requires special considerations. The locations of ship's antennas are determined by optimizing the desired radiation patterns with the physical limitations imposed by other features dictated by the ship's function. Often, the relocation of antennas, although physically permissible, is not feasible because of the location of the associated transmitters.

RF voltages have been measured aboard shiPs indicating resonance effects between 2 and 30 MHz. By carefully frequency utilization, it has been found that it is Possible to reduce coupling of RF voltages induced in crane structures and rigging. This method should be considered.

A better approach, however, is the use of RF High Voltage Insulator Links which protide protection for personnel against RF burns. (Refer to MIL-L-2441O (SHIPS), Link RF High Voltage Insulator for Ship Cranes). The required high electrical resistance, low capacitance, high tensile strength, mggedness and fail-safe features of the insulator links are provided by means of two separate bands of fiberglass filament wound on two zinc-coated stsel saddles. The inner band carries the full working load; the outer band is capable of carrying the full working load should the inner band break.

Refer to the Radio Frequency Bum Hazards manual, NAVSEA 0967-LP-317-7010, for types and stock number of insulator links.

when proper precautionary measures are taken, the operation of ek?ctronic transmitting equipment at any frequency having a rated output not greater than 250 watts, average, has been

proven safe while handling rigging. HOWEVER, PERSONNEL SHOULD BE CONSTANTLY ALERT TO THE FACT THAT EVEN UNDER THE ABOVE OPERATIONAL LIMITS, ELECTRONIC TRANSMI'M'ING EQUIPMENT CAN CAUSE HAZARDOUS VOLTAGES TO BE INDUCED IN THE STANDING RIGGING AND OTHER PORTIONS OF A SHIP'S STRUCTURE, PARTICULARLY THOSE STRUCTURES AND OBJECTS (i.e., AIRPLANES AND HELICOPTERS) WHICH PROTRUDE FROM THE SHIP IN THE SAME PLANE AS THE RADIATING SOURCE. The RF voltages induced in a ship's structures, rigging, or other objects will cause bums to personnel when contact is made with conductive objects. The bum hazard problem, ita causes and remedial techniques, are discussed in NAVSEA O967-LP-317-7O1O, Technical Manual, Radio Frequency Bum Hazards Reduction.

3-12.5 FUEL AND EXPLOSIVE VAPOR HAZARDS

The operation of electronic transmitters used for radio and radar, or the operation of any other electronic device emitting electromagnetic energy, will induce RF voltages in the standing rigging, parts of the superstructure, other transmitting and receiving antennas, cables, crane structures, or other objects whose electrical lengths are resonant at the transmitted frequency (or a harmonic thereof which approaches the resonant condition). The presence of RF voltages on such objects may arc between closelyspaced (usually 0.02 inches or less) conductive objects or cause sparks when contact is made or broken by personnel or other conductive media If the RF voltage contains sufficient energy, the heat of the spark (or arc) may be sufficient to ignite fuel vapors aud other explosive mixtures. At areas where gasoline vapors are present and during fueling and arming of aircraft, or handling of ammunition, volatile liquids, or gases (particularly during fueling operations involving the delivery of gasoline from hoses, spouts, cans, and the mixing of gasoline aud napalm), adequate precautionary measures must, therefore, be taken to nullify the hazards of explosions and fires.

3-12.5.1 Precautions During Handling of Ammunition, Volatile Liquids or Gases

During the handling of ammunition, volatile liquids, or gases in areas where booms, cranes or burtoning wires are operated, the following precautions shall be observed:

a Alert the deck-force or others as to the hazards involved.

b. Use an insulated steering hook for guidance of boom or crane cables.

c. Insulate the loading hook from burtoning wire, crane, or boom cables by use of manila rope or RF insulators when feasible (see preceding Subsection 3-lld, RF Bum Hazards).

d. Observe all safety precautions with respect to ventilation, danger from sparking, insulation of rigging, etc., as listed in Chapters 542 and 613 of the Naval Ships Technical Manual, and in the Radio Frequency Radiation Hazards manual, NAVSEA 0900-LP-O05-8000.

e. When transmitting antennae are in extreme close proximity to working areaa (such as on the flight deck of carriers), every effort shall be made to reduce hazardous conditions by relocating aircraft andlor ordnance as far as possible from the energized transmitting antennas,

3-12.5.2 Examples of RF Voltages Encountered

Although the many variables encountered at service installations preclude approximation of all possible RF voltages encountered, the following examples are cited:

a Radbfrequency pickup from ship antennae has been noted on smokestack guys, davit head spans, railings, and metal parts of wooden masts which are not effectively grounded.

b. A similar radbfrequency pickup has been observed aboard ship, particularly carriers, when the lengths involved in reeling-in or paying-out wire cables and wire hawsers approach resonance ta the emitted frequency.

c. Radiated radar energy will induce voltage in small metal objects or tools which, when discharged, will produce an arc sufficient to ignite gasoline vapors and combustible material. Light metal objects exposed directly in the radiated beam will, through heat, ignite flamrnable material or vapors.

3-12.5.3 Precautions At Shore Installations

At shore installations, the availability of space permits greater separation of antennae and lead from other circuits and structures, however, the increased power of transmitting equipment still presents certain hazard. Although the antenna and downleads are generally remote from most working areas, space limitation may necessitate the erecting of fueling stations, parking ramps, or other structures near the antenna site. When such structures or areaa are adjacently

located, the following precautions and procedures shall be observed.

a. Isolated metal parts, wherever feasible, shall be grounded. However, where grounding is not feasible, the metal parts shell be bonded together. Metal used in building structures, and particularly in wood structures, shall be grounded.

b. The fueling of gasoline powered motor vehicles, equipment or aircraft, in proximity to antennas and antenna down leads, shall be avoided or shall be conducted under special precautions. An ungrounded automobile, tmck, etc., and ungrounded filling nozzle, coupled with the attendant's body capacity will produce sparks sufficient to ignite gasoline vapor when the nozzle contacts the tank opening. Pump nozzles shall be grounded at all times, and motor vehicles and other gasoline-driven equipment or aircraft shall also be grounded when fueling and before opening the tank. (See Chapter 542 of the Naval Ships Technical Manual). Similar precautions must be taken prior to delivery of gasoline, or other explosive liquids, or gases. The application of highly volatile and flammable coatings (saran, vinyls, etc.) in the affected area shall be avoided.

3-12.6 HAZARDS OF ELECTRO-MAGNETIC RADIATION TO ORDNANCE (HERO)

The uses of electrically initiated explosive devices are increasing greatly, i.e., for initiating booster rocket igniters end warhead detonators, for stage separation in multistage rockets, for reliable high-speed operation of switches and valves, and for many other purposes. Some weapons continuous development efforts are directed toward reducing weight and space, lowering power requirements, assuring positive response, and increasing reliability and safety. However, these are not always complementary goals.

At the same time, the power of communications and radar transmitting equipment is being constantly increased end the frequency spectrum broadened.

These trends produce incompatible situations. Transmitters and their antemss have only one purpose-to radiate electromagnetic energy, whereas the initiating elements of ordnance items need only to be supplied with the proper amount of electrical energy for an explosion to take place. Several shipboard incidents involving ordnance items have been attributed to initiation to their EEDs by electromagnetic radiation from the ship's transmitting equipment. Each incident occurred during shipboard operation while the ordnance item was handled normally. Therefore, with many explosive ordnance items, constraints are required for safety and to ensure reliable performance.

To meet the growing need for new shipboard procedures to reduce the hazard to ordnance equipment from RF radiation, the Naval Sea System Command (NAVSEA) has sponsored tests which, coordinated with studies by other agencies, have enabled the formation of new guidelines and restrictions for handling electrically initiated ordnance equipment. The basic problem in determining an ordnance system's susceptibility to RF radiation lies in the evaluation of the antenna-like couplings exist between illuminating fields and the various EEDs employed in the system. RF energy may enter a weapon as wave radiated through a hole or crack in the weapon skin. RF energy may also be conducted into the weapon by the firing leads or other wires that penetrate the weapon enclosure. The precise probabilities of EED actuation are relatively unpredictable, being dependent upon variables of frequency, field strength, geometric orientation, environment, and metallic or personnel contacts with ordnance and aircraft. Actuation of EED is often undetectable without disassembly of weapons. The most susceptible periods are during assembly, disassembly, loading, unloading, or testing in electromagnetic fields. The most likely effects of premature actuation are dudding, reduction of reliability, or propellant ignition. In the very worst environments there is a low, but finite probability of warhead detonation.

Detailed restrictions and the necessary general and theoretical analysis to enable the reader to make intelligent assessments of the hazard present in tactical use of ordnance may be found in the Radio Frequency Hazards to Ordnance, Persomel, and Fuel manual. NAVORD OP 3565/NAVAIR 16-1-529.

3-13 X-RAYS

The use of high-power radar and communication equipments have created new radiation hazards. Modem electron tubes, such as klystrons, magnetrons, thyratrons, cathode-ray tubes, and high-voltage rectifiers, when operated with electric potentials in excess of 16,000 volts, may generate X-rays. These rays may emanate from the tube, if satisfactory shielding is not provialed. The ability of X-rays to penetrate solid matter and alter, damage, or destroy living tissue,

makes this energy extremely useful for medical treatments when controlled. However, it makes it a very serious hazard when not controlled.

3-13.1 EFFECTS OF X-RAYS

AU X-rays, except those of very low energy, will penetrate human tissues and form positive and negative ions. These ions cause tissue damage which may be either temporary or permanent. Unless the dosage is extremely high, there will be no noticeable effects for days, weeks, or in some cases, years after the exposure. In effect, this delay is, no doubt, the most important factor in cases of overdose of X-rays, since by the time the symptoms are evident, the damage has been done. Some of the known effects of overexposure to X-rays are:

a. An increase in the number of white blood cells (leukemia), a decrease in the number of white blood cells (leucopenia), and increase of blood clotting time, and anemia These effects on the blood lower the resistance of the body to bacteria which is a secondary hazard to over-exposure.

b. Bone damage–Most of the damage is done to the marrow which produces the blood cells; occasionally, the bones themselves are damaged.

c. Skin cancer, skin inflammation, and loss of hair. Reddening of the skin is one of the first symptoms of overexposure.

d. Mutations-Ulcers, sterility, or cataracts which may not appear until the second or third generation.

3-13.2 PROTECTION AGAINST X-RAYS

When working with high-voltage electron tubes, or on auy other device capable of producing X-rays, you should make certain that the radiation has been checked at all possible points of emission. Under normal operating conditions, there will probably be protective shielding (for radiation control). However, you must be aware of the possible increase in radiation under unusual conditions. Areas exposed to radiation must be checked to determine the radiation strength and, if necessary, to set some exposure time-limits for workers in the area The recommended maximum intensity levels in controlled radiation areas is 100 rnilliroetgens per week or 2.5 ndliroentgens per hour. Although these limits are considered safe, no one shall be exposed to X-ray radiation longer than it is absolutely necessary.

3-13.3 DETECTORS

Detectors, such as film badges or pocket meters, shall be worn in all radiation areas. However, these detectors should be used with the understanding that radiation may be concentrated on other portions of the body where the detectors are not carried. Several other types of portable radiation detectors are also available. These include ionization chambers, proportional counters. Geiger-Muller counters. scintillation detectors, and electroscopes.

3-14 LIGHTNING

Lightning poses a serious hazard to personnel who work with communications as well as other electronic equipment. To help cope with this hazard the information contained in the following subsections must be taken into consideration during operation, maintenance, and installation of electronic equipment.

3-14.1 LIGHTNING PROTECTION

Whenever antennas or transmission lines are installed, careful attention must be paid to appropriate safety measures. Protection can be obtained by using a number of devices, such as lightning arresters, capacitors, protector tubes, spark gaps, and ground wires. Although these devices are very effective, additional precautions must be exercised during the conduct of the work schedule. For example, work must not be performed on antennas, towers, or transmission lines during an electrical storm or whenever such a storm is imminent. The combination of lightning protection devices and common sense will provide a secure basis for life saving as well as for prevention of darnage to equipment.

3-14.2 LIGHTNING ARRESTERS

Antenna or transmission line lead-in conductors shall be protected by lightning arresters, unless the transmission line itself is protected by a continuous grounded metal sheath. The arresters shall be placed in the most direct line between the lead-in conductor and the point where the grounding connection is made; they may be located either outside or inside the equipment shelter.

Arresters shall not be installed in the immediate vicinity of inflamrnable material, nor at a location which is exposed to dust or inflemmable gases.

If lightning arresters with auxiliaries are installed inside a building, they shall be kept

away from all other equipment, passageways. and combustible materials or parts of the building. Air-break type arresters employed in circuits of more than 7500 volts shall be arranged, isolated and equipped so that they maybe readily disconnected from conductors by means of disconnects or clamping devices accessible from a safe distance. Such disconnecting devices shell be installed sufficiently far from all parts of the arrester equipment so that maintenance aud inspection work, required for any part of the arrester, can be performed safely. In addition, those disconnectors which are neither controlled nor operated remotely shall be situated in adequate working spaces, as specified, for disconnectors in general, in the National Safety Code.

oil-type lightning arresters are subject to the same precautions as oil switches, circuit breakers, and the like, and must, therefore, be separated from other apparatus by adequate fire-resistant barriers or otherwise adequately isolated. With outdoors installations, a means to quick drain away to a safe distance any spilled oil shall be provided. One method of providing oil drainage is the use of ditches or drains. Another, is the use of cinders or other absorbent material, paved to a depth of several inches in order to absorb the oil and eliminate any danger of its spreading. With indoor installation% floor drains shall be provided and arranged so that spilled oil will quickly collect in a suitable drainage or storage system provided for the purpose. If a large quantity of oil is involved, a separate fireproof compartment, suitably ventilated, is recommended.

The grounding wires of the arresters shall be of low impedance and of ample current capacity, and shall be run as directly as possible. Kinks and coils in the wire are undesirable. Metal parts of arresters must be grounded, even if the parts are not designed to carry current, unless they are elevated above the reach of personnel, or are satisfactorily guarded from making contact with live circuits.

All currentarrying parts of arresters, on circuits involving more than 70 volts, unless effectively isolated by elevation, shall have guards or barriers for the protection of personnel. Lightning arresters, unless provided with disconnectors which are always opened before work is preformed on the arresters, shall be arranged so that the necessary adjustments can be made without danger of contacting current-carrying parts. When adjustments must be performed on live arresters, either permanently grounded mechanisms or suitable insulating devices shall be used. Choke coils, gap electrodes, or other attachments inherent in the lightning-protective equipment, shall have an insulation, from 'he ground end other conductors, equal at least to the insulation required by other points of the circuit involved.

3-15 ELECTRICAL FIRES

An electrical fire aboard a Navy vessel can be more fatal and damaging to both personnel end ship than that resulting from battle. It is extremely important that all personnel know and understand shipboard fire-fighting procedures for electrical fires. Part of this knowledge is the learning of the types and locations of all Claes C fire= fighting equipment and apparatus iu the immediate working and berthing spaces, as well as throughout the ship. It is too late to try to learn during the course of a fire. The time is before; the time is now.

Detailed information pertaining to general shipboard fire-fighting procedures, fire hazards, and precautions is contained in Chapter 555, Fire Fighting, of the Naval Ships Technical Manuel.

3-15.1 THE FOUR CLASSES OF FIRE

The four classes of fire (A, B, C, and D) are dictated by the types of combustible material (or fuel) involved and by the methods and agents used in extinguishing them.

3-15.1.1 Class A Fires

Class A fires involve combustible materials that leave embers of wood, paper, cotton and wool fabrics, cork, etc. Although naval ships are constructed of steel, the equipment necessary for their operation includes a large quantity of Class A combustibles, which maybe ignited either directly or indirectly, as a result of heat transmitted from other fires. The main characteristic of Class A combustibles, the fact that they leave embers, deterrnines the method of extinguishment.

Surface extinguishment is not sufficient for Class A fires, except in the incipient stage. Therfore, these fires cannot be extinguished by smothering, since the entire mess of the embers must be cooled thoroughly. Water is the indicated extinguishing agent.

3-15.1.2 Class B Fires

Class B fires include combustible liquids which do not leave embers as in Class A

fires, such as cooking and fuel oils, grease, gasoline, jet fuels, kerosene, paint, turpentine, etc. Fires in paint lockers, machinery and fire rooms, and in oil and gasoline tanks constitute the greatest hazards. Another combustible material- the insulating oil of electric transformers used in electric and electronic equipment- is also considered a Class B fuel. However, the method of extinguishing burning insulating oil is considerably different from that used in machinery rooms, paint locker, etc. (See next Subsection 3-15.1.3, Class C Fires.)

Class B fires are usually extinguished by smothering, because vapor is emitted from the surface and bums when Class B combustibles are ignited. However, when the supply of oxygen is removed from the surface, the fire goes out. While the fire is burning over the surface, only the top layer of the oil under it is heated to its ignition temperature. For this reason, the rate of heat penetration in fuel and lubricating oils is low. Fuel oil burning for 10 to 15 minutes may have only an inchdeep layer of oil heated to its ignition temperature. Therefore, extinguishing such a fire is less difficult in its early stages. Foam, lightwater, water fog, and dry chemical powder are the recommended extinguishing agents for Class B Fires.

3-15.1.3 **Class C Fires**

Class C fires are not categorized according to the types of fuels involved. These are electrical fires and may involve fuels belonging to the CIsss A category (i.e., electrical insulating material, plastics, etc.); to the Class B category (i.e., insulating oil of electric transformers, some electrolytic substances, etc.); and possibly to the Claas D category (i.e., special metal alloys of magnesium, titanium, zinc, etc.); since any one or any combination of these fuels may ignite during an electrical fire. Claas C fires are a special situation in that an additiontd hazard of electric shock is involved, and that the fire must be extinguished without further damage to the delicate components of electric and electronic equipment. This situation requires specialized methods and specisl extinguishing agents.

Carbon dioxide (C02) is the preferred agent in extinguishing electrical fires, because it neither conducts electricity nor damages the equipment. Another choice is a dry chemical agent known as "PurpleK-Powder" (PKP). Carbon dioxide and PKP extinguishing agents are discussed in Subsection 3-15.2, Fire Extinguishing Agents.

3-15.1.4 **Class D Fires**

Class D fires include certain combustible metals such as magnesium, sodium, titanium, zinc, zirconium, and potassium. These metals are used in the manufacture of certain parts of aircraft, missiles, engines, electronic equipment, etc. Some of these metals do not require flame for their ignition; heat from radiation, conduction or convection, would be sufficient.

3-15.2 FIRE EXTINGUISHING AGENTS

The principal fire extinguishing agents used aboard ship are carbon dioxide gas, dry chemical powders, water, foam, and light water. These agents are discussed following.

