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NOTICE
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21 March 1991

MILITARY SPECIFICATION

PLANNED MAINTENANCE SYSTEM: DEVELOPMENT OF MAINTENANCE REQUIREMENT CARDS, MAINTENANCE INDEX PAGES, AND ASSOCIATED DOCUMENTATION

MIL-P-24534A(NAVY), 7 May 1985, has been reviewed and determined to be valid for use in acquisition.

Preparing activity:
Navy - SH

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7 May 1985
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(See 6.6)

MILITARY SPECIFICATION

PLANNED MAINTENANCE SYSTEM: DEVELOPMENT OF MAINTENANCE REQUIREMENT CARDS, MAINTENANCE INDEX PAGES, AND ASSOCIATED DOCUMENTATION

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification identifies the requirements and standards for the development and production of Maintenance Requirement Cards (MRCs), Maintenance Index Pages (MIPs), and other associated documentation used with the Navy Maintenance and Material Management (3-M) Systems, Planned Maintenance System (PMS), OPNAVINST 4790.4, Volume I. This specification implements Reliability Centered Maintenance (RCM) (see 6.3.33) methodology for the determination of maintenance requirements (see 6.5) and applies to all levels of system or equipment grouping, and to all scheduled maintenance, whether equipment is in use, ready for use, or in standby or lay up condition. This specification addresses the total scheduled maintenance program for a ship, irrespective of the maintenance echelon possessing the capability to perform the maintenance; that is, organizational, intermediate, and depot level scheduled maintenance tasks are considered. This specification provides procedures for development of unscheduled maintenance within the PMS program. Planned maintenance system documentation shall be developed in accordance with this specification. This specification is intended for use by PMS development activities and by activities which manage, monitor, or coordinate that development.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-M-38784 - Manuals, Technical: General Style and Format Requirements.

MIL-P-38790 - Printing Production of Technical Manuals: General Requirements for.

STANDARDS

MILITARY

MIL-STD-12 - Abbreviations for use on Drawings, and in Specifications, Standards and in Technical Documents.

MIL-STD-17-1 - Mechanical Symbols (other than Aeronautical, Aerospacecraft and Spacecraft Use).

MIL-STD-17-2 - Mechanical Symbols for Aeronautical, Aerospacecraft and Spacecraft Use.

MIL-STD-1364 - Standard General Purpose Electronics Test Equipment.

MIL-STD-1388-1 - Logistic Support Analysis.

HANDBOOKS

MILITARY

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment.

2.1.2 Government documents, drawings, and publications. The following Government documents, drawings, and publications form a part of this specification to the extent specified herein.

DEPARTMENT OF DEFENSE

DOD 5220.22-M - Industrial Security Manual for Safeguarding Classified Information.

DEPARTMENT OF NAVY

OPNAVINST 5513 (SERIES) - Security Classification Guides.

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

0900-LP-098-6010 - Ship Work Authorization Boundaries for Surface Ships.

0938-LP-011-4010 - Nuclear Powered Submarines Controlled Atmosphere.

ST000-AA-IDX-010/PEETE - Electrical/Electronic Test Equipment Index for Support Requirements of Shipboard Electronic, Electrical, IC, Weapons, and Reactor Systems.
OP 1700 - Volume 1 - Standard Fire Control Symbols.
OP 1700 - Volume 2 - Standard Fire Control Symbols for Underwater Related Quantities.
OP 1700 - Volume 3 - Standard Fire Control Symbols for Missile Related Quantities.
OD 3000 - Lubrication of Ordnance Equipment.

NAVAL SUPPLY SYSTEMS COMMAND
NAVSUP PUBLICATION 4400 - Afloat Shopping Guide.
CATALOGING HANDBOOK H4-2 - Federal Supply Code for Manufacturers, Code to Name.

NAVAL PERSONNEL SYSTEMS COMMAND
NAVPERS 18068D - Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards.

UNITED STATES GOVERNMENT PRINTING OFFICE
United States Government Printing Office (GPO) Style Manual

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

(Copies of specifications, standards, handbooks, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.

2.2 Other publications. The following documents form a part of this specification to the extent specified herein.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
Y 14.15 - Electrical and Electronics Diagrams.
Y 14.15A - Interconnection Diagrams.
Y 32.2 - Graphic Symbols for Electrical and Electronic Diagrams.
Y 32.14 - Graphic Symbols for Logic Diagrams (Two State Devices).
Y 32.16 - Reference Designations for Electrical and Electronics Parts and Equipments.

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

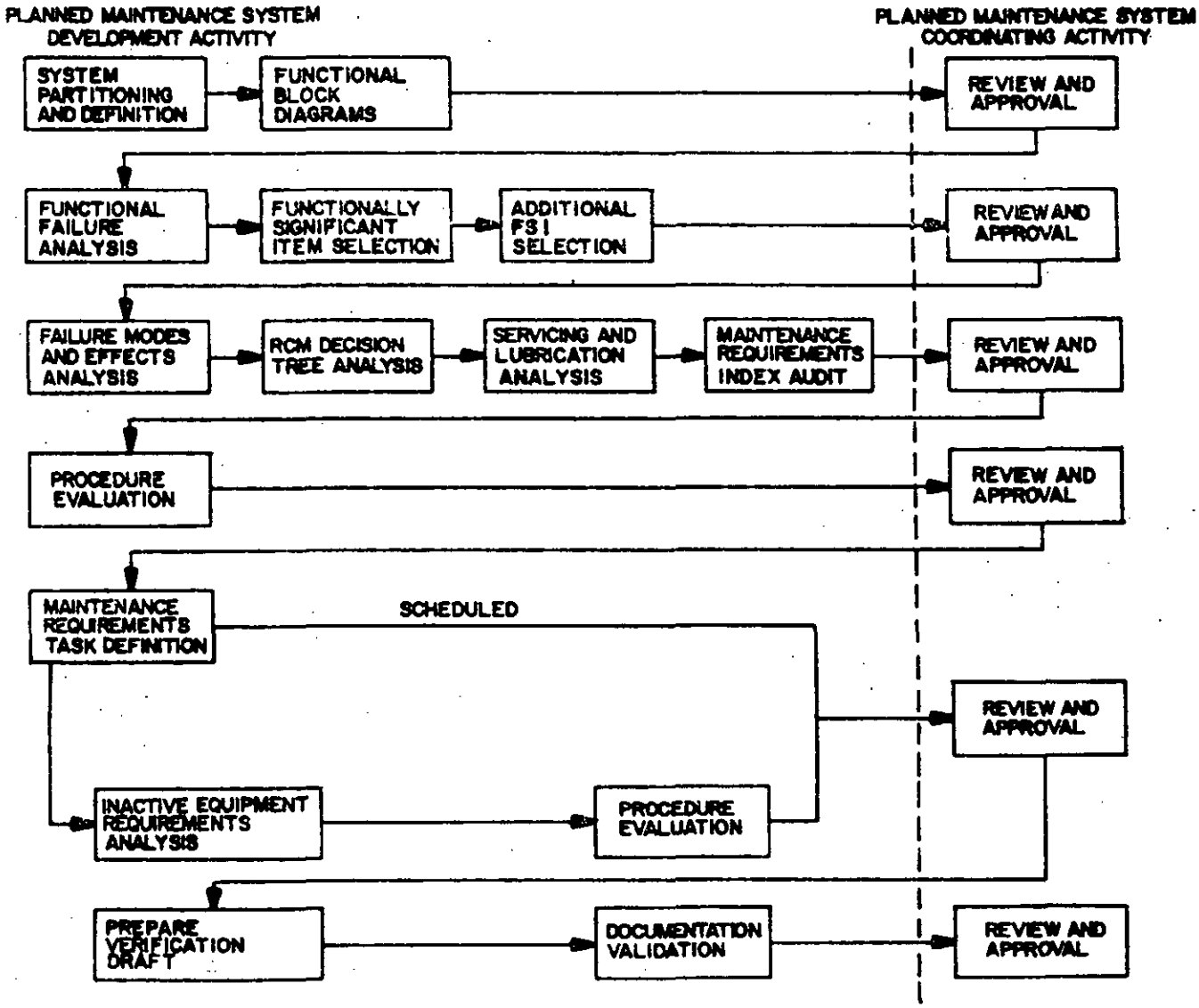
2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Maintenance requirements. Maintenance requirements shall be developed using the RCM methodology in the requirements investigation process.

3.2 Development coordination. The acquisition documents (see 6.3.1) for each PMS development shall include the name and address of the PMS Coordinating Activity (see 6.2.1 and 6.3.30) which will coordinate the development and preparation of the PMS documentation. The designation of this activity will be made by NAVSEA.

3.2.1 RCM methodology. The following flow diagram depicts the basic relationship between the Planned Maintenance System Development Activity (PMSDA) (see 6.3.26) and the PMS Coordinating Activity for developments using the RCM methodology in the requirements investigation process (see 6.3.34).



3.3 Planned maintenance system developer qualification. In addition to technical qualifications, personnel developing PMS documentation shall be qualified in MIP and MRC development (see 6.3.7) techniques. Techniques shall include method study and work measurement procedures taught by NAVSEACEN, or in an equivalent commercial course approved by the PMS Coordinating Activity.

3.4 Security classification. The security classification of materials to be used in MRC development shall be governed by the applicable enclosure of the OPNAVINST 5513 series security classification guides. The applicable enclosure of the OPNAVINST 5513 series is based upon program, project, weapon or ship for which MRC cards are being prepared. Security classification shall be based on data actually extracted for the MRC card rather than the overall classification of the source document. Inquiries concerning appropriate security classification or markings should be referred to the COMNAVSEASYSCOM (SEA 09B2).

3.5 Government-furnished material. The following materials, when required to produce deliverable items specified in the acquisition document, will be supplied as Government-furnished material.

(a) Master Systems and Subsystems Index form (see figure 1).
(b) Functional Failure Analysis form (see figure 2).
(c) Additional Functionally Significant Items Selection form (see figure 3).
(d) Functionally Significant Items Index form (see figure 4).
(e) Failure Modes and Effects Analysis form (see figure 5).
(f) Logic Tree Analysis form (see figure 6).
(g) Servicing and Lubrication Analysis form (see figure 7).
(h) Maintenance Requirement Index form (see figure 8).
(i) Task Definition form (see figure 9).
(j) RCM Documentation Control Sheet (see figure 10).
(k) Inactive Equipment Maintenance Requirement Analysis form, (see figure 11).
(l) Procedure Evaluation Sheet (see figure 12).
(m) Maintenance Index Page (MIP) form (see figure 13).
(n) Maintenance Index Page (MIP) continuation form (see figure 14).
(o) Maintenance Requirement Card (MRC) form (see figure 15).
(p) Maintenance Requirement Card (MRC) continuation form (see figure 16).
(q) Maintenance Requirement Card (MRC) continuation page foldout form (see figure 17 and figure 17a).
(r) MRC Quality Assurance Check Sheet (see figures 18, 18a and 18b).

3.6 Requirements investigation process. The requirements investigation process utilizes maintenance task analysis that shall determine the servicing and testing requirements necessary to maintain the system and equipment in a condition which will allow it to perform within performance standards. The scheduled maintenance task analysis shall identify and justify required maintenance actions and periodicities of accomplishment. Organizational, intermediate and depot levels of scheduled or unscheduled maintenance requirements may result from the analysis process. Other maintenance analyses which identify maintenance requirements meeting the criteria of 3.6.1 may be substituted upon approval of the PMS Coordinating Activity.