3-15.2.1 **Carbon Dioxide Gas**

A method for extinguishing fires by a smothering action is the use of the inert gas, carbon dioxide, to "starve" the fire by diluting or removing its oxygen content. If gaseous carbon dioxide is directed into a fire, the flames will subside and, finally will cease. Depending on the fuel, this action will take place when the 21-percent content of oxygen in sir is diluted with carbon dioxide which will reduce the oxygen content to 15 percent, or even lower. Some Class A fuels require reduction of oxygen content to less than 6 percent for extinguishment of the glowing ember combustion. The smothering action of carbon dioxide gas is a temporary one, however, and it must be remembered that a smothered fire may quickly rekindle if the oxygen must be kept away or the temperature of the burning substance and its surroundings must be lowered below its ignition temperature.

Carbon dioxide is a dry, non-corrosive gas, which is inert when in contact with most substances, and will not damage electronic equipment or other machinery. It is a nonconductor of electricity and can be safely used in fighting fires that involve an electrical shock hazard.

Carbon dioxide gas is generally stored in steel cylinders at a high pressure of approximately 850 psi at normal room temperatures. Under this pressure, about two-thirds of the volume of the carbon dioxide is in liquid form; but when discharged, it has the appearance of snow. The cooling effect of the low temperature "snow" (-llO" F) is of rather small consequence although it increases the effective dilution period. However, the snow will blister the skin and cause bums if it is allowed to remain on the skin.

Personnel must be aware of the fact that the very qualities which make carbon dioxide a valuable extinguishing agent, make it, also, dangerous to life. Certainly, when it replaces oxygen in the air, to the extent that combustion cannot be sustained, respiration cannot be sustained either. Prolonged inhalation in an atmosphere of high concentration of carbon dioxide will cause suffocation. This gas is odorless and colorless and, therefore, it gives no evidence of its presence. Since carbon dioxide is heavier than air, it does not rise, but remains close to the surface.

A portable carbon dioxide extinguisher consists of a forged-steel container fitted with a "squeeze-grip" control, and contains 15 pounds of carbon dioxide.

Normally-encountered freezing temperatures do not affect the operation of carbon dioxide extinguishers. However, extinguishers exposed to arctic temperatures for prolonged periods will fail to operate.

3-15.2.2 **Dry Chemical Powder**

Since all fires are results of chemical reactions, certain extinguishing agents operate on a purely chemical reaction basis for quenching flames. These agents are dry chemical powders which are blown onto the fire by a charge of expellant gas, such as carbon dioxide, nitrogen or high pressure air.

The chemical reaction and extinguishing mechanism of dry chemical agents is a very complicated one. It involves neither inertness, like carbon dioxide gas, nor cooling, like water fog. In general, it may be said that dry chemical agents halt the chemical reaction in afire, in the same manner as shields would if they were placed between the heat, the fuel and the oxygen. In the "fire triangle" of fuel, heat, and oxygen, application of dry chemical powder will halt the union of these three elements just long enough to cause the flames to cease.

The dry chemical agent used in the Navy is a purple-colored powder composed of potassium bicarbonate and is called "Purple-K-Powder" commonly called PKP.

Although PKP is provided primarily for use on Class B fires, it is also safe and effective for Claes C fires. However, it should not be used instead of carbon dioxide, unless absolutely necessary, because it leaves a residue that is difficult to remove from electronic components.

3-15.2.3 **Water**

Water being the most economical cooling and diluting agent, is far superior to other agents. Cooling or removal of heat, is the most common method of fire extinguishment. Aboard ship, water is applied to a fire with a single piece of equipment-the all-purpose nozzle-in three different forms:

a. As a straight solid stream of water with a long reach and penetrating power;

b. As a "high velocity" water-fog with some reach or throw of the umbrella-shaped pattern of small water particles; and

c. As a "low velocity" water-fog (when using an applicator) with little reach of exceedingly fine water particles in a wide umbrella-shaped "cloud" pattern. This pattern is very easily blown about by wind currents.

It must be remembered, that aboard ship, every gallon of water put on a fire, which does not actually cool the fire or remove the fuel, must be pumped overboard or disposed of in some other manner. For this reason the straight solid stream of water is seldom used unless its capabilities of long reach or deep penetration are needed. Solid streams of water are onlv used to reach into smoke-filled spaces or into remote areas which require cooling or washing-down to prevent or extinguish a fire.

Water-fog is perhaps the most useful heat removing agent. Water, in the form of either high or low velocity fog, is the most economical water usage. However, the fog must be applied directly to the area requiring cooling if its benefits are to be realized.

When water is broken UD into small particles, as in water-fog, there is 'little or no danger of carrying electric current, provided that the nozzle used for the application is operated at its designed pressure to produce a fine spray: Therefore, the all-purpose nozzle, or its applicator, constitutes a shock hazard because of possible accidental shifting from the water-fog position to the solid-stream position or of accidental contact of its applicator with electrical equipment. It must be remembered that even after electric power is shutoff, particularly in electronic equipment, a dangerous potential may remain in circuit until an effective ground is established. Water-fog is, therefore, not recommended as an extinguishing agent for electrical fires, except as a last resort. If it is necessary to apply water fog, the nozzle should not be brought any closer to the power source than is absolutely necessary for ultimate utilization of the fog pattern.

3-15.2.4 **Light Water (AFFF)**

Light Water was developed for combating Class B fires. It is a clear, amber-colored liquid, which has the ability of floating on the sur-

face of hydrocarbon fuels creating a film which prevents the escape of vapors and consequently prevente ignition. The Light Water is applied to the burning fuel surface, as a foam. As the Light Water solution drains from the foam, it forms the vapor-tight film on top of the fuel.

Although Light Water can be used separately, it is generally used in conjunction with PKP.

The shelf life of the concentrated Light Water or the mixed solution is infinite. There is no deterioration of the products with respect to time.

3-15.3 CONTROLLING COMBUSTION OF ELECTRICAL FIRES

The three methods of controlling combustion of electrical fires-the removal of fuel, the removal of heat, and the control of air (oxygen)–are discussed in the following paragraphs.

3-15.3.1 Removal of Fuel

When fighting a fire, combustible materials must, if at all possible, be removed from the area to prevent them from getting in contact with, or being heated by, the fire. In an electrical fire, this is done primarily to prevent the fire from spreading. Since it is not practical to remove combustible substances from the source of fire within electrical or electronic equipment, either the removal of heat or the control of air (or both) is the most practical approach in combatting an electrical fire.

3-15.3.2 Removal of Heat

Heat is transferred by radiation, con-duction, and convection. In radiation, heat radiates in all directions from the fire, thus raising the temperature of nearby substances or materiels. In conduction, heat is transferred through a material, such as metal work benches and compartment decks and walls, when such materiel comes in direct contact with fire. In turn, the material gives off heat along its length and mass. In convection, heated air and gases rise from a fire to contact and transfer heat to other substances or materials nearby. Water or water-fog should be used only to remove heat from substances or materiels surrounding an electrical fire.

3-15.3.3 Control of Air

Air, which is composed of approximately 21 percent oxygen and 79 percent nitrogen and other gases, is difficult tQ be controlled, because it is impossible to remove air from the atmosphere surrouriding the fire. However, the air can be diluted with a non-combustible gas, such as carbon dioxide, which will reduce the oxygen content. The reduction of the oxygen content in air will prevent its combustion even though the temperature of the fuel is sufficiently high to ignite it. Carbon dioxide, a **noncorrosive** gas, is one and one-half times heavier than air and, therefore, remains close to the surface of the deck or floor.

3-15.4 APPLICATION OF CARBON DIOXIDE

WARNING

The very qualities which make carbon dioxide a valuable extinguishing agent make it also dangerous to life. When carbon dioxide dilutes and replaces the oxygen in the air to the extent that combustion cannot be sustained. Respiration cannot be sustained either.

Personnel should be aware that prolonged exposure to an atmosphere heavily laden with carbon dioxide will cause suffocation, unless special breathing apparatus is used. Carbon dioxide cannot be seen or smelled and its presence gives no evidence that can be recognized by the human senses. In the event of prolonged exposure to carbon dioxide, artificial respiration or oxygen must be administered and the victims must be kept warm and quiet. However, in the use of the 15-pound portable carbon dioxide extinguishers, the possibility of suffocation is negligible, because the quantity of gas released from one or several of these cylinders is not usually sufficient to reduce the total oxygen content of the air in a compartment below a dangerous minimum.

If carbon dioxide is applied to a Claes C fire on time, the fire will cease immediately. When properly directed and applied to the fire, there is no danger of an electrical shock since carbon dioxide is a non-conductor of electricity. However, if the discharge horn of a portable carbon dioxide extinguisher has accumulated ice, and it accidentally touches an energized circuit, the "iced" horn may transmit a shock to the person handling the extinguisher. The squeeze-grip type extinguisher may be turned off during its use and it will hold the unexpended carbon dioxide indefinitely without leakage. In continuous opera-

tion, the 15 pound cylinder will expend its contents in about 40 seconds. Carbon dioxide cylinders should be recharged to capacity as soon as practical after use. A discharged cylinder must never be returned to its place of stowage.

The carbon dioxide extinguisher is similar in appearance to the PKP extinguisher. Therefore, make absolutely sure that it is the extinguisher desired before using it. READ THE IDENTIFICATION LABEL ON THE EXTINGUISHER.

3-15.5 APPLICATION OF PKP

A dry-chemical type extinguishing agent, known as Purple-K-Powder (PKP) is suitable for electrical fires because it is nonconductive end is very effective for extinguishing Class B combustible materials. However, damage to electrical or electronic parts of equipment may result from the use of this agent.

The PKP is neither toxic nor asphyxiating, like C02. However, in a closed compartment, its dense white discharge induces coughing when ingested into the lungs.

The dry-chemical extinguisher is similar in appearance to the carbon dioxide extinguisher; therefore, it must not be mistaken for and used in place of a carbon dioxide extinguisher. Prior to use, READ THE IDENTIFICATION LABEL ON THE EXTINGUISHER.

PKP fire extinguishers are carried to the fire scene and then the activation plunger is pushed to pressurize it. When the hose nozzle is squeezed, a dense cloud of fire-killing powder will be discharged. This discharge shall be applied at the base of the flame to "cut off" the fuel from its flame and then "wig-wagged" across the burning surface. The flames will immediately subside. Afterwards, the discharge shall be advanced to the farther edge of the fire and up into the flaming cloud to fully extinguish the fire.

3-15.6 PROCEDURE FOR COMBAITING ELECTRICAL FIRES

The following general procedures shall be used for combatting electrical fires:

a. Promptly de-energize the power circuit or equipment affected. Shift the operation to a stand-by circuit or equipment, if possible.

b. Sound an alarm in accordance with the station regulations or the ship's fire bill. When ashore, notify the fire department; if afloat, notify the officer of the deck. Give the fire location and state what is burning. If possible, report the extent of the fire, that is, what are its effects upon the surrounding area

c. Secure ventilation by closing compartment air vents or windows.

d. Attack the fire with equipment available in the immediate vicinity, such as portable 15-pound carbon dioxide (C02) extinguishers, proceed as follows:

(1) Carry the extinguisher in an upright position and approach the fire as close as the heat permits.

(2) Remove the locking pin from the valve.

(3) Grasp the horn handle. (It is insulated to protect against frostbite.)

(4) Squeeze the release lever; this will open the valve and will release the carbon dioxide.

(5) Direct the discharge at the base of the fire. (The maximum effective range for 15-pound extinguishers is 5 feet from the outer end of the horn.) If practical, attack the fire from the windward side, so that the wind will blow the heat away from you and at the same time will carry the carbon dioxide over the fire.

(6) In fighting a fire in electrical equipments or on bulkheads, direct the discharge of the carbon dioxide at the bottom of the flaming area Move the horn slowly from side to side and follow the flames upward as they recede.

(7) As soon as conditions permit, release the lever to close the valve and continue to open end close it as necessary. (It can be opened and closed repeatedly without 10ss from leakage.)

(8) When continuous operation is desired or when the valve is to remain open for recharge, depress the operating haudle and slip the D-yoke ring over the handle. (The D-yoke permits continuous operation by keeping the handle down, constantly.) Replace the D-yoke ring to its original position to resume intermittent operation.

e. Avoid prolonged exposure to high concentrations of carbon dioxide in confined spaces, since there is danger of suffocation, unless special breathing apparatus is available.

f. Administer artificial respiration or oxygen to any personnel overcome by carbon dioxide fumes and keep the victim warm.

When extinguishing an electrical fire, remember that quick action is required to re-energize the affected circuit. When this has been

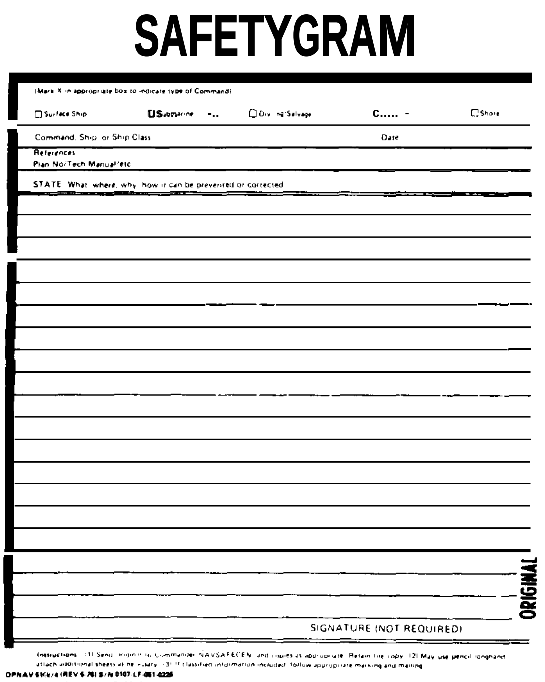
done-STOP! LOOK! THINK! The use of a C02 fire extinguisher directed at the base of the flame is always best for all electrical fires.

3-16 REPORTING UNSAFE CONDITIONS

To provide Navy. personnel with an informal means of reporting haaardous conditions or practices, the Surface Ship Safetygram and Submarine Safetygram forms are available. When a person observes a hazardous material condition or practice or has an accident prevention suggestion, that person may describe it on a Safetygram form and submit it to the Naval Safety Center with copies as appropriate.

The Safetygram (OPNAV Form 5102/4) illustrated in Figure 3-6 can be prepared locally or ordered from the supply system.

The Safetygram shall not be used as a substitute for either the Accidental Death/Injury Report (OPNAV 5102/1) or Material (Property) Damage Report (OPNAV 5102/2). The purpose of the Safetygram is to provide an informal method of reporting hazard-related suggestions or comments to the Naval Safety Center.



SAFETYGRAM

(Mark X in appropriate box to indicate type of Command)

☐ Surface Ship ☐ Submarine ☐ Diving/Salvage ☐ Shore

Command, Ship or Ship Class Date

References

Plan No/Tech Manual/etc

STATE What, where, why, how it can be prevented or corrected

SIGNATURE (NOT REQUIRED)

ORIGINAL

Instructions: (1) Send original to Commander NAVSAFECEN and copies as appropriate. Retain file copy. (2) May use pencil longhand; attach additional sheets as necessary. (3) If classified information included, follow appropriate marking and mailing.

OPNAV 5102/4 (REV 6-78) S/N 0107-LF-051-0226

OPNAV 5102/4 (Replaces NAVSAFECEN 5101/1, 5101/2 and 5101/3 which may also be utilized to deplete existing stocks.)

Figure 3-6. Safetygram

The PMS Feedback Report, OPNAV Form 479017A, is another very effective tool for reporting accident-related information to the Navy Material Command via the type commander. Instructions for preparing this form are contained on the backside of the green "Originator" copy. When submitting this form to report safety-related information, make sure that the "Safety Precautions" block is checked.

Commander
U.S. Naval Safety Center
Naval Air Station
Norfolk. VA 23511

3-17 REPORTING ACCIDENTS, NEAR ACCIDENTS, AND DEATH

Reporta of accidents and incidents provide the Chief of Naval Operations with detailed information necessary to conduct a comprehensive safety program. Complete reporting is essential. Facts discovered but not reported have no effect in accident prevention. The collective use of reports provide information which can be used for modifications and changes in design **criteria,** personnel planning, operations planning, and other staff actions which may, otherwise, be obscure to an individual investigating a single accident. Reporta and recommendations must be prepared with the thought that personnel at numerous Navy levels will review them, evaluate their contents, aud take appropriate action.

Instructions for the submission of mishap reporta (OPNAV 5102/1, OPNAV 5102/2) are contained in the Accident Investigation and Reporting Manual (OPNAVINST 5102.1).

3-17.1 PERSONNEL ACCIDENTAL INJURY/DEATH REPORT (5102/ 1)

Any accidental injury, death or occupational illness which results in one or more of the events below shall be investigated and reported using OPNAV FORM 5102/1:

a Death.

b. One or more lost workdays.

c. All cases of man overboard.

d. Electric shocks which **require** medical examination.

e. Chemical or toxic exposure or oxygen deficiency cases requiring medical examination.

f. All injuries which result from an explosive mishap.

3-17.2 MATERIAL (PROPERTY) DAMAGE REPORT (5102/2)

AU cases of accidental material (property) damage involving a repaidreplacement cost of $250 or more will be investigated and reported using OPNAV FORM 5102/2. In addition the following types of accidents will be reported regardless of the cost involved:

a Fire. All cases except small trash or similar fires in which no persomel injuries are sustained and material (property) damage is limited to the container in which the fire started.

b. Flooding.

c. Collision.

d. Grounding.

e. Explosions.

3-18 REPORTING HAZARDOUS DEFECTIVE MATERIAL

The reporting of defective material obtained through the supply system is of prime importance, especially when the use of this material could endanger personnel. NAVSUPINST 4440.120 outlines procedures and assigns responsibilities for the reporting of defective materials, and it applies to all ships and stations. Commanding officers, ships safety officers, and department heads should make all personnel aware of these responsibilities and reporting criteria as outlined in NAVSUPINST 4440.120. Remember, proper reporting of defective material may save a life.

3-19 SAFETY EQUIPMENT

Articles of clothing, equipment, floor and deck coverings, and other devices and materials which are designed exclusively for the protection of persomel working with or near electrical and electronic equipment are discussed in this subsection.

3-19.1 ELECTRIC GRADE DECK COVERING

To eliminate likely causes of accidents and to afford maximum protection to persomel from the hazards associated with electic shock, only the approved floor matting for electric and electronic spaces shall be used. In mauy instances, after accidents had occurred, investigations showed the operating locations and areas around electric and electronic equipment were covered with only general-purpose floor matting. This type of matting should not be used because its electrical characteristics do not provide adequate insulating properties to protect personnel from the possibility of electric shock; also, the material used in the manufacture of this matting is not fire-retardant.