3.6.1 Scheduled maintenance requirement criteria. The development procedures shall result in MRCs that meet the following criteria:

(a) Describe the minimum maintenance (see 6.3.27) for accomplishment by maintenance personnel.
(b) Ensure system or equipment operation is within performance standards and established readiness criteria.
(c) Provide maintenance procedures that are not redundant with lower level procedures at as high a level as possible (see 3.6.5).
(d) Provide maintenance procedures that can be safely conducted while system or equipment is operating in a functional mode.

3.6.2 Maintenance objectives. The process described herein is designed to meet the following objectives:

(a) Preservation of the inherent design levels of reliability, performance, and safety.
(b) Accomplishment of this preservation at the minimum practical costs (in terms of system downtime, manpower, tools, materials) based on the criteria of the user.

3.6.2.1 Maintenance objectives criteria. To meet these objectives, the following principles must be recognized:

(a) Only engineering design changes can correct deficiencies in the inherent levels of safety and reliability.
(b) Any maintenance program at its best can only prevent deterioration of the inherent levels of safety and reliability achieved through design.
(c) Maintenance plan determination is closely related to overall logistic support and to other system engineering disciplines such as reliability, maintainability, safety, standardization, human engineering, and training programs. Efficient maintenance planning requires input from and output to these related disciplines.

3.6.3 Task selection criteria. Scheduled maintenance tasks should be performed only when such tasks will prevent a decrease in reliability, a loss of mission capability, a deterioration of safety to unacceptable levels, or when the tasks will significantly reduce the life cycle cost of ownership of the items (see 6.3.23). Tasks will be time directed (TD) (see 6.3.39), condition directed (CD) (see 6.3.5), failure finding (FF) (see 6.3.14). Figure 19 illustrates the specific selection criteria for each task.

3.6.4 Structured approach. The methodologies shall accomplish the following:

(a) Identify functions (see 6.3.17) provided by all ships systems.
(b) Identify functional failure(s).
(c) Identify dominant failure modes (see 6.3.15) causing these failures.

(d) Select and justify applicable and effective preventive maintenance tasks (see 6.3.31) for operating equipment.
(e) Select and justify applicable and effective maintenance for inactive equipment.
(f) In the absence of applicable (see 6.3.3) and effective tasks (see 6.3.11) to prevent safety related failures, make a recommendation for a design change.
(g) Identify unscheduled maintenance requirements.

3.6.5 System approach to maintenance requirements investigation and development. The methodologies provided in this specification will use a system approach. Judgment will be based for selecting a maintenance requirement (MR) on:

(a) Severity of the effects of the failure (see 6.3.12) for which the task is designed to detect or prevent.
(b) Capability of the task to achieve the desired results.
(c) Criticality of the system's function.
(d) Cost effectiveness of the task to the user.

Functional system hiearchies provided by the Ship Work Authorization Boundary (SWAB) system, NAVSEA 0900-LP-098-6010, shall be utilized in determining what constitutes a given system. The SWAB system has been selected for this purpose because the configuration and logistic support data bases for ships are also structured under the SWAB system. Any changes considered necessary must be approved by the applicable Naval Sea Support Center. The SWAB system describes five levels of system identification, referred to as SWAB levels (see figure 20).

3.6.5.1 SWAB level 1 - Major functional grouping. The eight major functional groups are:

SWAB	MAJOR FUNCTIONAL GROUPING
100	Hull Structure Group
200	Propulsion Plant Group
300	Electrical Plant Group
400	Command and Surveillance Group
500	Auxiliary Group
600	Outfit and Furnishings, General
700	Armament Group
800	Integration/Engineering

3.6.5.2 SWAB level 2 - Integration/Engineering functional subgrouping of systems. This level groups systems which operate together to contribute to a more specific functional area than described at SWAB level 1; for example:

200	Propulsion Plant Group
230	Propulsion Units

3.6.5.3 SWAB level 3 - System and elements. This level groups systems and elements together at a more specific functional breakdown; for example:

200	Propulsion Plant Group
230	Propulsion Units
234	Propulsion Gas Turbines

3.6.5.4 SWAB level 4 - Subsystem or subelement. This level describes a group of subsystem or subelements operating together to perform a specific set of functions for the system; for example:

200	Propulsion Plant Group
230	Propulsion Units
234	Propulsion Gas Turbines
2341	Propulsion Gas Turbines, Main

3.6.5.5 SWAB level 5 - Components and equipment. This level describes a component or group of components designed to perform a set of specific functions for a subsystem or subelement; for example:

200	Propulsion Plant Group
230	Propulsion Units
234	Propulsion Gas Turbines
2341	Propulsion Gas Turbines, Main
2341NO	Nozzle, Fuel, LM2500 Gas Turbine

3.6.5.5.1 Component Dictionary Codes (CDC). The last two characters of the level 5 SWAB number are the CDC for the item. The CDC is assigned by the NAVSEACEN Ship Equipment Configuration Accounting System (SECAS) (see 6.4) to identify level 5 components and equipment.

3.6.5.6 Initial assignment for development. The assignment of systems for development will be made at various SWAB levels. Further top down breakdown partitioning shall be done by the PMSDA as part of the investigative process in phase 1 (see 3.7.2). If the acquisition document specifies a single equipment for development, the partitioning and functional failure analysis phases of the requirements investigation processes will be bypassed. Development will begin with the functionally significant item selection, phase 3.

3.7 RCM development. RCM development shall be accomplished in phases as specified in the acquisition document (see 6.2.1). Each phase of the RCM development is as follows:

(a) Phase 1 - partitioning of each SWAB group into systems and subsystems for further analysis and specific definition of boundaries and contents (see 3.7.2).
(b) Phase 2 - analysis of the functions of systems and subsystems and of the ways in which those functions can fail (see 3.7.3).
(c) Phase 3 - selection of the additional functionally significant items (FSIs) (see 3.7.4 and 6.3.18).
(d) Phase 4 - analysis of the failure modes and effects of failure (see 6.3.13) of the FSI (see 3.7.5).

(e) Phase 5 - decision logic ee analysis (see 3.7.6).
(f) Phase 6 - analysis of se icing and lubrication task requirements (see 3.7.7).
(g) Phase 7 - preparation of an index of MR determined necessary and justified in phases 5 and 6 (see 3.7.9).
(h) Phase 8 - method study and procedure evaluation of tasks not already covered adequately by existing MRCs (see 3.7.10).
(i) Phase 9 - detailed definition of tasks (see 3.7.11).
(j) Phase 10 - determination of inactive equipment maintenance (IEM) requirements (see 3.7.12).
(k) Phase 11 - determination of unscheduled maintenance requirements (see 3.7.13).
(l) Phase 12 - preparation of MRCs and formulation into MIPs (see 3.7.14, 3.11 and 3.12).

Forms specified herein shall be completed for each phase of the analysis to provide a complete development package for the system in accordance with the data ordering document specified in the acquisition document (see 6.2.2). Development forms will be either typewritten or hand printed with a black ballpoint pen. Camera ready copy data shall be typewritten.

3.7.1 Direction of twelve phase analysis. The distribution and review of any existing PMS documentation before phase 6 of the analysis shall be prohibited. This process is designed to be an objective determination of maintenance needs of the system based on facts, not a legalization of past practices.

3.7.2 Phase 1 - Functional block diagrams and partitioning. The developer shall secure or prepare functional block diagrams, including interfaces. The developer shall evaluate these diagrams and partition the group to any lower levels required to facilitate analysis. These levels shall include at least AN nomenclature/MK, MOD/APL/RIC/CID on the diagrams. The level of partitioning shall be commensurate with the relative functional complexity of the group and number of equipment or components. Based upon the partitioning, the developer shall prepare master system and Sub System Index Form (see figure 1). Subsequent phases of the analysis shall identify specific functions, define the failures of those functions, and determine the failure modes and their effects at the level where the failure occurs through the system level. The developer shall ultimately determine if there is an applicable and effective task that will prevent or detect functional failure. It is not beneficial or effective to partition the group to a level at which tasks will not be generated by subsequent analysis. Each system in the group shall be covered by one or more MIPs at the discretion of the PMS Coordinating Activity. Tasks generated as a result of the analysis may be directed at failure modes originating at level 5 (equipment and component) or below.

3.7.2.1 Functional block diagram preparation. The format of the functional block diagram shall be orderly but unrestrictive (see figure 21). When approved by the PMS Coordinating Activity, system schematics or line drawings reproduced from appropriate technical manuals or ship information books, may be used with applicable additions and annotations.

3.7.2.1.1 Functional block diagram contents. The functional block diagram shall display all components of the system, their functional relationships to one another, and in and out interfaces with other systems. Generally, some components of a system, although identified separately, may actually be grouped together to form higher assemblies. Assemblies may be appropriately labeled as a single box on the functional block diagram. Label components and assemblies in the system by their common name, including generic name, MK, MOD, and AN nomenclature or other identifier. Hardware such as switchboards or valve manifolds, that are not actually part of the system under analysis, may be included to simplify the diagram and to enhance meaningfulness. Such hardware may be identified by descriptor or nomenclature including assigned SWAB number.

3.7.2.1.2 Connections and interfaces. The components and assemblies of a system are connected to each other and interface with other systems through electrical, fluid, gas, or mechanical linkages. Linkages on the functional block diagram shall be shown as heavy lines. Each connection shall identify the connection and the normal parameter value or range of values. In addition to parameter labels, interface connections shall be labeled with the SWAB number of the system, subsystem or equipment from which the connection originates or which receives the out interfaces. Flow directional arrows shall be required on connection lines.

3.7.2.2 Completing the master systems and subsystems index. The Master Systems and Subsystems Index form, (see figure 1), is the key index to the functional system analysis and shall be prepared and completed as follows:

(a) Block 1 - SWAB group number. Enter the SWAB group level 1 number, a three-digit number containing two zeroes and the associated nomenclature.
(b) Block 2 - Group nomenclature. Enter the associated group nomenclature.
(c) Block 3 - Ship class. Enter the ship class and the hull number on which the analysis is based.
(d) Block 4 - Prepared by. Enter the analyst's name and the date.
(e) Block 5 - Reviewed by. Enter the first level reviewer's name and the date.
(f) Block 6 - Approved by. Reserved for PMS coordinating activity approval signature and date.
(g) Block 7 - Revision. Enter ORIGINAL, or A, B, or C, sequentially, and the date.

(h) Block 8 - SWAB subgroup/system/subsystem number. Enter a number identifying each subdivision through SWAB level 4. If the level 4 SWAB number cannot uniquely identify a subsystem, add a suffix number to the level 4 SWAB number and use this throughout the analysis.

(i) Block 9 - Subgroup/system/subsystem nomenclature. Enter the nomenclature of each SWAB subdivision identified.

(j) Block 10 - Serial number. Enter a serial number for this form as follows:

(1) Segment 1 - enter the developing organization abbreviation, followed by a slant (/).

(2) Segment 2 - for developers, enter the development authorization number, followed by a slant (/); for other development activities, assign a development number, followed by a slant (/).

(3) Segment 3 - enter the number 114 to indicate the Master Systems and Subsystems Index form, followed by a slant (/).

(4) Segment 4 - enter the highest indenture level (see 6.3.21) SWAB for the development group assigned. If an entire group is assigned, this number is a level 1 SWAB number - a three-digit number containing two zeros; for example, 100, 200.