For the protection of personnel, when work is being performed on electric and electronic equipment, steps should be taken to ensure that only the approved rubber floor matting (currently specified in Military Specification MIL-M-15562) is used. The approved matting is made of fire-retardant material, some with a diamond-shaped surface. Use of this matting will serve as a safety measure around electric and electronic equipments where electrical potentials up to but not exceeding 3000 volts may be encountered.

NOTE

Refer to Section 3 of the Naval Ships Technical Manual, Chapter 634, for information pertaining to deck preparation, installation instructions, and cleaning of this robber matting.

The careful design and fabrication of the floor matting material minimizes the possibility of accidents. However, to ensure that the safety factors which were incorporated in the manufacture of the material are effective, and that the matting is completely safe for use, operation and maintenance personnel must make certain that all foreign substances that could possibly contaminate or impair the dielectric properties of the matting material are promptly removed from its surface areas. For this reason, scheduled periodic visual inspection and cleaning practice procedures should be established. During visual inspections, personnel should make certain that the dielectric properties of the matting have not been impaired or destroyed by oil impregnation, piercing by metal chips, cracking, or other causes. If it is apparent that a section or the entire length of matting is defective for any reason, it should be removed, and replaced immediately by new matting material.

3-19.2 SLIP-RESISTANT DECK COVERING

For the safety of personnel working aloft or at any other topside location exposed to the weather, deck areas such as platforms, elevated walkways, and ladders should be treated with a slip-resistant material. There are a number of materials approved for shipboard use as specified in Chapter 634, Deck Coverings, of the Naval Ships Technical Manual. Perhaps the most practical slip-resistant deck covering for use on elevated platforms of radar antennas and other similar outside working spaces is the silicon carbide-coated fabric which conforms to Military Specification MIL-D-17951. This deck covering is black in color, can be cut to size and shape, has a pressure-sensitive adhesive backing, and can be installed satisfactorily over bare steel, wood, well-dried paint or primer, linoleum, deck tile, and all other deck coverings that are well adhered to the deck. This matting may be requisitioned using the following National Stock Numbers.

a. 9Q7220-OO-205-0389: Treads, 6 inches by 24 inches, 0.08 inches thick

b. 9Q7220-00-205-0390: Roll, 96 feet long, 24 inches wide, 0.08 inches thick

3-19.2.1 Deck Preparation

Prior to the application of pressure sensitive deck covering, all rust, grease, oil, and dirt must be removed from the deck surface. Deck tile and linoleum must be cleaned free of residual wax by using a good cleaning agent or solvent. If a solvent is used for cleaning, it must be allowed to evaporate before applying the deck covering.

3-19.2.2 Installation

The pressure-sensitive adhesive backing of this deck covering is protected by a plastic liner. To facilitate removal of the liner, rub the edge of the liner in the direction of removal using the rough surface of another piece of deck covering. This will lift the edge and the liner can then be removed easily. Apply the deck covering to the deck and roll with a weighter roller. All edges should be sealed with beading sealer (sealing compound, NSN 9Q8030-OO-264-3886) to waterproof. When installing sheet material, leave a l/16-inch space between sheets and bulkheads or coamings, because of expansion. Traffic can be permitted over the area after the sealer has dried hard.

Three treads with no space between should be installed at head and foot of ladders and on each side of doors used for continuous traffic (install over deck tile or linoleum, if present). This will protect the deck tile or linoleum from excessive wear on either side of doors. Slip-resistant cloth should not be painted or waxed as this will drastically reduce its slip-resistant properties.

3-19.3 SAFETY SHORTING PROBE

It is of the utmost importance that technical and maintenance personnel engaged in repairs of circuits which employ large capacitors, pulse forming networks, and the like, use only an authorized safety shorting probe to discharge the circuits. Figure 3-7 shows an authorized probe, NSN 9N-5920-01-029-4176.

Certain electronic equipments are provided with built-in special-purpose safety shorting probes. These probes are not considered "general-purpose", and are to be used only with the equipment with which they are provided and only in a manner as directed by the technical manuals for the equipment. THEY SHALL NOT BE REMOVED AND USED ELSEWHERE.

When using the general-purpose safety shorting probe, always be sure first to connect the grounding clip to a good ground connection (if necessary, scrape the paint of the grounding metal to make a good contact). Then, while holding the safety shorting probe by the handle behind the protective shield, touch the end of metal rod to the point to be shorted-out. Touch each point to be shorted-out several times to make sure that the circuit is completely discharged.

Always be extremely careful and make absolutely sure that you do not touch any of the metal parts of the safety shorting probe while touching the probe to the exposed "hot" terminal. It pays to be safe; use the safety shorting probe with care.

3-19.4 SAFETY HARNESSES AND FALL-PREVENTION DEVICES

In the realm of safety, when importance of function is taken into consideration, belts and harnesses might be place in the same category with parachutes, because they do not compromise; they either save the falling person, usually from death, or they do not.

The only authorized safety harness for naval service application is the parachute-type safety harness (NSN 9G-4240-00-022-2522).

The parachute-type safety harness is compatible with both the kapok life jacket and the submarine safety track follower assembly. It is also useful in all submarine deck applications and contains enough D-rings to attach a bridge tending line for additional recovery protection while gaining access to the safety track.

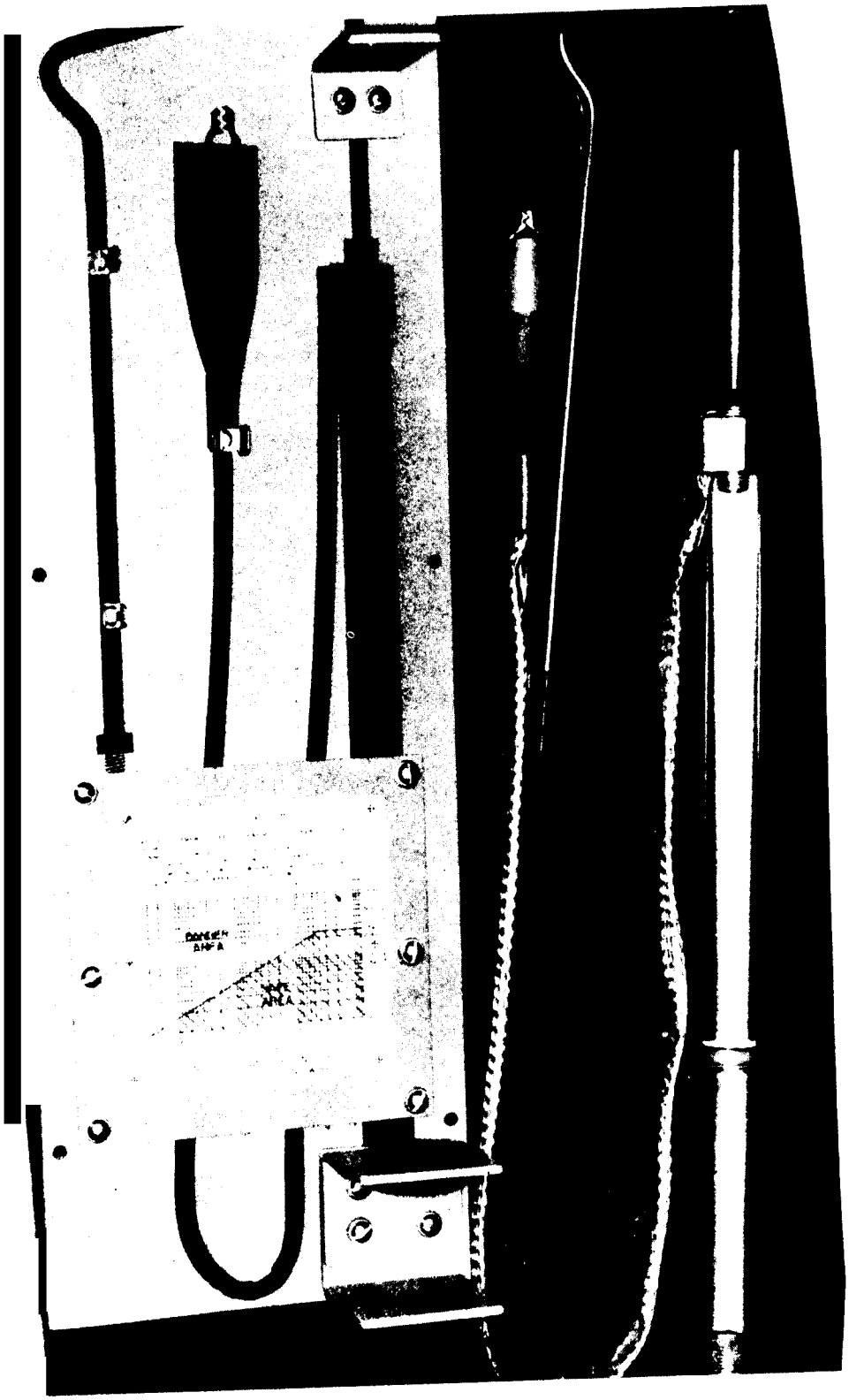


Figure 3-7. Safety Shorting Probe

"When working at elevated locations or over the side, the parachute-type safety harness shall be used with the Safety Lanyard (NSN 9G 4240-00-022-2521)."

"General Specifications for Ships of the U.S. Navy, Section 622, requires that a climber safety device be installed in accordance with NAVSEA Drawing No. 804-4563125 on permanently installed topside ladders on masts, kingposts, and other similar topside structure providing access to a hazardous location and where a person is expected to wear a safety harness." One of these devices consists of a sleeve which slides on a rail attached to the ladder. The sleeve moves freely up and down with normal ascent or descent, but locks within six inches when the wearer slips or falls from the ladder. These rails should not be painted or lubricated, but, should corrosion build up, be wire-brushed. (Where rigid-rail type installation is not practical (i.e. for ladders less than 12" wide or peg-rung ladders on polemaats) a Retractable-Wire type installation is to be used.)

3-19.5 RUBBER GLOVES

Electrician's lineman rubber gloves, Federal Specification ZZG-402B, are available in sizes 10 and 11, and may be requisitioned using NSN 9D8415-00-266-8691 and 8692. These rubber gloves are rated at 5,000 volts, Detailed information for the recommended safe practices in the care and inspection of rubber insulating gloves is contained in the Naval Ships Technical Manual, Chapter 300.

3-19.6 SAFETY GOGGLES

Refer to the Safety Equipment ManuaI, NAVMAT P-1047O, for approved types of safety goggles and other eye and face protection devices.

3-19.7 RESPIRATORY EQUIPMENT

Refer to the Safety Equipment Manual, NAVMAT P-1047O for approved respiratory equipment.

3-19.8 EQUIPMENT BUILT-IN SAFETY DEVICES

Because of the hazards which confront electronic technicians in the performance of their duties, each person concerned should make it their responsibility to read, and thoroughly understand, the safety practices and procedures contained in applicable technical publications, before attempting to repair or adjust electronic equipment. Technicians should never endanger their life or the lives of their associates by disregarding or taking too lightly the built-in devices that are provided for their safety. (See also, Subsection 3-4.18, Interlocks.) The primary built-in safety devices of electronic equipment are discussed in the following paragraphs.

3-19.8.1 Guards and Barriers

All contacts, terminals, and like devices having potentials in excess of 70 volts RMS or DC, with respect to ground, have barriers or guards to prevent personnel from accidental contact with such voltage. The bamiers or guards shall be marked so as to indicate the approximate highest voltage which may be encountered upon removal.

3-19.8.2 Warning Markings

AU contacts, terminals, and like devices having potentials in excess of 500 volts RMS or DC are clearly marked "DANGER HIGH VOLTAGE (maximum voltage applicable) VOLTS," in addition to having guards and barriers as specified in the preceding paragraph. These high voltage markings are posted conspicuously as close to the point of danger as possible.

3-19.8.3 High Voltage Monitoring

Equipments employing potentials in excess of 300 volts peak, which require measurement, have either a monitoring test point or a safety-type panel meter connected via a voltage divider network. The voltage divider networks are calibrated so that high voltages can be measured at relatively low potentials, but in no case above 300 volts peak.

3-19.8.4 Interlocks

Major units which have doors, covers or plates and where access into these units is required for maintenance during normal operation are provided with interlocks which remove all potentials in excess of 70 volts RMS or DC. Bypass devices are sometimes used with interlocks, providing that the potentials are not in excess of 500 volts RMS or DC.

3-19.8.5 Battle Short Switches

When battle short switches are provided, they are normally located on the main operating console or assembly, and they function to by-pass all safety interlocks. Their usage shall be restricted to emergency operating conditions only.

3-20 WARNING SIGNS AND POSTERS

Warning signs and suitable guards shall be provided for preventing persomel from accidentally coming in contact with dangerous voltages, for warning personnel of possible presence of explosive vapors and RF radiation, for warning personnel working aloft of poisonous effects of stack gases, and for warning of other dangers which may cause injuries to personnel. Equipment installations should not be considered complete until appropriate warning signs have been conspicuously posted.

3-20.1 HIGH VOLTAGE AND SHOCK HAZARD WARNING SIGNS

High voltage and shock hazard warning signs shall be installed on or in the vicinity of equipments or accessories having exposed conductors at potentials of 30 volts (RMS or DC) or above. Exposed conductors include those in which personnel may receive a shock by physical contact or by voltage are over. The signs shall be posted so that they are obvious and can be clearly read upon entrance.

Compartments or walk-in enclosures containing equipment with exposed conductors presenting shock hazards in excess of 500 volts RMS or DC shall have a "Danger High Voltage" sign posted conspicuously within each entrance.

Compartments or walk-in enclosures containing equipment with exposed conductors presenting shock hazards between 30 volts RMS or DC and 500 volts RMS or DC shall have either a "Danger High Voltage" sign or a "Danger Shock Hazard" sign posted conspicuously within each entrance.

The above requirements are minimum requirements, and are in agreement with those specified in the General Specifications for Ships of the United States Navy, NAVSEA S9AA0-AA-SPN-010/GEN-SPEC Although the requirements direct the posting of these signs within the entrances of compartments and walk-in enclosures, additional signs may also be posted at or near the exposed conductors within the space.

"Danger High Voltage" signs may be manufactured in accordance with NAVSEA Drawing Number 807-2680621. This sign, shown in Figure 3-8 is 7 inches by 10 inches in size and made of 18-gauge sheet steel. "Danger High Voltage" laminated placards may be requisitioned using the following cognizant-I stock numbers. (Refer to Section 4 of this handbook for requisitioning instructions.)

Size (inches)	Stock Number (Cog 1)
2%x4	0177-LF-225-2800
5%X7	O177-LF-225-21OO
4 x8	0177-LF-225-6700

"Danger Shock Hazard" signs may be manufactured in accordance with NAVSEA Drawing Number 807-2699757. This sign is made of 18-gauge sheet steel and is available in two sizes: 7 inches by 10 inches and 3% inches by 5 inches.

3-20.2 STACK GAS WARNING SIGN

A warning sign to alert personnel working aloft in way of smoke pipe (stack) gases (NAVSEA Drawing Number 807-2680542) is shown in Figure 3-9. One sign should be mounted near the bottom of each access ladder leading aloft and another sign should be located at the top of each ladder, but mounted on the outside of the antenna pedestal. This sign (8-¼ inches by 10 inches) may be requisitioned using stock number 0177-LF-226 2900. (Refer to Section 4 of this handbook for requisitioning instructions.)

3-20.3 RADIO FREQUENCY RADIATION HAZARD WARNING SIGNS

There are six radio frequency radiation hazard warning signs as shown in Figure 3-11. All six signs are included in NAVSEA Drawing Number 807-2681228 (Revision J, Sheets 1 and 2). Requisitioning NAVSEA number (cog I) and instructions as to where these signs are to be posted are included in the illustration of each sign.

3-20.4 EXPLOSIVE VAPORS WARNING SIGN

This sign (NAVSHIPS Drawing, 807-2680602) is a warning against the energizing of electronic equipment installed in spaces where explosive vapors may accumulate until the space is adequately ventilated. (See Figure 3-10.) Although this Warning plate is to be specifically installed in small craft, it may also be displayed in other spaces where explosive vapors may accumulate.

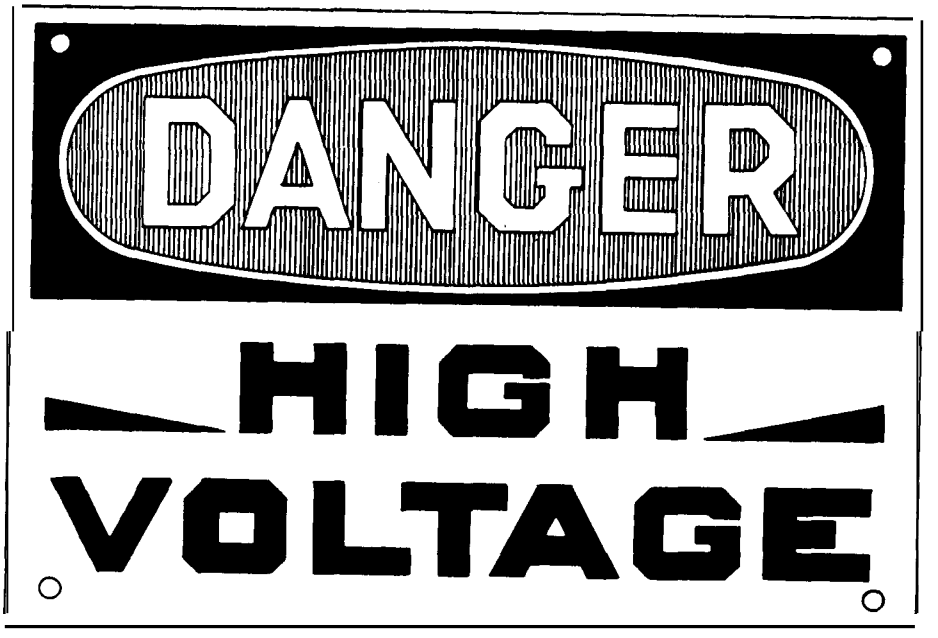


Figure 3-8. High Voltage Warning Sign

Figure 3-9. Stack Gas Warning Sign

Figure 3-10. Explosive Vapors Warning Sign

3-20.5 ADDITIONAL SIGNS AND POSTERS

The following is a list of laminated placards and posters which may be requisitioned using the corresponding stock numbers. (Refer to Section 4 of this handbook for requisitioning procedures.)