3.7.3 Phase 2 - Functional failure analysis (FFA). Upon direction from the PMS Coordinating Activity, the developer shall perform the system FFA and document the analysis on the FFA form (see figure 2) for each of the systems and subsystems identified in phase 1.

3.7.3.1 Purposes of the FFA. The FFA is performed to determine and to document:

(a) A functional description of the system and subsystem including protective features, installed monitoring and testing devices, redundancy provided, and any other information associated with the maintenance needs of the system and visibility of failures.

(b) The definition of the specific functions of the system.

(c) The definition of the interfaces of the system or subsystem with other systems.

(d) The definition of the functional failures of the system or subsystem.

3.7.3.2 Preparation guidelines. One FFA shall be required for each subdivision identified in phase 1 and listed on the master systems and subsystem index. If a system is simple, only a single FFA shall be required. The FFA when completed, shall describe the characteristics (see 6.3.4) of the system that must be considered for potential preventive maintenance tasks. If a system includes several relatively complex subsystems, an FFA shall be required for the system and for each subsystem. Only those elements unique to the system shall be included in the system FFA. The functional block diagrams from phase 1, technical manuals, and other pertinent references shall be used as the basis for the FFA.

3.7.3.3 Order of operation. The purpose of the analysis is to identify potential sources of functional failures. The FFA shall collect sufficient information for the analyst to decide which items, if any, should be separately selected as FSIs. The FFA requires a brief narrative description with emphasis on maintenance needs. The FFA includes specific identification of design features that provide mitigation of failure effects, such as redundancy, protective devices, and fail-safe features. It also includes specific identification of design features that make system condition and maintenance needs visible; for example, built in test equipment (BITE), and system indicators.

3.7.3.3.1 Functions. A system may provide a function (see 6.3.17) by providing information, providing flow and pressure of a fluid, or converting stored energy to motion. Functions of this type are called "active functions" because they require activity of the system. Loss of, or degradation of, that activity is a functional failure. A system may also provide a function by not doing something, such as a tank holding fluid. Functions of this type are called "passive functions" because they are inactive. An activity such as a leak in the tank is a functional failure. When a function fails, alarms or performance of the system may alert the operating crew immediately that the function has been lost. This type of function is called an evident or visible function since its loss is visible to the crew. Functions, that give no immediate indication that they have failed are called hidden functions. For hidden functions it is necessary to perform some special procedure to see if the function is available. In a combatant ship, some systems are infrequently used. The functions of these infrequently used systems are hidden functions. Some systems have co-functions, which are functions that are physically or environmentally closely associated. Failures in one function will adversely affect other functions, even though these functions are normally independent. All functions of the system shall be determined and documented.

3.7.3.3.2 Redundancy. Some degree of redundancy (see 6.3.32) may have been designed into the system. This level of redundancy was created to provide increased availability. Redundancy exists when the function can still be obtained in the quality and quantities required after subsystem or equipment failure.

3.7.3.3.3 Interfaces. Systems usually receive input from other systems and provide output to other systems. Loss of input can cause a failure in the system and loss of output can cause a failure in other systems. System interfaces are addressed separately in the FFA process because they are easily overlooked and vary widely for different configurations of the same basic system. "In" interfaces shall be assumed to be available. "Out" interfaces shall be treated as functions.

3.7.3.3.4 Installed safety devices inclusion. If safety or protective devices, such as circuit breakers, overloads, relief valves, or other are installed in a system, that system shall have a function to protect itself and the crew. These devices are easily overlooked because of their high reliability; however, they shall be identified and documented as functions of the system (see 6.2.1).

3.7.3.3.5 Functional failures. A functional failure exists when a system or subsystem ceases to provide a required function; whether the function is active (see 6.3.2), passive (see 6.3.29), evident, or hidden (see 6.3.20). The definition of what constitutes a failure is of primary importance. Whenever a failure is defined by some level of performance, condition, or dimension, the appropriate standards must be stated to provide the basis for establishing whether a failure has occurred. Where applicable, these definitions of failures in terms of system parameters or performance standards are required. When defining functional failures of functions provided by redundant items, the failure shall be clearly defined as a failure of all redundant items.

3.7.3.4 Completing the FFA form. The FFA form (see figure 2) shall be completed as follows:

(a) Block 1 - SWAB number. Duplicate each entry in the Master Systems and Subsystems Index form, block 8.
(b) Block 2 - Nomenclature. Enter the nomenclature used on the Master Systems and Subsystems Index form, block 9, for the selected system or subsystem.
(c) Block 3 - Ship class. Duplicate the entries on the Master Systems and Subsystems Index form, block 3.
(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, block 7 - Revision. See instructions for the Master Systems and Subsystems Index form in 3.7.2.2d. through 3.7.2.2g.
(e) Block 8 - Sources of information. Enter the drawing, manual, document and report numbers. Enter titles of reference material actually used in this analysis.
(f) Block 9 - Description. Referring to the block diagram prepared in phase 1, enter a brief physical and functional description of the subdivision. Focus on what the hardware is and what it does, oriented toward preventive maintenance needs. After this narrative, document the following specific information about the system, using the format below (parenthetical statements describe the information to be documented):

(1) REDUNDANCY: Enter NONE or describe the redundant relationship.
(2) PROTECTIVE DEVICES: List the protective devices and the circumstances under which they operate; for example, CIRCUIT BREAKER - 30 AMP, CASING RELIEF VALVE - LIFTS AT 150 POUNDS PER SQUARE INCH (lb/in^2), RESEATS AT 135 (lb/in^2).
(3) SAFETY FEATURES: Describe special safety features such as interlocks.
(4) FAIL SAFE OR UNSAFE FEATURES: State whether system is fail safe or unsafe; describe any fail safe features.
(5) CONDITION INDICATORS: Document TYPE, INDICATES, and TO WHOM in a single group for each indicator.

a. TYPE: Enter GAGE, THERMOMETER, METER, BITE, INDICATOR LIGHT, AUDIBLE VISUAL ALARMS, as appropriate.

b. INDICATES: Describe what the indicator tells about the system.

c. TO WHOM: List the watch station or the title of the operator who observes the indicator. Specify the conditions when that station is manned.

(6) ENVIRONMENT: Describe the environment to which the system is exposed; for example, EXPOSED TO WEATHER, EXPOSED TO HIGH HUMIDITY, EXPOSED TO HIGH HEAT, or other.

(7) DUTY CYCLE: Describe the particulars of normal operational practices and estimated operational time per year. For example, THE SYSTEM IS NORMALLY ON LINE WHEN UNDERWAY AND IS AUTOMATICALLY CONTROLLED. AIR COMPRESSORS CYCLE ON AND OFF UNDER CONTROL OF ASSOCIATED RECEIVER PRESSURE SWITCHES. COMPRESSORS RUN ABOUT 250 HRS A YEAR, DEPENDING ON DEMAND.

(8) USE RESTRICTIONS: Enter any special restrictions on the operation of the system; for example, cannot be safely activated in port.

(9) SPECIAL MAINTENANCE FEATURES: Describe any special provisions for maintenance installed; for example, system is equipped with external test connections enabling full diagnostics while on line.

(g) Block 10 - Functions and out interfaces. Enter a description of functions of the system. Include self or crew protective features, out interfaces and all co-functions. State minimum operational function parameters or performance standards if appropriate. Number functions sequentially; for example, 1, 2, and 3.

(h) Block 11 - System in interfaces. Enter sources of input and critical values. Specify the SWAB number for each source.

(i) Block 12 - Functional failures. Enter the definition of what constitutes a failure for each function and output interface listed in block 10. There may be several functional failures for each function; all functional failures must be identified. Number each functional failure 1.1, 1.2, 1.3; 2.1, 2.2, and 2.3, to correspond to the function number in block 10.

(j) Block 13 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2).
(3) Segment 3 - enter the number 116, indicating the FFA form, followed by a slant (/).
(4) Segment 4 - enter the SWAB number from block 1.

3.7.4 Phase 3 - Additional FSI selection and FSI index. The developer shall prepare the Additional FSI Selection forms for items considered to be candidates for selection as additional FSIs. After preparation of these Additional FSI selection forms, the developer shall prepare an index listing all FSIs.

3.7.4.1 Preparation guidelines. Items listed on the Master Systems and Subsystems Index are FSIs. Others will be selected by this analysis. Equipment and repairable or replaceable assemblies are potential candidates. In the case of simple systems, sometimes it is practical to consider an entire system as the only FSI. Ultimately, a failure modes and effects analysis (FMEA) will be required for each FSI. Functionally significant items should be selected at such a level that the FMEA is meaningful and simple. Careful review of the system block diagram is required to determine which of the following approaches will be used.

(a) A single FSI for the entire system,
(b) Functionally significant items assigned at subsystem and systems levels but not to equipment or other assemblies,
(c) Functionally significant items assigned at equipment and assembly level and subsystem and system levels. This approach permits "hybrid" solutions; for example, relatively few equipments may be considered for selection as additional FSIs. The functions and failures of items not selected as additional FSIs are considered in the analysis of the related subsystem.

3.7.4.1.1 Method for additional FSI selection. After choosing the approach, an Additional FSI Selection form, (see figure 3) shall be prepared for each candidate FSI.

3.7.4.2 Functionally significant items selection process. The FSI selection process identifies items other than the entire system or subsystem that merit separate analysis because of their importance or complexity. This process determines and documents a brief description of the candidate FSIs similar to that prepared in system and subsystem FFAs. The functions and functional failures of the FSI are determined and listed specifying values of parameters or performance standards where applicable. A series of yes or no questions, based on the analyst's judgment of the FSI in question, are used to determine the validity of the analyst's decision.

3.7.4.3 Completing the additional FSI selection form. The Additional FSI Selection form (see figure 3) shall be completed as follows:

(a) Block 1 - SWAB number. Enter the SWAB number for the FSI candidate. If the candidate is below level 4 and does not have a unique SWAB number, add a suffix number to the level 4 SWAB number and use this throughout the analysis.
(b) Block 2 - Nomenclature FSI candidate. Enter the nomenclature of the FSI candidate.
(c) Block 3 - Ship class. Duplicate the entries on the Master Systems and Subsystems Index Form, block 3.
(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, and block 7 - Revision. See instructions for Master Systems and Subsystems Index form in 3.7.2.2d through 3.7.2.2g.

(e) Block 8 - Description. Enter a brief functional description of this item keyed to its maintenance needs and provisions for maintenance. Identify redundancies, interface, BITE, and indicators including what they show about the system; to whom, operator or watch title, responsibilities, and conditions of manning the station.

(f) Block 9 - Location. Enter the compartment numbers of spaces where this item is located.

(g) Block 10 - Quantity. Enter the quantity of items installed in this system.

(h) Block 11 - Function(s). Enter definitions of the functions of this item; number sequentially 1, 2, and 3. Under the Impact column, block 11a, enter a YES or NO in answer to the question, "Are any of these functions necessary for safety, mobility, or mission?"

(i) Block 12 - Functional failures. Enter the definitions of the failure for each of the functions listed in block 11. Number each 1.1, 1.2, 1.3; 2.1, 2.2, and 2.3 corresponding to the appropriate function. Under the Impact column, block 12a, enter a YES or NO in answer to the question, "Do any of these failures have a direct adverse impact on safety?"

(j) Block 13 - Reliability. Under the Impact column, block 13a, enter a YES or NO in answer to the question, "Is the estimated corrective maintenance rate greater than 1 a year?"

(k) Block 14 - Cost. Under the Impact column adjacent to block 14a, enter a YES or NO in answer to the question, "Is this item's purchase cost greater than $5,000?"