Title of Placard or Poster	Stock Number
Electrical Safety Precautions	O177-LF-225-11OO
General Electrical Safety Precautions	0177 -LF-211-8500
Electrical Safety (Radio Room)	O177-LF-214-31OO
Safety Precautions when men are Going Aloft (Radio Room)	0177-LF-214-3300
Safety precautions for men working aloft	0177-LF-224-4500
Battery Storage Safety Precautions	0177-LF-225-1300
Danger No Smoking– Battery on charge	0177-LF-225-6800
Mouth to mouth Resuscitation	0177 -LF-226-3400
Electric Shock and its Prevention	0283-LP-236-OOO0
Low Voltage can Kill you	0283-LP-236-2000
Never use an Extension Light Without a Guard	0283-LP-236-3000
Don't Monkey with Electrical Equipment	0283-LP-236-4000
Be Careful when Removing Broken Bulbs	0283-LP-236-5000
Repair Equipment that gives a Shock	0283-LP-236-6000
Beware of Switchboards	0283-LP-236-7000
Pliers are not for Fuse Pullers	0283-LP-236-8000
Don't try to Fix it Yourself—Take it to the Electrical Shop	0283-LP-236-9000
Study Electrical Shock Prevention	0283-LP-237-OOO0
Don't be a Shock Absorber	O283-LP-237-1OOO
Rubber Gloves are Stocked to Prevent Electric Shock	0283-LP-237-2000

3-21 CARDIO-PULMONARY RESUSCITATION AND ARTIFICIAL RESPIRATION

At least quarterly, the electronics officer shall require that all personnel, who engage in the operation and maintenance of electronic equipment, demonstrate their practical knowledge in the application of cardio-pulmonary resuscitation and artificial respiration procedures. The Electronics Officer shall arrange for additional training if it is deemed necessary, so that all personnel will maintain proficiency in resuscitation techniques. For further detailed guidance see NAVSHIP TECH Manual Chapter 300.

3-22 COLD WEATHER SAFETY PRECAUTIONS

Careful instruction and indoc&ination of aU personnel are necessary to ensure that safety precautions, peculiar to cold weather and arctic operations afloat and ashore, are observed. Subjects for consideration are listed below:

a. Wear loose clothing: Tight clothing and foot gear restrict blood circulation and invite frostbite or trench foot.

b. Wear dry clothing: Outer layers of clothing should be water repellent and impervious to rain, snow, and sleet.

c. Wear several layers of thin clothing. Individual layers of clothing can be removed as body heat rises.

d. Wear eye protection. Sun glasses or goggles with tinted lenses should be worn to protect the eyes from snow blindness and prevent eye strain.

e. Avoid overheating. Excessive sweating darnpens clothing, resulting in poor insulation. Perspiration cools the body even more, as it evaporates. It is better to feel slightly chilly than to perspire excessively.

f. Avoid overexposure. Use wind shields or screens whenever working on exposed equipments.

g. Avoid overexertion. Frequent rest, hot drinks, and food are necessary for efficiency of personnel working on exposed equipment.

h. Work in pairs. Check each other for frostbite, since a person can become frostbitten without realizing it. Frostbite skin becomes whitish or grayish, and the parts feel numb rather than painful.

i. Do not touch metal objects. Never touch metal objects with bare hands. Although the skin may seem dry, it will freeze to very cold metal.

j. Do not touch fuels or volatile liquids. Be very careful when working with fuels and volatile liquids. Gasoline, for example, will freeze flesh in a matter of seconds.

LOCATION 024 RAOAR ANTENNA PEDESTALS

REQUISITION NAVSHIPS 0967 305 1010

SIZE 6'7" X 6'7"

LOCATION IN A SUITABLE LOCATION IN VIEW OF OECK FORCE PERSONNEL

REQUISITION NAVSHIPS 096131$2010

SIZE 6'7" X 6'7"

LOCAIION AI FUEL HANDLING AREAS WNJCH ARE SUBJECTEO TO RF RADIATION

REQUISITION NAVSHIPS 0967-315 JO IO.

SIZE 6'7" X 6'1"

LOCATION IN II ADIO 1RAN9411 FER ROOMS IN SUITABLE LOCATION FOR FULL VIEW BY OPERATION PERSONNEL

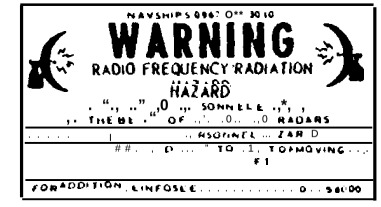
REQUISITION NAVSHIPS 0967 090 1010

SIZE 6'7" X 6'7"

LOCATION AT EYE LEVEL AI IHE FOOT OF ALL LADDERS OR OTHER ACCESSES TO ALL TOWERS, MASTS AND SUPER STRUCTURES WHICH ARE SUBJECTED TO HAZARDOUS LEVELS OF RADIATION

REQUISITION NAVSHIPS 0967 153 8010

SIZE 6'7" X 6'7"



LOCATION ON, OR ADJACENT TO, RAOAR SET CONTROL

REQUISITION NAVSHIPS 0967 096 3010

SIZE 3"X 6"

NOTE REFER TO RF RADIATION HAZARDS MANUAL, NAVSHIPS 0900-005-8000 FOR INSTRUCTIONS 10 IN TERPERT OR INSERT DATA ON THIS SIGN.

Figure 3-11. Radio Frequency Radiation Hazard Warning Signs

SECTION 4

PUBLICATIONS AND THEIR HANDLING

4-1 INTRODUCTION

This section provides Fleet personnel and other users of NAVSEA technical manuals (including those manuals identified by NAVORD and NAVSHIPS publications numbers) with information required to properly maintain publications and publication libraries. Additional information and procedures are outlined in NAVSEA S0005-AA-GYD-030/TMMP, Guide For User Maintenance of NAVSEA Technical, promulgated as part of the NAVSEA Technical Manual Management Program (TMMP).

The purpose of this section and the users guide is to assist technical manual users with specific information related to:

(a) The determining of which technical manuals are required.

(b) Requesting of technical manuals.

(c) Reporting of technical manual deficiencies.

(d) The maintaining of technical manuals.

4-2 NAVSEA TECHNICAL MANUAL MANAGEMENT PROGRAM

4-2.1 PROGRAM MANAGEMENT AND PURPOSE

The Naval Sea Systems Command (NAVSEA) Technical Manual Management Program (TMMP) was developed to ensure the availability of adequate and satisfactory technical information of fleet personnel and other technical manual users when they need it. The NAVSEA TMMP is managed by the Technical Publications and Engineering Drawings Branch (SEA 5524),

4-2.2 REQUISITIONING MANAGEMENT AND CONTROL

The Naval Sea Systems Command (NAVSEA) has designated the Naval Sea Data Support Activity (NSDSA), Port Hueneme, CA, Code 5711 as the single point of contact for all NAVSEA technical manual support functions.

All technical manual requisitioning offices requesting NAVSEA assistance with problems such as issue restrictions, quantity exceptions, publication identification assistance, MILSTRIP assistance, back orders, follow-up resistance, etc., should contact NSDSA Code 5711.

The address of the NSDSA office provialing this support function is: Commanding Officer, Naval Ship Weapon Systems Engineering Station, Code 5711, Naval Sea Data Support Activity, Port Hueneme, CA 93043. Phone: Autovon 360-5172/4425 or Commercial (805) 982-5172/4425.

4-2.3 INITIAL PROCUREMENT AND DISTRIBUTION

All technical and maintenance manuals procured in bulk quantities by the NAVY are stocked as Cognizance "I" material at NPFC, Philadelphia. Initial distribution of equipment manuals is specified by the equipment procurement contract. Currently, two copies are shipped with each new equipment. Additional distribution includes installation, maintenance, and operational and logistic support activities. Whenever manuals are not received with new equipment, a report of incomplete shipment shall be made promptly to the shipping activity. A copy of this report shall be sent to the Naval Sea Systems Command, and action will be taken to obtain the missing publications.

One copy of each publication applicable to shipboard equipments is required to be maintained onboard. Only one publication is required for any number of identical equipments. Publications applicable to shipboard equipments are listed in the Publications Allowance List (PAL). All manuals retained onboard shall be kept up-to-date. The basic publications allowance for each ship provides: a) two copies of the maintenance manual for each equipment (no more than five identical manuals are outfitted regardless of the quantity of identical equipments onboard), b) two copies of each systems manual, and c) one copy of each general-type publication. Surplus copies shall be shipped to the Naval Publications and Forms Center (NPFC). 5801 Tabor Avenue, Philadelphia, PA 19120 and marked "Returned for Stock."

4-2.4 DISPOSITION OF SURPLUS MANUALS

Excessive copies of manuals or manuals with multiple changes shall be disposed of locally rather than returned to NPFC, Philadelphia, if their value is less than the administrative costs involved in returning them to

the supply system. If classified, disposal shall be in accordance with the Department of the Navy Security Manual for Classified Information, OPNAVINST 5510.1. In instances where some doubt may exist as to whether material should be turned-in or disposed of locally, a listing of the material and quantities involved shall be submitted to NPFC, Philadelphia, for review. Procedures for turning-in material are contained in the Introduction to Navy Stock List of Publications and Forms (hard copy), NAVSUP Publication 2002, stock number 0535-LP-004-0001.

Preliminary manuals are to be destroyed upon receipt of final manuals, as indicated in the promulgating letter in the final books. If the manuals to be destroyed are classified, disposal must be in accordance with OPNAVINST 5510.1 (series).

The instructions which accompany changes to manuals indicate the desired disposition of material removed from the manuals.

4 3 DEFINITIONS.

The following definitions are applicable to this document and the users guide NAVSEA SOO05-AA-GYD-030/TMMP.

4-3.1 HARDCOPY.

Hardcopy is a descriptive term used in reference to technical manuals printed on paper and bound in book form.

4-3.2 MICROFICHE.

Microfiche is a descriptive term referring to a sheet of film containing multiple microimages of technical manual pages in a grid pattern. It contains a heading or title which can be read without ramification.

4-3.3 MICROFILM.

A fine-grain, high resolution film containing one or more images greatly reduced in size from the original. As used in this document, microfilm describes a strip of processed microfilm wound on a reel (roll microfilm) or enclosed in a container (cartridge microfilm).

4-3.4 TECHNICAL MANUAL USERS.

The term technical manual user is any person, military or civilian, who is required to use NAVSEA technical publications. It includes personnel assigned to shore activities, ships, boats and craft, personnel within the Naval Sea Systems Command, personnel within other commands of the U.S. Navy, and personnel within other DoD or Government agencies.

4-3.5 TECHNICAL MANUAL.

A publication containing a description of equipment, weapons, or weapon systems, with instructions for effective use, including one or more of the following sections, as required: instructions covering initial preparation for use; operational instructions; maintenance instructions; overhaul instructions; modification instructions; inspection procedures; parts lists, or parts breakdown; and related technical information or procedures, exclusive of those of an administrative nature.

4-3.6 TECHNICAL MANUAL MAINTENANCE.

Technical manual maintenance is all technical and administrative actions taken to maintain technical manuals at an up-to-date level of technical accuracy and adequacy and to provide these technical manuals in the quantity, quality, and usable form required by users.

4-3.7 TECHNICAL MANUAL CHANGES AND REVISIONS.

A technical manual change or revision is a modification made to a technical manual or volume of a technical manual to ensure that it is technically accurate and adequate for its intended use. Authorized changes and revisions t. NAVSEA technical manuals are limited to advance change notices (ACNS), permanent changes and revisions.

4-3.7.1 Advance Change Notice (ACN).

An ACN is an advance change to a technical manual which is issued when a deficiency or problem with the manual requires immediate correction, and time does not permit issuance of a permanent change or revision.

4-3.7.2 Permanent Change.

A permanent change to a hardcopy technical manual is issued as a package containing one or more complete page replacements or additions and instructions for integrating the change into the affected technical manual. A permanent change to a microfiche technical manual is issued as a complete replacement of the microfiche technical manual or volume thereof.

4-3.7.3 Revision.

A revision is issued as a complete technical manual or volume thereof and supersedes all previous issues and changes to that manual or volume. A revision may be either of two types:

a. Complete Revision. A complete revision is a rewrite or reorganization of the technical manual to meet the content, style, and format requirements of current military specifications (e.g., MIL-M-15071H, MIL-M-241OOB with

amendment 1, etc.). It incorporates all previous changes and new data. In a complete revision, all pages, paragraphs, illustrations and tables are renumbered, as necessary, eliminating all number suffixes and establishing correct sequence.

b. Update Revision. An update revision incorporates all previous changes and new data into applicable portions of the basic manual without rewriting or reorganizing the technical content of the material. It is prepared in the style, format, level of specificity and comprehension of the basic manual. In an update revision, suffixed paragraph, illustration and table numbers are retained whenever possible.

4-4 PUBLICATIONS APPLICABILITY LIST

The Publication Applicability List (PAL) is a document that 1ists technical manuals required for operating and maintaining NAVSEA and NAVELEX systems and equipment on a specific ship. PAL combines and replaces the various documentation listings such as Technical Documentation Indexes (TDIs), Publication Requirement Lists (PRLs), and Indexes of Technical Manuals (ITMs).

PAL indicates to a ship the total NAVSEA and NAVELEX technical publications required to be on board and also the system/equipmentlsubject application of listed publications.

4-4.1 CONTENT

General publications; electronics equipment and electronic test equipment publications; hull, mechanical and electrical (HM&E) equipment technical manuals; and ordnance systems and equipment publications are listed and cross-referenced in the PAL. The information is in separate volumes according to subject matter. This permits the separation of the volumes by those who maintain technical manuals in the areas of electronics, HM&E and ordnance.

4-4.2 FORMAT OF LISTINGS

The publications are listed in two major sequences: (1) by equipment (except for general publications), and (2) by publication number.

4-4,2.1 Equipment Sequence.

Electronics equipment and electronic test equipment are listed alphanumerically by Government Type Designation. All other system/equipment listings are alphabetical by equipment noun name.

4-4.2.2 Publication Number Sequence.

The publication number sequences in the PAL include numbers assigned under several different systems according to the issuing authority and the age of the publication.

a. The most common publication numbers in PAL listings are publications issued by NAVSEA (including any of its predecessors) and NAVELEX. These numbers will appear in one of the following forms:

Issuing Authority	Publication Number Forms
NAVSEA (Naval Ordnance Systems Command)	OD15315 OP2082
NAVSEA (Bureau of ships)	35104 351-0048 0358-042-6000
NAVSEA (Naval Ship Systems Command)	0361-182-0103 0947-LP-018-7002
NAVELEX (Naval Electronic Systems Command)	0285-048-1001 0967-LP-038-0060
NAVSEA (Naval Sea Systems Command)	0338-LP-051-4013 SE211-AB-MMI-O1O (See paragraph 4-4.2.3)

b. In addition to publications issued by NAVSEA and NAVELEX, the PAL may list publications and their corresponding identification numbers issued by other Navy Commands or Department of Defense agencies. For example:

Issuing Command or Agency	Publication Number Form
Naval Air Systems Command (NAVAIR)	00-25-600
Depmtment of the Army (DA)	FM 23-08 (Field Manual) TM9-1095-2O (Technical Manual)
Department of the Air Force (AF)	T.O. 14 DI-2-1 (Technical Order) AFM 281-2 (Air Force Manual)

4-4.2.3 REPLACEMENT OF PUBLICATIONS NUMBER BY TMINS NUMBER

NAVSEA Standard Technical Manual Identification Numbering System (TMINS) publication numbers of the form "SE211-AB-MMI-O1O" are currently being assigned by NAVSEA to all new and revised technical manuals. These TMINS numbers will ultimately replace all previous NAVSEA, NAVSEA-predecessor, and NAVELEX publication numbers and forms.

4-4.3 FORMAT OF VOLUMES

a. Volume 1 - General publications (not identified to specific hardware). Publications listed in this volume are not repeated in any other volume.

(1) Part 1 - General electronics, safety, transportation, Naval Ship's Technical Manual (NSTM), and miscellaneous publications.

(a) Publication number sequence

(b) Additions/deletions since previous PAL

(2) Part 2 - General ordnance publications.

(a) Publication number sequence

(b) Additions/deletions since previous PAL

b. Volume 2- Electronics equipment publications.

(1) Part 1- Equipment sequence

(2) Part 2- Publication number sequence

(3) Part 3 - Additions/deletions since previous PAL.

c. Volume 3 - HM&E equipment publications.

(1) Part 1- Equipment sequence

(2) Part 2- Publication number sequence

(3) Part 3 - Additions/deletions since previous PAL

d. Volume 4 - Ordnance equipment publications.

(1) Part 1- Equipment sequence

(2) Part 2- Publication number sequence

(3) Part 3 - Additions/deletions since previous PAL

NOTE

If you cannot locate the publication in Parts 1 or 2 of the appropriate volumes, check Part 3 of the specific volume to determine if it has been deleted from the PAL.

4-4.4 PAL MAINTENANCE

Some errors in the publications listed may be caused by differences between the actual systemlequipment configurations aboard ship or craft and the configurations reported to NAVSEA. Electronics and ordnance systems and equipment listed in the PAL are those reported for the ship or craft during construction or by the Ship Equipment Configuration Accounting System (SECAS). HM&E equipment listings are based on configuration data maintained by the Naval Ship Weapon Systems Engineering Station (NSWSES), Code 5700. All changes or corrections to system/equipment configurations should be reported in accordance with OPNAVINST 479o.4 CH 1 of April 1974 (Ships 3-M Manual, Volume II). In addition, all changes or corrections to HM&E configurations, as well as any identified publication listing errors, should be reported to the Naval Sea Data Support Activity (NSWSES Code 5700). Corrections may be submitted by marking up copies of PAL pages on which there are errors with the corrected information. If the PAL is on microfiche, reproduce copies of the affected pages on microfiche readerlprinter and mark-up those copies. Send the marked-up copies, via the appropriate Type Commander (TYCOM) to:

Commanding Officer
Naval Ship Weapon System Engineering Station
Naval Sea Data Support Activity (NSDSA)
Port Hueneme, CA 93043
Attention: NSWSES Code 5700

The data files will be corrected and the next issue of PAL will reflect the reported changes. PALs for active ships will be updated and distributed semiannually. For additional information on PALs, call AUTOVON 360-5047 or commercial (805) 982-5047.

4-4.5 PAL REQUISITIONS

PALs are produced in hardcopy and 48:1 microfiche. If a hardcopy of PAL or additional microfiche copies are needed send a request directly to the address listed in paragraph 4-4.4. Send a copy of the request to the TYCOM. If you need individual publications listed in the PAL, refer paragraph 4-5 of this document.

4-5 REQUISITIONING OF NAVSEA TECHNICAL MANUALS

4-5.1 GENERAL

Technical manuals are normally requisitioned for one of the following reasons:

(a) They are authorized but not on hand

(b) They are required to support a newly assigned mission.

(c) They are needed to replace damaged manuals (including normal wear and tear).