(l) Block 15 - Master FSI index transfer. If there is a YES in the Impact column for any block (11a through 14a), enter YES.

(m) Block 16 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2).
(3) Segment 3 - enter the number 117, indicating the additional FSI selection form, followed by a slant (/).
(4) Segment 4 - enter the SWAB number from block 1.

3.7.4.4 Nonsignificant items. Items not selected as FSIs will not be given further item level analysis; they will be considered as part of a higher level FSI.

3.7.4.5 Preparing the FSI index. The FSI Index form (see figure 4) will be completed as follows:

(a) Block 1 - System/subsystem SWAB number. Enter the highest level SWAB number to be covered by the index.

(b) Block 2 - System/subsystem nomenclature. Enter the associated system/subsystem nomenclature for the SWAB number specified in block 1.

(c) Block 3 - Ship class. Enter the ship class and hull number to which the analysis applies.

(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, block 7 - Revision. See instructions for Master Systems and Subsystems Index form, in 3.7.2.2d through 3.7.2.2g.

(e) Block 8 - SWAB number. Duplicate the entry on each FFA form, block 1, or Additional FSI Selection form, block 1, as applicable.

(f) Block 9 - Nomenclature. Duplicate the entry on each FFA form, block 2, or Additional FSI Selection form, block 2.

(g) Block 10 - Location. Duplicate the entries in block 9 of the Additional FSI Selection form for the item (equipment only).

(h) Block 11 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2).
(3) Segment 3 - enter the number 118, indicating the FSI Index form, followed by a slant (/).
(4) Segment 4 - SWAB number from block 1.

3.7.5 Phase 4 - FMEA. Upon direction from the PMS Coordinating Activity, the developer shall perform an FMEA and complete a form for each FSI identified and approved in phase 3. An FMEA shall be required to determine the basic information needed for applying the decision logic. The specific purpose of the FMEA is to determine the dominant failure modes (the manner in which the functional failures identified in the FFA and the FSI process can occur) and to determine the effects of each failure mode on the item where it occurs and through higher levels.

3.7.5.1 Preparation guidelines. Each FSI on the FSI Index shall require an FMEA. Each functional failure of each FSI must be analyzed. Copies of the FFA, additional FSI Selection, and FSI Index forms, as well as the system block diagram, shall be the basis for the FMEA.

3.7.5.2 Functional failure modes. This FMEA differs from other FMEA processes because it shall be used to filter out unimportant and unlikely failure modes. Consideration can then be focused on the failure modes most important for preventive maintenance determination. The dominant failure (see 6.3.9) modes for each functional failure on the FMEA form shall be listed. At this stage it may be possible that the only failure for a particular FSI is such that the effects are insignificant and the likelihood of the failure is remote. For this reason, a mechanism for ceasing further analysis of such failure modes shall be provided. After careful evaluation, the failure modes that are most important, either because of their frequent occurrence relative to the other failure modes or because of the severity of their effects, shall be subjected to further analysis.

3.7.5.3 Completing the FMEA form. The FMEA form (see figure 5) shall be completed as follows:

(a) Block 1 - SWAB number. Duplicate each entry from the FSI Index form, block 8.

(b) Block 2 - Nomenclature. Duplicate each entry from FSI Index form, block 9.

(c) Block 3 - Ship class. Duplicate the entry from FFA form, block 3.

(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, block 7 - Revision. See instructions for Master Systems and Subsystems Index form in 3.7.2.2d through 3.7.2.2g.

(e) Block 8 - Function(s). Enter the numbers of the functions listed in FFA form, block 10, or the Additional FSI Selection form, block 11.

(f) Block 9 - Functional failures. Duplicate entries from FFA form, block 12, or Additional FSI Selection form, block 12, as applicable.

(g) Block 10 - Dominant failure modes. Enter the dominant failure mode for each functional failure. Number sequentially to correspond to the appropriate functional failure and function; for example, 1.1a., 1.1b., 1.2a. Failure modes should be identified at the level at which the analysis is made. If there are no dominant failure modes, enter NONE.

(h) Block 11 - Failure effects (local, subsystem, system). Enter the details of the effects of each failure mode on the FSI where the failure mode occurs; at system and subsystem level if appropriate, and the end effect. If the failure mode has no effect on a particular level, enter NONE in the appropriate column. If the particulars of the effects are such that a safety hazard or reduction in mission capability results, indicate:

(1) SAFETY HAZARD TO OPERATORS
(2) SAFETY HAZARD TO PERSONNEL IN VICINITY
(3) PARTIAL LOSS OF CAPABILITY TO DETECT AND TRACK SURFACE CONTACTS WITH RADAR
(4) TOTAL LOSS OF MOBILITY CAPABILITY
(5) If the details of the effects are such that only a redundant item is lost, indicate using the phrase, LOSS OF REDUNDANCY.

(i) Block 12 - Transfer (yes or no). Enter YES if the failure mode indicates further analysis should take place. If the failure mode has insignificant effects, or it is only remotely likely to occur, enter NO and provide rationale for this decision on clearly labeled backup sheets. For failure modes of redundant items, the likelihood of failure of redundant items must be considered. The PMS Coordinating Activity shall scrutinize this area during the review process.

(j) Block 13 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2).
(3) Segment 3 - enter the number 119, indicating the FMEA form, followed by a slant (/).
(4) Segment 4 - enter the SWAB number for the item from block 8 of the FSI Index for the item.

3.7.6 Phase 5 - RCM decision logic tree analysis. The developer shall perform the decision logic tree analysis for each functional failure identified in phase 4. The results of the analysis shall be recorded on Decision Logic Tree Analysis forms, with rationale and justification backup sheets. The analysis of servicing and lubrication task requirements will be separately treated in phase 6. If a need for a specific servicing or lubrication task is identified during the logic tree analysis, this information should be held for use in phase 6. The most critical step in the processing of FSIs is the application of decision logic. The logic consists of a series of yes or no questions that determine, the need for and availability of, applicable and effective preventive maintenance tasks (see figure 22).