NAVSEA technical manuals are available in one or more of the following forms:

(a) Hardcopy
(b) Microfiche
(c) Microfilm rolls
(d) Microfilm Cartridges

4-5.2 HARDCOPY NAVSEA TECHNICAL MANUALS.

NAVSEA technical manuals are generally available in hardcopy form. Most hardcopy NAVSEA technical manuals are stocked by the Naval Supply System at the Navy Publications and Forms Center (NPFC), Philadelphia, PA, and can be obtained through the use of the MILSTRIP requisition DD Form 1348. Refer to NAVSUP Publication 2002 for the listing of technical manuals stocked at NPFC. The information in the following paragraphs will assist you in obtaining these manuals.

4-5.2.1 **NORMAL REQUISITIONS.**

The MILSTRIP requisition, DD Form 1348, is the means by which COG I (NPFC-stocked) technical manuals are obtained. Detailed instructions for the use of MILSTRIP are provialed in NAVSUP Publication 437. Simplified instructions for the use of MILSTRIP by shipboard personnel may be found in enclosure (1) to NAVSUPINST 4235.3A, Fleet Use of MILSTRIP. Send requisitions to:

Naval Publications and Forms Center (NPFC)
5801 Tabor Avenue
Philadelphia, PA 19120

4-5.2.2 **Urgent Requisitions**

If the need for a hardcopy technical manual is urgent, contact the Customer Service Branch of NPFC, telephone AUTOVON 442-3321 or Commercial (213) 692-3321, to submit the request. Requests must be submitted in MILSTRIP format, so have a properly completed DD Form 1348 that can be read to the NPFC customer service representative. The duty hours at NPFC are 0800 to 1630 hours EST, Monday through Friday; offduty requests are serviced by an automated answering service, seven days a week.

4-5.2.3 **Requisition Restrictions.**

Certain NAVSEA technical manuals within the COG I category (for example, technical manuals dealing with nuclear propulsion) have requisition restrictions (column RR in the NAVSUP 2002 listings) placed on their issue. The Introduction to NAVSUP 2002 (SIN 0535-LP-044-0001) provides information as to how the DD Form 1348 should be coded and to whom such requisitions should be submitted.

4-5.2.4 **Requisition Reply–Backordered or Out of Stock.**

After requisitioning a NAVSEA technical manual, a reply maybe received from the supply point, particularly NPFC, that the manual is backordered or out of stock. Due to a lack of funds, NAVSEA is unable to replenish the stocks of many manuals and, in all probability, an out-of-stock manual will remain out of stock. If the lack of the technical manual will adversely affect the operation or mission capabilities of the ship, system or equipment, use the proper channels to advise the Type Commander of the problem.

4-5.2.5 **Special Requisitions.**

Some NAVSEA technical manuals are not stocked by NPFC. If the technical manual is not listed in NAVSUP 2002, help can be obtained in identifying the stock point, and in obtaining the manual, by contacting the Naval Sea Data Support Activity (NSDSA), Naval Ship Weapon Systems Engineering Station, Port Hueneme, CA.

4-5.2.5.1 Non-COG I Technical Manuals.

Some NAVSEA technical manuals (non-COG I) are not stocked by NPFC. If the needed technical manual is not listed in NAVSUP Publication 2002, submit a request for the technical manual to the NSDSA. Send a message or letter justifying the need and provide as much information as possible to help identify the manual (e.g., subject of equipment application, equipment manufacturer's name or FSCM code, type of technical manual, publication identification number or numbers, etc.). Provide a point of contact in your activity, including the telephone number, to be contacted should NSDSA need additional information.

The NSDSA address for a message is:

NAVSHIPWPNSYSENGSTA
Port Hueneme, CA
(Add to the message:
NAVSHIPWPNSYSENGSTA-
PASS TO CODE 5700)

The NSDA address for a letter is:

Commanding Officer
Naval Ship Weapon Systems
Engineering Station
Naval Sea Data Support
Activity (NSDSA)
Port Hueneme, CA 93043
Attention: NSWSES Code 5700

45.2.5.2 **Naval Ship's Technical Manual (NSTM) Requisitions.**

Chapters of the NSTM are published in both hardcopy and microfiche form. Hardcopies of chapters are available in stock at NPFC; microfiche chapters are available at NSDSA.

If additional hardcopies are required of one or more required chapter, together with a covering letter which justifies the need for the chapter or chapters, to the NSDSA. The justification must include the following:

a. Designate current number of NSTM chapter(s) now being received.

b. Indicate whether documentation requested is needed to fill current allowance or to increase allowance.

c. Provide statement that all NSTM documentation held is being maintained current.

d. Provide statement that all working-level personnel in the activity have access to the NSTM.

e. Furnish justificatiordreason for the requested increase in NSTM chapter(s).

NSDSA will validate the need and forward the requisition to NPFC if the need is justified. Requisitions submitted directly to NPFC without NSDSA endorsement shall be returned to the originator with appropriate direction for resubmittal.

Activities desiring modification of their status on the NSTM distribution lists shall submit their requirements to the NSDSA together with appropriate justification. Activities are encouraged to request a change of their distnbution from hardcopy to microfiche when that form is compatible with their needs.

4-5.2.5.3 **Obtaining Preliminary Technical Manuals.**

Some technical manuals are distributed to the Fleet in preliminary form for interim use while the final manual is being prepared and printed. Small quantities of these preliminary manuals are also provided to NPFC for issue under controlled circumstances. If you need a copy of a preliminary technical manual, your request for the manual will have to be approved by the cognizant NAVSEA activity before NPFC will issue the manual to you. Send your request, along with a statement justifying your need, directly to the cognizant activity. If your request is approved, the cognizant activity will direct NPFC to issure the manual. If you cannot identify the cognizant activity, contact the NSDSA for assistance.

4-5.2.6 Low Stock Levels **and Replacement Pages**

Prior to requisitioning a new NAVSEA technical manual, determine if it is really needed. Stock levels of NAVSEA manuals are being drawn down faster than they can be replaced (because of a lack of funds). Some manuals are already out of stock and the stock level for many other manuals soon will be exhausted. If a manual is really needed, then order it; but do not order a new manual to replace a worn, dirty or dog-eared but otherwise usable and readable one. If most of the manual is usable except for a few pages that are unreadable (or missing), do not requisition a new manual to replace it. Contact the Naval Sea Data Support Activity (NSDSA) to see if it is feasible for them to

forward copies of replacement pages. Identify the manual by title and identification number and indicate the page or pages that are missing by volume, chapter and page number. Be sure to include your address and, if possible, a telephone number to be contacted should the NSDSA need additional information. Whenever possible, the NSDSA will make copies of the missing pages and mail them as quickly as possible.

4-5.3 MICROFICHE FORM NAVSEA TECHNICAL MANUALS.

Under the OPNAV and CNM Technical Manual Shipboard Microfiche Program, selected technical manuals have been and are being converted to microfiche form. In the future, many more technical manuals will be available on microfiche. Ships and shore activities equipped with microfiche viewers and viewerlprinters are encouraged to obtain required manuals in microfiche form, subject to availability, whenever that form is compatible with user requirements. Microfiche copies of NAVSEA technical manuals are stocked by the NSDSA.

4-5.3.1 NPFC-LISTED (COG 1) MANUALS.

Since not all NAVSEA technical manuals have been or will be converted to microfiche form, check the listings in NAVSUP 2002 before trying to requisition a manual in this form. If the manual is a COG I manual available on microfiche, the stock number listing in NAVSUP 2002 will display an "XD" in the Requisition Restriction (RR) column. Send your DD Form 1348 directly to the NSDSA.

4-5.3.2 NON-COG I MANUALS.

Some non-COG I technical manuals, principally in the ordnance field, are available on microfiche from the NSDSA. To learn if the needed manual is available on microfiche, call the NSDSA, AUTOVON 360-5094 or commercial (805) 982-5094, or write to the address referenced in paragraph 4-5.2.5.1

4-5.4 MICROFILM FORM NAVSEA TECHNICAL MANUALS.

Some NAVSEA technical manuals have been produced in microfilm roll and microfilm cartridge forms. Distribution of these forms of technical manual have not been widespread and these microfilm manuals are not stocked by the SUpply system. However, such manuals are available from the cognizant technical activity or inservice engineering activity for the applicable equipment. If a microfilm roll or cartridge manual is needed, the request should be sent directly to the cognizant activity. If the cognizant activity cannot be identified, call or write the NSDSA for assistance. Include as much information (publication identification number, system or equipment, manual title, etc.) as possible to help the NSDSA identify the manual and the cognizant activity.

4-5.5 AUTOMATIC DISTRIBUTION LIMITATIONS.

Publications requisitioned from NPFC or obtained from NSDSA do not place the requestor on automatic distribution. Therefore, subsequent changes and revisions to such publications will not be automatically distributed to the requester. To be placed on automatic distribution for any NAVSEA technical manual, other than NSTM chapters, a letter must be submitted to the NSDSA that identifies the manual (by identification number, title, systemlequipment applicability, etc.) and justifies the need for automatic distribution. Include a point of contact and telephone number in case additional information is needed by the NSDSA.

4-6 REPORTING TECHNICAL MANUAL DEFICIENCIES

When reporting technical manual deficiencies, first identify the deficiency as to its characteristics and determine the priority (importance) for correcting the deficiency. The priority determines the method of reporting the deficiency and the type of response it will receive at the NSDSA.

4-6.1 DEFICIENCY IDENTIFICATION

Technical manual deficiencies adversely affect one or more of the following characteristics: accuracy, adequacy, and usability. The following paragraphs list some of the deficiencies that may be found in technical manuals:

4-6.1.1 ACCURACY DEFICIENCIES.

Deficiencies in technical manual accuracy usually fall into one of the following categories.

a. Measurement or value errors
b. Procedural errors
c. Theory or descriptive errors
d. Errors in listings
e. Incorrect component or component identification

4-6.1.2 Adequacy Deficiencies.

The adequacy of a technical manual can be affected by many things, particularly omissions. Typical adequacy deficiencies are:

a. Specific configuration not covered

b. Missing or incomplete information

c. Lack of detail

d. Ambiguous data

4-6.1.3 **Usability Deficiencies.**

Usability deficiencies, although not normally as critical as accuracy or adequacy deficiencies, reduce the value of the technical manual and should be corrected. Typical usability de ficiencies are:

a. Poorly reproduced text or illustrations

b. Incorrect references

c. Confusing presentation of material

4-6.2 PRIORITY ASSIGNMENT

Carefully consider the seriousness of the deficiency to be reported and determine its appropriate priority from one of the following:

4-6.2.1 **Emergency.**

Requires immediate correction. Involves conditions which, if not corrected, may result in injury to personnel, extensive damage or destruction of equipment or property, or inability to achieve or maintain operational status.

4-6.2.2 **Urgent.**

Requires prompt correction. Involves conditions which, if not corrected, could result in damage to equipment or property, reduction in operational efficiency, or jeopardy to success of the mission.

4-6.2.3 **Routine.**

Requires correction. Involves conditions which, if not corrected, may result in: hazardous conditions through prolonged use, negative effects on operation or maintenance efficiency, reduced operational life or serviceability of equipment.

4-6.3 METHOD OF REPORTING DEFICIENCIES

If more than one deficiency is being reported for a single technical manual, the highest priority for an individual deficiency establishes the overaU priority of the subsequent report. After the overall priority has been determined, select the appropriate reporting method from one of the following:

a. Emergency deficiencies must be reported by naval message, or if no electrical means of transmission is available, by speedletter (paragraph). Assign a PRIORITY precedence to the message.

b. Urgent deficiencies must be reported by naval message or speedletter. Assign a ROUTINE precedence to the message (paragraph).

c. Routine deficiencies should be reported by mail using a Technical Manual Deficiency/Evaluation Report (TMDER) form (paragraph).

4-6.4 NAVSEA TECHNiCAL MANUAL DEFICIENCY/EVALUATION REPORT (TMDER) FORM.

The method of reporting routine deficiencies in NAVSEA technical manuals uses the preaddressed NAVSEA TMDER (form NAVSEA 5600/2 - see figure 4-l).

Current hardcopy NAVSEA technical manuals normally contain three TMDER forms, located at the end of the manual and immediately before the rear cover. Microfiche copies of NAVSEA technical manuals have one TMDER positioned on the frame immediately preceding the index on the last sheet of fiche in the set. When using Microfiche, a copy of the TMDER may be printed and using a separate envelope address it to the NSDSA.

NAVSEA technical manuals in microfiche cartridges do not include a TMDER form. Additional TMDER forms (Stock number O116-LF-O56-OO1O) are available in your supply office or can be ordered from the Naval Publications and Forms Center (NPFC), 5801 Tabor Avenue, Philadelphia, PA 19120 in accordance with the instructions in NAVSUP Publications 2002 and 437.

Some previous issues of NAVSEA technical manuals (particularly those bearing a NAVSHIPS publication identification number) had a User Activity TM Comment Sheet (form NAVSHIPS 5600/2) bound into the rear of the manual. This form has been superseded by the TMDER form and should no longer be used.

4-6.4.1 **Completing the TMDER**

The following guidance will help in filling out the TMDER form. An example of a completed TMDER form is shown in figure 4-2.

a. If the TMDER being used is from the technical manual, blocks 1 through 4 will have been completed. If not, furnish the appropriate information.

b. If the deficiency is being reported on a microfiche or cartridge manual, fill in the appropriate information for blocks 5 through 8.

c. Enter the system or equipment noun name in block 9 and the nameplate nomenclature (MK/MOD/AN) in block 10. Do not enter the name and nomenclature data printed on the technical manual.

d. Enter the word "Routine" in block 11.

e. Check the applicable box in block 12. Enter any supporting information for your evaluation under "RELATED REMARKS".

f. Check the applicable box in block 13. Use the available space in block 13 to explain any problem, ask a question, or make a suggestion or comments.

NOTE

If more space is needed, use the space in block 14 (if specific changes are not being recommended), or continue on a blank sheet of paper. If a blank sheet is used, indicate the block number, i.e., "Block 13, continued".

g. Use block 14 to identify specific deficiencies or make specific change recommendations. Indicate, in the appropriate columns, the page number (or frame number on microfiche and microfilm), paragraph number, line number, figure number or table number where the deficiency appears and explain the problem or recommended change in the large column to the right. Use additional blank sheets as necessary but identify the continuing portion by the same block and column information.

h. Enter the appropriate information in blocks 15, 16, 17 and 19. Enter the work center supervisor's name and rate in block 18 and obtain his signature.

i. Do not enter anything in the parts of block 20.

j. Enter the date in the appropriate apace to the right of block 16.

k. Fold the TMDER form along the dotted lines on the reverse side of the form, seal the form and mail it. If the TMDER was reproduced from microfiche, put the completed form in an envelope, seal it, and mail to :

Commanding Officer
Naval Ship Weapon Systems
Engineering Station
Naval Sea Data Support Activity
(NSDSA)
Port Hueneme, CA 93043

Attention: NSWSES Code 5700

4-6.5 NAVAL MESSAGES AND SPEEDLEITERS

The primary methods for the reporting of Emergency or Urgent priority technical manual deficiencies are the Naval Message (Joint Message form, DD Form 173) and the Naval Speedletter (OPNAV Form 5216/145). Although there is no set format for reporting technical manual deficiencies by these methods, the following guidance may be used:

a. The addressee will always be the NSDSA.

b. The subject will be: Technical Manual Deficiency Report.

c. The balance of the information in the message or speedletter should be equivalent to that reflected in the TMDER form (paragraph 4-6.4). As a minimum, the message should:

(1) Clearly identify the deficiency technical manual by title, volume number and NAVSEA identification number;

(2) State the priority assigned to the report;

(3) Identify the specific deficiency, referencing the page, paragraph, figure or table number; or

(4) Explain the problem.

d. Include a point of contact and telephone number for use should NSDSA require additional information.

4-6.6 NAVSEA RESPONSES

NSDSA, upon receipt, will analyze the deficiency and forward the report to the responsible technical activity.

a. If an Emergency priority deficiency report is submitted the originator will be notified of the action being taken within three working days after receipt by the responsible technical activity.

b. If an Urgent priority deficiency report is submitted the originator will be notified

NAVSEA (USER I TECHNICAL MANUAL Deficiency/EVALUATION REPORT (TMDER)

(Check Appropriate Block)
☐ UNCLASSIFIED ☐ CLASSIFIED c 1 (Specify) _____
(If CLASSIFIED, this report must he marked and mailed in accordance with OPNAVINST 5510.1 E.)

INSTRUCTIONS: 1. Use this report to indicate deficiencies, userremarks and recommendation relating tO the publication.
2. • T. be filled in by Contractor before printing.
3. Fold on dotted line, staple and mail to: Commanding Officer, Naval Ship Weapon Systems Engineering Station, NSOSA (Code S700). Dept. of the Navy, port Hueneme, CA. 93043.

• 1. NAVSEA NO.	*2. VOL/PART #	• 3. TITLE (Nomenclature)

*3. TITLE (Nomenclature) (Cont'd)	4. REv. DATE (TM, CHG)	MICROFILM/	IICROFICHE	
		5. CART/FICHE # 6. CART/FICHE OATE	7. FRAME NO.	8. OTHER 1.0. NO.

S. SYSTEM/EQUIPMENT	10. IDENTIFICATION (M K/MOD/AN)	11. PRIORITY

12. USER EVALUATION (Manual Is?) (Check One)

☐ EXCELLENT ☐ Gooo ☐ FAIR ☐ POOR ☐ COMPLETE ☐ NCOfAPLETE

RELATEO REMARKS:

13. OTHER USER INFO (Chock One • nd Briefly Discuss)
☐ pR08LEfA ☐ QUESTION ☐ Suggestion ☐ COMMENT

14. REcoMMENDED CHANGE(S) 10 PUBLICATION

PAGE NO.	PARA-GRAPH	LINE NO.	'IGURE NO.	TABLE No.	RECOMMENCED CHANGES AND REASONS

16. ORIGINATOR	6. RAN KIRATE OR GRADE ANO TITLE	DATE

17. WORK CENTER	18. SuPERVISOR

10. SHIP MULL NO. ANOIOR STATION AOORESS

20. NSDSA USE ONLY

a. CONTROL NO.	b. COG ISEA	OATE c. fREC.	d. FWD	e. DUE	f.	g.	h.	i.	j. PRIORITY k. NSDSA l. FIN AL

NAVSEA 5S00/7! (Rev.6-78) (BACKI
SIN 0116.LF.0%001 1

Figure 4-1. NAVSEA Technical Manual Deficiency/Evaluation Report (Form NAVSEA 5600/2).

NAVSEA (USERI TECHNICAL MANUAL DE FICIENCY/EVALUAT ION REPORT (TMDER)

heck Appropr s... Blocks)
☐ UNCLASSIFIED ☐ CLASSIFIED (Specify) (If CLASSIFIED, this repo rt ...1 be marked and mailed ,. accordance.1 u. O? II AVINSTR5510.1F.1

INSTRUCTIONS 1 Use this report to indicate deficiencies, ... remarks ● "Q recommendations relating to the publication
2 To be filled in b, Contractor M• ore printing
3 Fold on dotted l• "., staple and mail ,0 Cm-". manding Officer Naval Ship Weapon Systems Engineering Station, NSDSA (Code 5700). Dept of the Navy ● 0** -.... mo, CA 93043

"1 NAVSEA No	● 2. VOL/PART m.	" 3 TITLE (Nomenclature)
0941-LP- 03-3010	1	propulsion Unit - Steam Turbine

● J. TITLE (Nomenclature) (COP!•d)	4 REV. DATE (N. CXG)	MICROFILM/MICROFICHE	
	30 Sep 71	5. CART/FICHE # s CART/FICHE OATE 7F RAM E NO	8 OTHER I D NO

9 SYSTEM/EQUIPME NT	10 IDE NT IF, CA TION(MK/MOD/AN)	11 PRIORITY
Steam Turbine	LA	Routine

12 uSE R E VA LUATI ON (Manual is?) (Check One)

☐ EXCELLENT ☐ -O ☒ FAIR ☐ POOR ☐ COM,,E,E ☐ INCOMWE

☐ e LATED REMARKS
Very short index osakes it hard to find necessary information. Also, photograph.+ are very hard to understand.

13 OTHER USER INFO (Check One ● .O Br· **iv Discuss)
☐ PROBLEM D O . ESTION ☐ Suggestion ☐ COMMENT

14 ☐ CC OMMCNOCO CHANGEIS! TO IBLICATION

PAGE No	PARA GRAP!	LINE NO	IGURE No	ABLE NO
3-5	3-10	15		

RECOMMENDE O CHANGES AND 17 EASONS
Change torque requirements on safety valve installation from "1OO ft-lbe" to "72 ft-lbs" to agree vith figure 3-16 and MRC.

15 ORI GIN ATOR: J. LinRo
5 RAN K/R ATE OR GRADE ANO TITLE: BT 1 DATE:
17 WORK CENTER: EBO-1
I S SUPE RVISOR: D. Hammond BTC
19 SHIP MULL NO AND/OR STATION ADDRESS: LPD-7

20 NSDSA uSE ONLY

• CONTROL NO	b COG /S EA	OATE c REC	d Fwo	" OLJE	f	g	h.	,	,	PRIORITY NSDSA	FINAL
	HI			1							

NAV SEA 5s00/2 (REV. 6-78) (BACK)

Figure 4-2. Sample Deficiency Report (TMDER)

of the action being taken within ten working days after receipt by the responsible technical activity.

NOTE

Based on the judgment of the technical activity, action needed to correct the deficiency normally will be sent in the form of an Advance Change Notice (ACN) by the fastest means appropriate.

c. If a Routine priority deficiency report, the originator will receive acknowledgement of receipt and be advised of the intended action to be taken within ten working days after receipt by the responsible technical activity. The originator will be notified of the corrective action taken by the responsible technical activity within ninety days after receipt by that activity. For most routine deficiency reports of a non-technical nature, correction of the deficiency will be incorporated into the next change or revision to the technical manual.

4-6.7 OTHER REPORTING METHODS

NAVSEA technical activities monitor the various maintenance data reports for technical-manual-related problems and forward identified technical manual deficiencies to the NSDSA. The NSDSA, in concert with the appropriate technical activity, analyzes the affected technical manual, and, if required, a change or revision is prepared and distributed. However, this method requires more time to correct deficiencies than the method utilizing the preferred NAVSEA TMDER.

4-7 NAVSEA TECHNICAL MANUAL MAINTENANCE

Modification to technical manuals are required to maintain their accuracy, adequacy and usability in a current status.

Technical manual modifications may be required as a result of any of the following: hardware or ship alterations and improvements (e.g., engineering changes, field changes, ordnance alterations, ship alterations, etc.); changes in policy and requirements (e.g., safety, medical hazard, environmental protection, etc.); and deficiencies (Section 4) reported by the Fleet and other users.

NOTE

Modifications to technical manuals are described in relation to complete manuals. However, individual volumes of multi-volume technical manuals (and chapters of the Naval Ship's Technical Manual or NSTM) are often modified independent of the overall manual. The process of modification remains the same,

As previously discussed in paragraph 4-3.7 NAVSEA technical manuals are maintained current by the issuance of one of the following:

a. Advance Change Notices (ACNS),
b. Permanent changes, and
c. Revisions.

4-7.1 ADVANCE CHANGE NOTICES

An ACN is originated by the cognizant NAVSEA technical activity to modify the contents of a technical manual or Naval Ship's Technical Manual chapter in response to an urgent need for corrected or expanded information.

ACNS are prepared in either naval message or letter form. The form selected depends upon the urgency, the amount of information required, and the number of technical manual holders who require the information. ACNS are prepared for pen-and-ink or cut-and-tape insertion into the technical manual. The information to be inserted is maintained at a level of specificity and comprehension equivalent to the existing material. The ACN directs the user to a specific chapter, section, part, page, paragraph, sentence, figure and/or table, as applicable, and provides the exact information to be added, substituted or deleted.

The issuance of ACNS is strictly controlled. ACNS are assigned an identification or control number that provides dual information: specifically, the serial number of the ACN as it applies to a specific technical manual or NSTM chapter, followed by the number of the permanent change to the technical manual or NSTM chapter into which the ACN is to be incorporated. The serial number and change number are separated by a slant line. Numbering of ACNS after issuance of a permanent change begins over again with serial number 1 followed by the next permanent change number to be assigned. The NSDSA utilizes this

number to track the conversion of ACNS to permanent changes. ACN data will be incorporated into and superseded by a permanent change or revision within sixty days for NSTM chapters or within six months for other manuals.

ACNS may be distributed in any of the three mediums: Naval Message, Speedletter, or regular letter. The distribution of ACNS is limited to holders of the technical manual that have immediate need for the information. However, ACN data for Type II and Type IV field changes may be promulgated via Electronic Information Bulletins (EIBs).

47.2 PERMANENT CHANGES

Permanent changes are originated or procured by the cognizant NAVSEA technical activity having the technical manual maintenance responsibility. For permanent changes to correct technical manual deficiencies or to incorporate ACNS, the NSDSA may also originate or procure the change after coordination with the cognizant technical activity.

Permanent changes to NAVSEA technical manuals are prepared as change page packages, consisting of: a change (instruction) sheet, replacement (changed) pages for those in the existing manual, and, if necessary, additional pages to be included in the manual. The changed pages replace the correspondingly numbered pages in the manual and may involve changed material, additional material, or the deletion of existing material. Material that cannot be included in its entirety on a replacement page is prepared as an additional page for insertion between or after the affected pages. The material comprising a permanent change is prepared in the same format, and on the same level of specificity and comprehension as the material in the existing manual.

Each permanent change includes (as replacement pages) a new title page and List of Effective Pages. The new title page indicates the change level and change date of the material in the package. The new List of Effective Pages reflects the change status of all pages in the manual, including any pages added or deleted by incorporation of the change page package.

Changes to the text and tables (including new material or added pages) are indicated by a vertical line or symbol in the margin extending close to the entire area of the material affected (outer margin for double-columned material, margin opposite binding edge for single-columned material). When a change symbol is used, such as a number sign "#", plus "+", etc., its meaning is explained in the introductory portion of the change sheet. Changed lines or symbols are not used when material is relocated, paragraphs are renumbered, a complete part, chapter or section is replaced or added, or an editorial error having no technical significance is corrected.

A miniature pointing hand may be used to highlight the area containing the change on a photograph or line drawing. Changes to diagrams and schematics may be highlighted by a screen or shaded border around the affected area.

Added paragraphs, illustrations (including index numbers), tables and pages are numbered by adding either a decimal (e.g., 2-4.1) or alphabetical (e.g., 2-4A) sequence to the preceding paragraph/illustration/table/page, except when material is added at the end of a sequence (section or chapter), in which case the next consecutive number is used.

Where a change deletes a paragraph, illustration or table without substituting another, the space formerly occupied by the paragraph, illustration or table is noted with a statement, such as "Paragraph 4-2 deleted." The Table of Contents, List of Illustrations, List of Tables and Alphabetic Index are changed accordingly. When a complete page is deleted, a statement indicating the deletion is placed in the bottom margin of the preceding page or in the top margin of the succeeding page. For example, "AU data on page 2-4, including figure 2-1, deleted. " When the deleted page is the reverse side of another page (which will remain), the deletion statement is pIaced on the blank page.

Each page containing changed, added or deleted materiaI bears the words "change..." placed at the bottom of the page. Each permanent change to a technical manual is numbered in sequence. The assignment of all permanent changes is controlled by the NSDSA. Numbering of permanent changes after issuance of each technical manual revision begins again with number 1.

Permanent changes are issued only to the holders of the technical manual on record. For those technical manuals issued in microfiche or microfilm cartridge form, the permanent changes are incorporated into the manual, the changed manuals refihned and then issued as a complete microfiche set or microfilm cartridge.

4-7.3 REVISIONS

Revisions are prepared or procured by the cognizant NAVSEA technical activity or the NSDSA (in coordination with the cognizant technical activity).

A revision is a second or subsequent edition of an existing technical manual. A revision is developed whenever a hardware modification (e.g., ECP, SHIPALT, or ORDALT) or technical manual deficiency is of sufficient magnitude to require changing the majority of the pages in the existing manual. A revision also may be developed when an existing manual already has several permanent changes issued against it and the issuance of an additional change would substantially reduce the usability of the manual.

Revisions, applicable to NAVSEA technical manuals, are of two types: complete revisions and update revisions (see paragraph 4-3.7.3).

Change symbols are used only in update revisions to identify new or altered material that differs in the revision from that contained in the latest previous edition.

When a NAVSEA technical manual is revised, all change numbers (if any) are removed from the pages and the last change number and change date are removed from the title page and replaced by the revision date. In a complete revision, all pages, paragraphs, illustrations and tables are numbered to eliminate all number suffixes and to establish correct sequence. In an update revision, suffixed paragraph, illustration and table numbers are often retained when the usability of the manual will not be substantially improved by renumbering.

Complete and update revisions are issued to all holders of the technical manual on record.

4-8 USER TECHNICAL MANUAL MAINTENANCE

The initial action to be taken when any technical manual modification material (ACN, permanent change or revision) is received is to determine the applicability of the material to a specific ship, system or equipment. For ACNS, check that the technical manual title and number shown in the "A" line (message format) or paragraph 1 (letter form) matches the manual. ACNS for the NSTM will indicate an NSTM chapter number in those locations. For permanent changes, compare the publication number on the new title page to the manual and check the general instructions (if any) on the change (instruction) sheet to determine any hardware configuration differences covered by the change. Also, inspect the change package for a new Foreword or Reference Data Table (Chapter 1) that may limit the applicability of the change to specific ship, system or equipment applications. For revisions, check the Foreword or introductory chapter for hardware applicability and compare the configuration (or configurations) covered to your hardware. Do not incorporate an ACN or permanent change or destroy an existing manual until it is positive the new material is applicable to your requirements.

4-8.1 ADVANCE CHANGE NOTICE (ACN)

Upon receipt of an ACN, incorporate the data into the technical manuals as specified in the ACN. Some data in an ACN maybe formatted for insertion as pen-and-ink corrections, some data may be formatted for cut-and-tape insertion, and other data may be formatted for direct page insertion. After entering the ACN into the manual, record the entry on the Record of Changes page located in the front of the manual. Holders of the technical manual in a microfiche envelope or local index and file the ACN where it will be readily available.

An ACN is effective upon receipt; however, issuance of an ACN does not authorize modification of existing project orders, work requests or allotments.

Authorization and necessary funding to accomplish efforts required by the ACN from the cognizant authority.

An ACN will be incorporated into the next permanent change or publication revision, as appropriate, within six months (sixty days for NSTM chapters) after issuance of the ACN. The ACN is automatically cancelled after issuance of the permanent change or revision incorporating its contents.

4-8.2 PERMANENT CHANGE

4-8.2.1 CHANGES TO HARDCOPY TECHNICAL MANUALS.

Each permanent change to a hardcopy technical manual includes a new title page, list of effective pages, replacements pages, and a change sheet. Inspect the set of pages for completeness against the list of effective pages. Follow the instructions on the change sheet for actual removal of superseded pages and insertion of replacement pages. In addition to other instructions, the change sheet instruction page will identify the reason for the change and those ACNS included in the permanent change. Be sure the change is applicable to the ship, system or equipment before entering it in the manual. After incorporating the permanent change pages, record the

entry on the Record of Change page and draw a line through any superseded ACNS. Destroy the removed pages in accordance with local disposal instructions.

4-8.2.2 **Changes to Microfiche Technical Manuals.**

Microfiche technical manual holders will be supplied with a complete microfiche or microfiche set, aa appropriate, that incorporates the changed pages. Microfiche technical manuals that are intended for shipboard use and that incorporate permanent changes are tailored to specific hull configurations. Thus, not all changes to a technical manual will be reflected in all replacement microfiche sets. The header at the top of the microfiche will indicate the inclusion of the change. Verify the hardware configuration covered by the replacement microfiche (or set) against your hardware. If it is different, contact the NSDSA (see paragraph). Ensure the configurations match, then destroy any superseded microfiche in accordance with local disposal instructions.

4-8.3 REVISIONS

4-8.3.1 REVISIONS TO HARDCOPY TECHNICAL MANUALS

Upon receipt of a revised technical manual, verify its applicability to the specific ship, system or equipment configuration prior to the replacement of the superseded edition. All super. sealed editions and changes should be destroyed in accordance with local disposal instructions.

4-8.3.2 **REVISIONS TO MICROFICHE TECHNICAL MANUALS**

Microfiche technical manual holders wili be supplied with a complete set of microfiche for the revised technical manual. Verify the applicability of the revised manual to the specific ship, system or equipment prior to the replacement of the superseded set of microfiche. All superseded microfiche should be destroyed in accordance with local disposal instructions.

4-8.3.3 **IDENTIFICATION NUMBERS FOR REVISIONS**

All new and revised NAVSEA technical manuals issued after 17 May 1977 will be identified by a publication number assigned in accordance with NAVSEA Standard Technical Manual Identification Numbering System (TMINS - see paragraph 4.4.2.3). A revision to an existing manual will indicate, on the cover and title page, both the TMINS number and former publication number. The former publication number will be indicated in the supersedure notice. Upon receipt of a technical manual bearing one of the new identification numbers, check the cover or title page to see if it supersedes a manual in your inventory.

4-9 TECHNICAL MANUAL IDENTIFICATION NUMBERING SYSTEM (TMINS)

The Standard Technical Manual Identification Numbering System (TMINS) NAVSEA M0000-00-IDX-000/TMINS, establishes a standard method of assigning a unique and significant Technical Manual (TM) identification number to each individual technical document and separately-bound portion of a technical document. The assigned TM identification number may be composed of either one or two distinct parts. Use of the first part is mandatory under all conditions; use of the second part is mandatory only for classified documents and separately bound unclassified portions of classified documents.

The first part of the standardized TM identification number is a publication identifier (pi) patterned to have precisely thirteen characters, the same quantity aa the National Stock Number (NSN) for publications, i.e., OOOO-LP-OOO-OOOO, and is all that is required to provide unique identification to a document. The significant aspects of the assigned number are baaed on the classification of the technical document by its subject or related commodity.

The second part of the TM identification number is a variable-length suffix of up to 17 characters which may be added to publication identifier. This suffix is added to provide security information for classified documents and to provide user-oriented information such aa the applicable equipment designator, nomenclature, hull number, etc., when such information provides better configuration identification. Except for classified documents, use of the suffix is not a mandatory requirement.

The two parts of the TM identification number are always separated by virgule (slash mark).

Standard assignment of the TM identification number permits ADP selection of information and preparation of selected listings (e.g., lists can be created to index all communication receiver manuals, all flight manuals, all NAVELEX Confidential manuals, all manuals pertaining to the SSN 688, etc).

4-9.1 PI COMPOSITION.

The publication identifier (PI) is made up of the Hardware/Subject Identifier, and the TM Identifier.

4-9.1.1 Hardware/Subject **Identifier**

The first seven characters of the PI is called the "Hardware/Subject Identifier", since it is a code assigned to represent a given subject or a specific item of hardware. Once assigned to a specific equipment model, the Hardware/Subject Identifier should never change. Therefore, the TMINS of all TMs relating to the same item of hardware will normally have an identical first seven characters and will index as a group.

These seven characters are composed of three code groups: (1) cognizant Command (COG COMM), (2) standard subject classification code (SSCC), and (3) the subject serial identity number (SUBJECT SERIAL #).

4-9.1.2 **TM Identifier**

The TM Identifier consists of six characters. It indicates by a 3-character abbreviation or acronym, the type of TM to which the TMIN is assigned, and by a unique 3-character serial, the separately bound volumes, parts, and changes pertaining to that TM.

4-9.2 SUFFIX COMPOSITION.

The TMIN suffix is a variable length field that is separated from the PI by a virgule (/). The suffix is used to indicate the security classification of classified TMs and provide user-recognizable information, such as equipment nomenclature, ship class or hull number, for easy association between TM number and subject.

4-9.2,1 **Classified Manuals.**

The Suffix is always used with classified manuals. In such cases, the security classification indicator always forms the first component of the suffix. The security classification indicator is always a letter representing the level of classification and is always enclosed in parentheses. The second component in the suffix for a classified manual is the amplifying information.

4-9.2.2 **Unclassified Manuals.**

For unclassified manuals, the Suffix will contain onIy amplifying information. In such cases, the first alphanumeric character of the amplifying information will be positioned immediately following the virgule and will not be enclosed in parentheses.

4-9.2.3 **Maximum Length,**

In order to conform to a standard ADP data field, the suffix is limited to 17 alphanumeric and symboI characters, including the virgule and spaces. Thus, the amplifying information component for classified manuals will have a suffix limit of 13 characters while the same component for unclassified manuals will have a limit of 16 characters. It is intended that amplifying information will be of minimum length necessary to convey understanding, and will rarely reach its limit.

4-9.3 TM INS ASSEMBLY

The preceding paragraphs have described the components and individual coded groups that are included in the TMINS. Figure 4-3 illustrates the entire TMINS as an assemblage of all component parts.

49.4 HYPHENATION

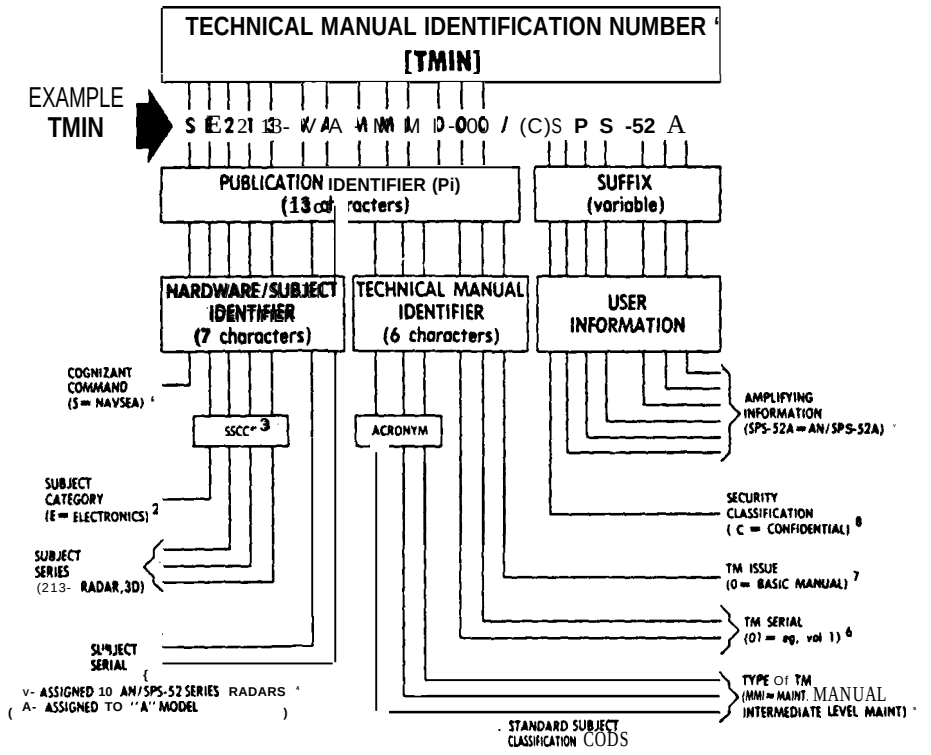
Hyphenation of components or code groups is not necessary for TMINS significance or for automatic data processing manipulation. However, for use as the identifying manual cover or page headings, the TMINS will normally be hyphenated as follows:

NAVMAT: MXXXX-XX-XXX-XXW(X)
NAVAIR: AX-XXXXX-XXX-XXX/(X)
NAVELEX: EXXXX-XX-XXX-XXX/(X)
NAVSEA: SXXXX-XX-XXX-XXW(X)

4-9.5 CODING INFORMATION

Although TMINS appear different from other identification numbers, they incorporate coding features of the Navy Standard Subject Identification Code (SSIC), the Ships Work Breakdown Structure (SWBS), and the Naval Air Systems Command TM identification number. Specifically, the code that relates the TMIN to the subject or type of hardware covered by TM is termed the "Standard Subject Classification Code (SSCC)."

The command designator codes, the SSCC categories and the categories "E" and "T" codes are listed in the following paragraphs. For a complete listing of all codes see NAVSEA MOOOO-OO-IDX-OOO/TMINS.



NOTES (Other Examples):

[1] Command Designators: See paragraph 4-14.5.1

[2] Categories: See paragraph 4-14.5.2

[3] SSCCs: See paragraph 4-14.5.3

[4] Subject Serial:
Non-significant but computer intelligent code used for differentiating between equipment and hardware, and for logical indexing

[5] Types of TMs:
MMA - Maintenance Manual, All Maintenance Levels
MMD - Maintenance Manual, Depot Level Maintenance
SIB - Ships Information Book
TAB - Training Aid Booklet

[6] TM Serfal:
Non-significant but computer intelligent code used for differentiating between separately bound volumes and parts of a technical manual

[7] TM Issue:
Normally a zero (0): letters indicate that the document is a permanent change to the respective technical manual

[8] Security Classificati On:
(C) - Confidential; (S) - Secret: (U) - Unclassified volume of classified TM.

[9] Amplifying Information:
User recognizable information to relate a TMIN to its hardware or subject: /sPs-lo - Radar Set AN/SPS-10; CV66 - Aircraft Carrier USS America; MK12-1 Mark 12 Mod 1; ThMP - Technical Manual Management Program.

Figure 4-3. TMINS Assembly

4-9.5.1 Naval Command Designator Codes

The first digit of the TMINS number is a single alphabetical character that identifies the cognizant Naval Command. The following are currently assigned Command Designator Codes:

CODE	COMMAND
A	Air Systems Command
B	Air Systems Command (NAVAIR manuals not under NATSF cognizance)
c	Reserved for Marine Corps
E	Electronic Systems Command
F	Reserved for Facilities Engineering Command
H	Reserved for Bureau of Medicine
J	Reserved for Training Command
M	Material Command
P	Reserved for Bureau of Personnel
s	Sea Systems Command
T	NAVSEA documents not subject to replenishment by NAVSEA 55Z412
x	Supply Systems Command

4-9.5.2 Subject Category Codes

The second digit of the TMINS number is a single alpha or numeric characters representing the major category to which the subject belongs. The currently assigned subject categories are:

D	Deck/Hanger/Flying Field Equipment.
E	Electronics Equipment/Systems
G	Ground/Ship Support/Service/Handling Equipment
H	Health/Medicine/Dentistry/Sanitation
L	Logistics
M	Meteorological Equipment
N	Instruments
P	Photographic/Audiovisual Equipment
s	Personnel Survival/Safety Equipment
T	Test Equipment/ATE (General Purpose-GPETE)
N	Weapons/Armament/Ordnance
o	General
1	Aircraft/Aviation
2	Telecommunication
3	Missiles (less Ordnance)
4	Vehicles/Construction Equipment
5	Ashore/Ground Station and Shore Facilities
6	General Material
7	Unassigned
8	Training (General)
9	Ships/Craft.

4-9.5.3 Subject Series Codes

The third, fourth and fifth digits of the TMINS number classifies the subject to a distinct series within the assigned major or subject category. Categories "E" and "T" Series are listed in this paragraph. See NAVSEA MOOOO-00-IDX-000/'l'MINS, Table 2-2 for a complete listing of subject series codes.

CATEGORY E - ELECTRONICS
[Less Fire Control (CAT. W) and General Purpose Test Equipment (CAT. T))

SERIES	
E-000	General
E-001	Electronic Circuit Theory/ Analysis/Design
E-002	Installation Practices and Standards
E-003	Electronic Maintenance/Practices
E-004	Circuit Boards/Miniature-microminiature Circuits /Integrated Circuits
E-005	Controls
E-01O	Power Supplies
E-015	Mounts
E-020	Amplifiers
E-025	Filters
E-loo	Communications (except Sonar) – General
E-101	Announcing/Public AddresslEntertainment Systems (orig. E-120)
E-105	Intercommunication Systems
E-106	Telephone, Secure Voice
E-11O	Antennae
E-Ill	Antenna Couplerll'uners
E-120	Auxiliary Systems
E-125	Receivers
E-140	Transmitters
E-150	Transceivers
E-160	Terminal Equipments
E-161	Teletype

CATEGORY E - ELECTRONICS (Cent'd)

SERIES	
E-162	Converters
E-163	Multiplexer
E-164	Processors
E-165	Telephone Systems/EquiPment
E-166	Telemetry
E-167	Switchboards/Panels (See also E-670 Series)
E-168	Alarm, Safety, and Warning Equipment
E-169	Misc/Compositi
E-170	Navigationid Aids
E-171	Loran
E-172	Tacan
E-173	Omega
E-174	SatNav
E-175	Beacons
E-176	Direction Finders
E-177	Altimeters
E-178	Speed/Velocity Indicators
E-179	Misc/CompositS
E-180	Crypto/Security Equipment
E-181	Interior Intrusion Detection Systems
E-185	Tactical Data (See also E-68[5])
E-187	Digital Data
E-190	Communications Test Sets
E-195	Studio Equipment
E-199	Misc/Composite
E-200	Radar — General (except fire control, see also W-200 Series)
E-21O	Detection (Composite)
E-211	Surface Search
E-212	Air search (2D)
E-213	Air Search (3D)
E-214	Airborne
E-215	Bombing
E-216	Aircraft Control Approach/ Instrument Landing System
E-217	Navigation/Beacon
E-218	Space Vehicle, Electronic Tracking
E-219	Multiple Node
E-220	Height Finding
E-230	IFF-Identification and Recognition
E-235	IFF Test Sets
E-240	Data Relay and Distribution
E-245	Switchboards (See also E-678)
E-250	Display/Indicators
E-251	PPI
E-255	Range
E-256	Height
E-257	Data Display Groups
E-258	Target Designation Indicators
E-259	Misc/Compositi
E-260	Moving Target Indicator (MTI)
E-265	Video Clutter Suppressor
E-270	Missile Guidance (See also W-262, W-272)
E-280	Trainers/Simulators
E-285	Video Processors
E-290	Radar Test sets
E-299	Misc/CompositS
E-300	Sonar – General
E-305	Airborne Active; ActivelPassive
E-31O	Submarine Active; ActivelPassive (E-31O and E-311)
E-312	Surface Ship Active; Active/Passive (E-312 thru E-314)
E-315	Mine Detection; Surface
E-316	Mine Detection; Submarine
E-317	Mine Detection: Airborne
E-320	Pagsive-Listening; Surface
E-321	Passive-Listening; Submarine
E-322	Passive-Listening; Airborne
E-325	Sonobuoys
E-326	Buoys; Transponder
E-330	Fire Control
E-335	Bottom Mapping
E-340	Communication (E-340 thru E-345)
E-350	Navigation (E-350 thru E-354)
E-355	Beacon
E-360	Depth Determining/Fathometers/ Sounders (E-360 thru E-362)
E-365	BathythermograPh
E-370	Harbor Defense
E-375	Countermeasures (E-375 thru E-377)
E-380	Trainers (E-380 and E-381)
E-390	Auxiliary and Special
E-391	Indicators and Data Display Equipment
E-392	Recorders, Recorder/Computers, Recorder/Reproducer
E-393	Analyzers
E-395	Transducers
E-396	Hoists (Use G-820 Series)
E-398	Test sets
E-399	Misc/CompositS
E-400	Countermeasures – General
E-41O	Jammers
E-411	Communication
E-412	Radar
E-413	Sonar

CATEGORY E - ELECTRONICS (Cent'd)

SERIES	
E-420	Detection
E-430	**Antennas**
E-440	Panoramic Adaptors
E-450	Pulse Analyzers
E-460	Receivers
E-461	Transmitters
E-462	Transceivers/Transponders
E-465	Test Sets
E-470	Recorders
E-480	Deception Equipment
E-490	Auxiliary/Deception Devices
E-491	Mine Detectors
E-492	Chaff
E-495	Misc
E-500	Television – General
E-51O	Special Purpose
E-520	Receivers
E-530	Cameras
E-540	Video Recorders, Players, Played Recorders
E-550	Transmitters
E-560	Studio Equipment
E-565	Monitors
E-570	Antennae
E-580	Accessories
E-590	Misc/Composite
E-600	Data Processing – General
E-61O	Computers – General Purpose
E-620	Input Peripheral Equipment
E-630	Output Peripheral Equipment
E-640	Input/Output Devices
E-650	Signal Data Converters
E-660	Computer Programming
E-670	Switchboards, General
E-671	Integral Fire Control

SERIES	
E-672	Missile Fire Control
E-673	Gun Fire Control
E-674	Underwater Battery Fire Control
E-675	Digital
E-676	Command/Control
E-677	Interior Communications
E-678	Video (Radar)
E-679	Communications
E-680	Timing
E-681	Ships Service
E-682	Analog
E-683	Combat System
E-685	Tactical Data System Equipment – General
E-686	Data Display
E-687	Data Processing
E-688	Test Sets
E-690	Interface
E-700	Radiac – General
E-71O	**Surveys**
E-720	Dosimeters (including chargers and readers)
E-730	Monitors
E-740	Laboratory Equipment
E-800	Infrared – General
E-81O	Communication
E-820	Search
E-830	Navigation
E-840	Laboratory Equipment
E-900	Industrial – General
E-920	Plant and Machinery Instrumentation
E-930	Warning and Safety Devices
E-940	Product Development Instruments
E-990	Special, Limited Purpose

CATEGORY T - TEST EQUIPMENT/ATE (GENERAL PURPOSE-G PETE)

SERIES	
T-000	General
T-100	Test Equipment – Basic Measurement
T-110	Multimeters
T-115	Electronic
T-120	Voltmeters
T-121	DC
T-122	AC (General)
T-123	AC (RF)
T-125	Special Purpose
T-130	Ohmmeters, Megohmmeters
T-140	Bridges (Multipurpose)
T-141	Resistance
T-142	Impedance
T-143	Capacitance
T-144	Inductance
T-145	Special Purpose
T-150	Ammeters
T-200	Frequency Measuring – General
T-210	Absorption Type
T-220	Heterodyne Type
T-230	Direct Reading
T-250	Time Base Measuring
T-300	Waveform Measuring – General
T-310	Oscilloscopes
T-315	Oscilloscope Subassemblies/ Accessories
T-320	Spectrum Analyzer/Panoramic Adapters
T-330	Wave Analyzers
T-350	Frequency Deviation Meter
T-360	Special Purpose
T-400	Signal Generator – General
T-410	Audio Frequency
T-420	Radio Frequency
T-421	Radio Frequency (AM)
T-422	Radio Frequency (CW)
T-423	Radio Frequency (FM)
T-424	Radio Frequency (PM)
T-430	Pulse Generating
T-431	Trigger Pulse
T-432	Time Marker
T-440	square Wave
T-450	sweep
T-460	Special Purpose
T-461	Interface
T-500	Field Intensity and Noise Measuring – General
T-510	Field Intensity
T-520	Noise Field Intensity
T-525	Noise Analyzer/Recorder
T-530	Noise Figure Meters
T-540	Noise Generating
T-550	Special Purpose

SERIES	
T-600	Power, Dissipation Measuring – General
T-610	power Meters
T-620	Dummy Loads
T-630	Nuclear Energy Measurement
T-640	Standing Wave Ratio Measurements – General
T-641	Ratio Meter
T-642	Reflectometer
T-643	Slotted Lines
T-700	Calibration
T-705	Procedures
T-710	Standards
T-720	Range Calibrators
T-750	Special Purpose
T-800	Tester and Performance Test Sets
T-810	Electron Tube and Semiconductor Transistor Testers
T-820	Automatic Test Sets (ATE) and Semi-automatic Test Sets Module Testers
T-82*	Major Automatic Test (ATE)
T-821	Module Testers
T-822	Performance Monitoring/Fault Location
T-830	Radar Test sets
T-840	Radio Test sets
T-850	Teletype and Terminal Test Sets
T-851	Distortion Generators
T-852	Distortion Analyzers
T-853	Relay Test sets
T-860	System Sensitivity
T-870	Sonar Test Set
T-890	Special Purpose
T-900	Miscellaneous Items and Test Devices
T-901	Adaptors
T-902	Attenuators
T-903	Decade Boxes, Potentiometers
T-904	Filters
T-905	Voltage Dividers
T-906	Amplifiers
T-907	Transformer% Variable Transforms, Variacs
T-909	Components
T-910	Directional Couplers/Coaxial Waveguides and Components
T-920	Battery Tester
T-930	Fluxmeters, Stroboscopes
T-940	power Supplies, Modulators
T-950	Recorders
T-990	Special Purpose
T-995	Multipurpose

* Alpha Character

4-9.5.4 Subject **Serial Code**

The sixth and seventh digits of the TMINS numbers is a nonsignificant two-character code used to differentiate among items assigned to a standard subject classification code (SSCC). For more detailed information see Table 2-3 of NAVSEA M0000-00-IDX-000/TMINS

49.5.5 **Technical Manual Type Codes**

The three character acronym **(digits** 8, 9 and 10) identifies the technical manual type. The acronym or work unit identification code was selected from or determined by the guidelines of MOOOO-OO-IDX-OOO/TMINS, Table 2-4.

4-9.5.6 TM Serial/TM Issue Codes

The two character TM serial (digits 11 and 12) and the single character TM issue (digit 13) are used to identify different volumes, parts and changes to specific technical manuals.

4-1o NAVSEA DECKPLATE

The NAVSEA DE CKPLATE (formerly the NAVSEA JOURNAL) is a technical periodical published monthly by the Naval Sea Systems Command (NAVSEA) for the information of personnel in the naval establishment. This periodical contains information on the design, construction, conversion, operation, maintenance, and repair of Navy vessels and their equipment, on programs under the cognizance of NAVSEA, as well as on personnel safety, service hints, and adopted beneficial suggestions.

The contents of the NAVSEA DECKPLATE are for information only, and should not be regarded as authority for altering or superseding official regulations, orders, or directives.

4-11 ELECTRONICS INFORMATION BULLETIN (EIB)

The Electronics Information Bulletin (EIB), is an authoritative publication, published biweekly, and is forwarded to all naval ships and naval electronics installation and maintenance activities.

The EIB contains advance information of field changes, installation techniques, maintenance hints, safety notices, beneficial suggestions adopted by various yards and bases, and notification of the availability of changes and revisions to technical manuals and the EIMB. All articles, including those under the cognizance of Naval Electronic Systems Command (NAVELEX), have been authenticated and are authoritative in nature. Accordingly, reference may be made to a particular EIB issue as the authority for adoption of ideaa and accomplishment of field changes appearing therein, except for interface changes between equipment and systems or between equipment and ship.

Unless otherwise indicated, the maintenance requirements prescribed in the various issues of the EIB are consistent with those contained in the Planned Maintenance System.

Articles of lasting interest are later transcribed into the EIMB except for field changes and corrections to publications.

As issues are received, they are to be filed in a folder or notebook in consecutive order. An EIB index, located in Section 5 of this handbook, is provided as a ready reference to all articles contained in the EIB's. The index is arranged in two sections: one section lists general information articles and the other section lists equipment-related articles in equipment type number sequence.

Confidential issues of the EIB, called the CEIB, are published when sufficient data justify their issue.

4-11.1 SPECIAL INSTRUCTIONS PERTAINING TO THE EIB, CEIB, AND EIMB

The Naval Sea Systems Command NAVSEA 05L31 is the preparing activity for the Electronics Information Bulletin (EIB), the Confidential EIB (CEIB), and the Electronics Installation and Maintenance Books (EIMB) and is the main control point concerning additions, deletions, or changes to the Automatic Distribution List for these publications.

The EIB and EIMB are "For Official Use Only" documents. The designation "For Official Use Only" signifies that the EIB and EIMB may not be further released to the public or to sources outside the U.S. Government without the permission of the Commander, Naval Sea Systems Command.

4-11.2 AUTOMATIC DISTRIBUTION OF EIB AND EIMB

Automatic Distributions Lists are maintained by NAVSEA 05L31 for the EIB, and EIMB as well as for MIL-HDBK-140 "security Classification and Cognizant Activity of Electronic Equipment". Naval, Coast Guard, and DOD activities can be included in this computerized

distribution system by submitting a letter, memo, or "Comment Sheet" to:

Commander
Naval Sea Systems Command
Sea 552412
Washington DC 20362

Activities outside the Department of Defense (i.e., commercial companies) desiring to be placed on automatic distribution for the EIB, EIMB, and MIL-HDBK-140 are required to process written requests through their military liaison or contracting officer or through the nearest Defense Contract Administration Services Office (DCAS). These commerical requests shall include the Navy contract number(s) and contract completion date(s). Automatic distribution of these documents will terminate upon completion of the contract and, therefore, a new request is required whenever a contract is extended or a new contract is awarded. These requirements are also applicable for requests regarding additions, deletions, change of address, or quantity.

Naval, Coast Guard, and DOD activities need only to notify NAVSEA 05131 by comment sheet, memo, letter, or telephone (202) 692-1060 or (AUTOVON) 222-1060 regarding additions, deletions, change of address, or quantity. Correspondence should be explicit in the needs of the activity-state the publication and the number of copies involved, the action required, and the activity's complete unabbreviated mailing address. However, these activities should check their internal distribution lists to verify that the requested documents are being routed to the actual requestore, and to ensure that only the copies actually required are being requested, to avoid waste or unnecessary correspondence. Check with the mailroom to verify that the received copies were distributed properly, and make sure that there is an actual need for additional copies, before requesting extra copies.

Foreign distribution was discontinued 1 June 1972 as a result of implementing the policy of NAVSHIPINST 5500.llA of 18 February 1972. This NAVSHIPS Instruction establishes criteria for the control of "For Official Use Only" documents. However, foreign governments may request information concerning specific equipments in their possession by contacting their assisting technical activity or U.S. Military Advisory Group.

Distribution of a CEIB is only to the command holding the particular equipment for which the article is written.

4-11.3 REQUISITIONING COPIES

The EIB, CEIB, and the EIMB series are not stocked at NAVSEA S!5Z41. They are stocked at NPFC, Philadelphia, and must be requisitioned as Cognizance I material from NPFC in accordance with paragraph 4-5 of this section.

When requisitioning the EIB, CEIB, or EIMB, or when requisitioning back issues, additional copies, or changes to these documents, use the thirteendigit TMINS number of the particular document or change and place it in the "Stock Number" block of DD Form 1348 (or 1348m).

EIB issues up to and including EIB 844 of DEC 72 have been cancelled and are no longer stocked for requisitioning purposes.

4-11.4 COMMENT SHEETS

Two types of Comment Sheets are available for the purpose of submitting equipment and publications-type comments, problems, questions, suggestions, and other voluntary information: the NAVSEA (user) Technical Manual Deficiency/Evaluation Report (TMDER) NAVSEA 416011 (Figure 4-1) and the Electronics Information Bulletin (EIB) Comment Sheet.

The TMDER is attached to the back of technical manuals and other electronics publications, and the EIB Comment Sheet is found in periodic issues of the EIB. Both are used for the same purpose, and both are pre-addressed. Their difference is the address to which they will be forwarded. EIB Comment sheets are addressed to NAVSEA 5574 only.

The Comment Sheets which are received by NAVSEA 5574 are either processed "in-house" and answered directly, or are forwarded to the responsible technical supporting activity or code for processing. All EIB Comment Sheets are answered, unless, of course, the sender has not included his mailing address.

4-12 NAVAL SHIP'S TECHNICAL MANUAL

The Naval Ship's Technical Manual is a complete and authoritative reference available on NAVSEA cognizant material. This manual contains administrative and technical instructions not included in the U.S. Navy Regulations or other publications of higher authority but which are deemed necessary for a clear understanding of the requirements of the technical work and equipment

under the cognizance of the Naval Sea Systems Command.

Each chapter of the manual is prepared as a separate pamphlet so that individual chapters may be issued to naval vessels or other naval activities for use in the instruction of naval personnel. Copies of individual chapters maybe requisitioned directly from the Naval Publications and Forms Center as directed in Subsection 4-5 of this section.

Chapter 400 "Electronics" of this manual, should be read by electronics personnel. This chapter provides major policies and instructions pertaining to electronics work and electronic material under the cognizance or technical control of the Naval Sea Systems Command. In addition, this chapter refers to other cbapters containing relative information valuable to electronics personnel.

In addition to the information contained in Chapter 400 the foUowing chapters of the Naval Ship's Technical Manual may be of interest to electronics personnel.

Chapter	Title
001	General
022	Submarines
030	Publications and Drawings
034	Service Craft
041	Administration of Funds
050	Readiness and Care of Inactive ships
070	Radiological Recovery of Ships After Nuclear Weapons Explosions
078	Gaskets, Packings, and Seals
083	AUowances, Issues, and Expenditures of Material and Repair Parts
090	Inspection, Tests, Records, and Reports
094	Trials
096	Weights and Stability
262	Lubricating Oils, Greases, and Hydraulic Fluids and Lubricating Systems
300	Electric Plant-General
302	Electric Motors and ControUers
310	Electric Power Generators and Conversion Equipment
313	Portable Storage and Dry Batteries
320	Electric Power Distribution Systems
330	Lighting
400	Electronics
430	Interior Communication InstaUations
434	Motion Picture Equipment
491	Electrical Measuring and Test Instruments
510	Ventilating, Heating, Cooling, and Air Conditioning Systems for Surface Ships
532	Liquid Cooling Systems for Electronic Equipment
542	Gasoline and JP-5 Fuel Systems
555	Firefighting-Ships
556	Hydraulic Equipment
585	Submarine Antennas and Masts
613	Wire, Fiber Rope, and Rigging
631	Preservation of Ships in Service (Cathodic Protection)
634	Deck Coverings
670	Stowage, Handling and Disposal of Hazardous General Use Consumables
700	Ship Ammunition Handling and Stowage

Two preventive maintenance systems are in use in the Navy-the Planned Maintenance Sub-system (PMS) and the Maintenance Data Collection Sub-system (MDCS) which complements the PMS to form the basic Maintenance and Material Management (3-M) System.

The Ship's Maintenance and Material Management (3-M) Manual, OPNAVINST 4790.4, prescribes policy guidance, organization, and procedures for the installation and operation of the 3-M System. This manual provides the management tools required for efficient and economical utilization of personnel and material resources in the performance of improved maintenance and the reporting of expenditure of resources. The procedures and tools of the two principle subsystems of the 3-M system, the Planned Maintenance Sub-System (PMS) and the Maintenance Data CoUection Sub-System (MDCS), are discussed in Volumes 1 and 2 of this manual.

4-13 SAFETY-ORIENTED PUBLICATIONS

Refer to Section 3 of this handbook for a listing of safety-oriented publications.

4-14 SECURITY-ORIENTED PUBLICATIONS

Refer to Section 2 of this handbook for a listing of security-oriented publications.

4-15 COMMERCIAL MANUALS

Commercial manuals (sometimes called "off-the-shelf" manuals) are manufacturer's existing manuals which contain technical information covering assembly, installation, operation, servicing, overhaul, and parts identification. This technical information is normally furnished by manufacturers to their customers. However, Navy contractors are required to provide supplements to the commercial manuals to supply any required technical data which is not included in the "off-the-shelf" issues.

Commercial manuals are normally assigned publications numbers and, therefore, stocked as Cognizance "I" material at NPFC, Philadelphia.

4-16 ELECTRONICS-ORIENTED PUBLICATIONS OF INTEREST

Various publications, some of which are discussed in the following paragraphs, are availahle for guidance in the maintenance of electronic equipment tmd for reference and study by electronics personnel.

a. Shipboard Antenna Systems.

The Shipboard Antenna Systems serves as a source of information for those concerned with the installation and maintenance of shipboard antennas. Information contained in this manual supplements, but does not supersede, existing specifications. It consists of the following five volumes (or chapters), formerly known as the Shipboard Antenna Details, NAVSHIPS 900, 121 (A), Chapters 1 through 8.

(1) Volume 1, Communications Antenna Fundamentals, NAVSEA 0967-LP-77-301O

(2) Volume 2, Antenna Installation Details. NAVSEA 0967 -LP-177-3020.

(3) Volume 3, Antenna Coupler Systems, NAVSEA 0967 -LP-177-3030.

(4) Volume 4, Testing and Maintenance NAVSEA 0967 -LP-177-3040.

(5) Volume 5, Antenna Data Sheets, NAVSEA 0967-LP-177-3050

b. Emissions and Bandwidth Handbook NAVSEA O967-LP-3O8-OO1O

This handbook is concerned with the emissions and bandwidths of radio signals used for communications purposes in the U.S. Navy. It discusses and describes communications signals, various other emissions, both natural and man-made, frequency allocation and assignment, electromagnetic interference, and methods and specific techniques used to suppress electromagnetic interference. This publication is written for electronic technicians, and is highly recommended.

c. Single Sideband Communications NAVSEA O967-LP-3O7-7O1O

This handbook highlights the important concepts of single sideband (SSB) to aid shipboard operators in getting the best communications from any of the SSB and associated equipments. The handbook identifies and clarifies the areas where operators have had difficulty in developing an understanding of SSB. It is recommended for reading by all technicians and operators associated with SSB equipment.

d. Principles of MODEMS NAVSEA O967-LP-291-6O1O. This document explains, in a basic non-technical language, the various methods by which modulation and demodulation of signal-carrying electric currents are accomplished, and some of the characteristics of the methods that determine their applicability to various system designs. A glossary of terms commonly used in conjunction with modulator-demodulator (MODEM) application is included, as well os a bibliography to assist those who desire a more thorough technical treatment of the subject.

e. Principles of Telegraphy (Teletypewriter)NAVSEA O967-LP-255-OO1O. This handbook is devoted to the principles and practices of telegraphy as applied to the teletypewriter. It is designed as an introductory text for students and engineers who are concerned with practical systems and equipments within the military service, and is recommended reading for Navy electronic technicians and operaturs associated with telegraphy.

f. Miniature lMicrominiature Electronic Repair Program NAVSEA TEOOO-AA-HBK-010/2M, and NAVSEA TE000-AA-HBK-02012M, and NAVSEA TE000-AA-HBK-03012M The primary purpose of this document is to establish uniform procedures and techniques for repairing high-reliability electronic assemblies to ensure the continuance of the original quality and reliability of the electronic component, and, at the same time, to afford a basis for developing the skills of new personnel and controlling the end results of their repair actions.

g. Military Communication System Technical Standards. MIL-STD-188( ). This standard provides technical design standards for military communication systems. The standards are intended for guidance in research and development of new equipment as well as in preparation of operating standards and engineering installation standards for communication systems. The objective of this standard is to enable engineering, installation, and operation of military communication systems to be accomplished without undue difficulty from equipment interface problems and problems of incompatibility between systems and equipments.

h. Shipboard Bonding, Grounding and Other Techniques for Electromagnetic Compatibility and 'Safety, MIL-STD-1310( ) (SHIPS). The requirements of this standard apply to all new shipboard installations and to that part of existing installations that are being modified. It is not the intent of this standard to retrofit existing installations that are not programmed for modification or to retrofit work accomplished according to previous requirements. The procedures and methods specified in this standard shall be utilized only whenever it is required to bond, ground, insulate, or use nonmetallic materials so as to provide electromagnetic compatibility, personnel safety from electrical shock hazards, safeguard electrical transmissions of classified information, and a DC reference ground.

i. Electronic Material Officer NAVEDTRA 10473(A). This publication acquaints line officers of the Navy and Navy Reserve with the administrative responsibilities and procedures with which they should be familiar when assigned to billets concerned with electronic material. Organizations, procedures, and facilities for supplying naval electronic material are described.

4-17 CATALOGS, LISTS, INDEXES, AND DIRECTORIES

Catalogs, lists, indexes, and directories of electronic equipment are discussed in the following paragraphs.

a. Equipment Identification Code (EIC) Master Index. This index provides a listing of Equipment Identification Codes (EICS) in two sections. Section 1 is a listing of EIC numbers in numerical sequence and identifies the equipment nomenclature assigned to each EIC number. Section II is just the opposite. It lists nomenclature in alphabetical-numerical sequence and identifies the EIC numbers assigned to equipment. The EIC Master Index is published by the Maintenance Support Office, Mechanicsburg, Pennsylvania and is usually located in the ship's maintenance office.

b. Electronic Test Equipment Stowage Guide, NAVSEA 0969-LP-019-5000. This publication has been prepared as a guide to assist ship installation and design activites in determining adequate storage facilities for electronic test equipment. The nomenclature of the general-purpose test equipment presently in use aboard ships for the operation, maintenance, and repair of electronic equipments and systems is arranged in this publication so as to include military test equipment by manufacturer's designating symbols. The nomenclature, name, functional description, dimensions, weight, and volume of each general-purpose test equipment is listed.

c. Electronic Test Equipment, MIL-HDBK-172 ( ). This publication consists of two volumes: Volume 1, UNCLASSIFIED; Volume 2, CONFIDENTIAL. It presents data and information on the technical, physical, and operational characteristics as well as logistics information of electronic test equipment used in the Department of Defense. It is intended primarily for use by standardization, design, development, and procurement activities of the Department of Defense, and by technical planning and coordinating logistics personnel involved in supply and maintenance of military technical equipment operations.

d. United States Radar Equipment (U), MIL-HDBK-162( ). This handbook is a confidential publication which contains technical and functional descriptions, logistical information, installation considerations. and reference data on radar equipments used in the Department of Defense. Ground, airborne, and shipboard radar equipments are included. The book provides, in concise and convenient form, factual data to familiarize maintenance and engineering military personnel as well as government contractors, with technical and physical characteristics of radar equipments. It is designed to supplement departmental manuals and directives and is intended for use, to the greatest extent possible, in the standardization of the design, development, procurement, and application of military radar equipment.

e. Electronic Test Equipment Application Guide. NAVSEA 0969-LP-019-7000. The primary purpose of this publication is to supply manufacturers of major electronic equipment with technical information of electronic test equip-

ment currently used in the Navy. It is a guide for the selection and application of test equipment which is to be used in conjunction with prime equipment. It includes descriptions of the primary function of individual equipments, electrical and mechanical characteristics, mounting methods, accessories supplied, and shipping data.

f. Handbook of Miniature Parts and Integrated Circuit Devices for Electronic Equipment, NAVSEA O967-LP-O31-1OOO. This hsndbook lists and describes commercial miniature electronic parts and integrated circuit devices that are available from suppliers. The handbook is intended primarily for industry and government design personnel.

g. Index of Teletype and Facsimile and Associated Equipment, NAVSEA O967-LP-1O4-OO1O. This index contains brief functional descriptions of facsimile and associated equipments, and a cross-reference between commerical end JAN nomenclatures. The book is intended primarily for design personnel as a source of reference data.

h. Coordinated Shipboard Allowance List (COSAL). Refer to Section 2 of this handbook.

i. Electrical/Electronic Test Equipment Index For SuPPort Requirements of Shipboard Electronic, Electrical, IC, Weapons, and Reactor Systems; NAVSEA STOOO-AA-IDX-010/PEETE. This Index has been prepsred as a guide to assist Fleet personnel in identifying portable electrical/electronic test equipment (PEETE) required for support of prime electronic, electrical, IC, weapons, and reactor instrumentation systems. It may also be used as an aid to establish priorities for the calibration of PEETE.

In general, this Index should be used in conjunction with the Ships Portable Electrical/ Electronic Test Equipment Requirements List (SPETERL). Data in this Index is subject to revision periodically as new equipmentlsystems become available, and new requirements are generated. Hence, incongruities may exist between data in this Index and the SPETERL, depending upon issue date of the latter. Under present procedures, these incongruities will be eliminated automatically in subsequent issues of the SPETERL. This Index does NOT, in any way, supersede or modify the SPETERL, nor does it authorize procurement of, or requisition of, items not listed on the SPETERL. This Index is published on an annual basis in the spring of each year.

SECTION 5

EIB/EIMB INDEXES

5-1 INTRODUCTION

The indexes identify the location of data contained in the Electronic Information Bulletin (EIB) and in the thirteen handbooks of the EIMB series. Three indexes are provided; two indexes for the EIB, and one index for the EIMB handbooks. These indexes are identified below and their page numbers are listed for their location witbin this section.

5-2 EIB INDEXES

The EIB indexes (A and B) provide a comprehensive listing of articles published in the EIB and identify the EIB in which each article appears. Index A lists, by equipment type number and/or name, articles pertaining to specific equipments (i.e., AN/SPS-10, LS-458/SIC, MK 23 MOD 3 GYRO COMPASS, TACAN, TED-1, TEKTRONIX TYPE 316 OSCILLOSCOPE,etc.). This index is prepared using an automatic data processing system with a basic columnar sort sequence, and, therefore, many entries are not in their true numeric sequence. For example: R-1051)/u RR precedes R-390/URR and ANISPA-33 precedes ANISPA-4. Field changes are identified by "FC" following the equipment type numbers, i.e., R-390A/URR-FC-5.

Index B lists, by subject, all articles of general information not pertaining to specific equipment (i.e., Coxial Lines-Prevention of Corrosion Due to Salt Spray on).

5-2.1 DISTRIBUTION

The EIB indexes (A and B) are distributed automatically as a change to the General EIMB handbook, NAVSEA SEOOO-OO-EIM-1OO. Activities desiring extra copies of the EIB indexes should requisition them directly from the Naval Publications and Forms Center (NPFC), Philadelphia. Complete instructions for requisitioning publications are contained in NAVSUP Publication 2002 and in Section 4 of this handbook.

5-2.2 UPDATING

supplements to the EIB indexes will be published periodically in the EIB. Revised indexes will be published in future changes to the GeneraI EIMB handbook, NAVSEA SEOOO-OO-EIM-1OO. The current status of EIB Indexes A and B is stated on pages A-1 and B-1.

5-3 EIMB INDEX

The EIMB Subject Index, Index C, will be issued at a later date as a change to this document.

ELECTRONICS INSTALLATION and MAINTENANCE BOOK (EIMB) Comment Sheet

TITLE: _____ PUBLICATION NO.: _____

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PROBLEM ☐ QUESTION O SUGGESTION ☐ COMMENT ☐ (check one)

SUBJECT: _____

NAME _____

RANK/RATE/TITLE _____

MAILING ADDRESS _____

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TELEPHONE (A UTOVON) _____ (COMMERCIAL) _____

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