3.7.6.1 Preparation guidelines. Each functional failure on the FMEA form will be processed through the RCM decision logic tree. Only failure modes receiving a YES in block 12 shall be considered in the logic tree analysis.

3.7.6.1.1 Review of existing PMS documentation. Do not review existing PMS documentation before doing the logic tree analysis. Use your knowledge about the functions, functional failures, and failure modes to select each task.

3.7.6.2 Reliability centered maintenance decision logic tree - question 1. Is the occurrence of a failure evident to the operating crew while it is performing its normal duties? This question separates the functional failure into two groups:

(a) Those functional failures which are evident to the crew during routine duties. The functions in this group are those that are operated either continuously or so often that the crew knows whether a functional failure has occurred.

(b) Those functional failures which are hidden from the crew until the function is actually demanded of this FSI. Functions in this group are those used intermittently or infrequently so that the crew does not know whether a functional failure has occurred without some special check or test, or those that are not detectable until after another failure. For example, a failed shut relief valve that cannot be discovered by the crew until overpressurization damages another item in the system. If an applicable and effective preventive task is available for either failure, it will be used. However, if no task is available that will prevent the hidden failure, a specific task to find the failure may be necessary to tell the crew that restoration of the function is needed and to improve the probability that the function of the FSI will be available when needed.

(1) If this question is answered yes, the rationale and justification required on the backup sheets must describe how this failure is evident; that is, what is observed, who (which watch station or operator) observes it, and under what conditions that watch station or operator station is actually manned. If this question actually manned. If this question is answered no, the rationale and justification required should explain why the failure is hidden from the crew.

3.7.6.3 Reliability centered maintenance decision logic tree - question 2. Does the failure cause a loss of function or secondary damage that has a direct and adverse effect on operating safety? This question separates the evident functional failures into two groups:

(a) Those that directly impact operating safety. The functional failures in this group are the evident failure modes of any system which impact safety by their occurrence and the evident failures of safety equipment and protective devices.

(b) Those that do not impact operating safety. Functional failures in this group will have impact on either the capability of the ship to perform its mission or support functions.

(1) In considering how this question should be answered, the analyst must consider each dominant failure mode shown in the FMEA for each functional failure and its effects. For failures of protective devices or safety equipment, he must also consider the effects of a second failure that requires the safety equipment or protective devices to operate. The effects of this "worst case" situation should be judged to answer the question. The analyst should not assume more than two failures to answer this question, and this is the only question in which more than one failure should be considered at a time.

(2) If the answer to this question is yes, the rationale and justification must describe the particulars of the threat to life, limb, or health of the crew.

3.7.6.4 Reliability centered maintenance decision logic tree - question 3. Does the failure have a direct and adverse effect on operational capability? This question separates the evident, non-safety-related functional failures into two groups:

(a) Those which affect the ability of the ship to perform its military functions.

(b) Those that impact non-mission-related capabilities of the ship.

(1) When processing functional failures through the logic tree, if the answer to question 3 is no, postpone further analysis of this failure until after completing the processing of the safety and mission related failures. These failures have only an economic impact, and scheduled maintenance for them must be economically justified. The cost effectiveness of tasks for these items can be affected by the task results for safety and mission related items; for example, a non-critical inspection may not be economically justifiable by itself if it requires excess time and cost, but if the excess time and cost are determined to be required for a safety or mission related inspection, then the noncritical inspection may be justifiable if it is combined with the

safety or mission related inspection. For this reason, the economic aspects of cost critical item tasks should be addressed only after the preventive maintenance requirements for safety and mission critical items (see 6.3.36 and 6.3.28) are determined.

(2) If the answer to this question is yes, the rationale and justification must describe the military functions which are degraded by this failure.

3.7.6.5 Reliability centered maintenance decision logic tree - questions 4, 5, 6, and 7. Is there an applicable and effective preventive task (or combination of tasks) that will prevent functional failures? This question is asked about the dominant failure modes and separates them into two groups:

(a) Those for which an applicable and effective preventive maintenance task (or tasks) can be specified.

(b) Those for which there is no applicable and effective task.

(1) Although this same question is asked in each of the four branches, the answer depends on the criticality of the failure.

3.7.6.5.1 Applicability. A task or group of tasks is applicable if, and only if, the task really does prevent, discover, or reduce the impact of the failure mode in question. There are three types of tasks that prevent or reduce failures:

(a) Condition-directed tasks. These tasks are periodic tests or inspection to compare the existing conditions or performance of the item with established standards. For a CD task to be applicable, the occurrence of a specific failure mode must be preceded by a reduction in resistance to failure that is detectable sufficiently in advance of actual failure so that appropriate action can be taken to avoid the actual failure. This set of conditions is called potential failure. If the potential failure conditions cannot be defined or if they are not detectable sufficiently far in advance to avoid the failure, then no CD task is applicable.

(b) Time-directed or hard-time tasks (see 6.3.19) rework tasks (RW) (see 6.3.35) and life-limit tasks (LL) (see 6.3.24). These are tasks of periodic restoration (RW) or replacement (LL) of an item which is performed before the item reaches an age where the risk of failure is much greater than at earlier ages. For a TD task to be applicable, the item must exhibit an increased risk of failure after some age has been reached. There must be no condition that predicts failure. If the item does not exhibit this adverse age - reliability relationship, RW or LL tasks are not applicable. Figure 23 displays the characteristics of an item for which hard time tasks are applicable.

(1) Condition directed tasks are usually more effective than RW or LL tasks because, if selected properly, they rely on a condition standard that is highly correlated to future failure.

(c) Failure finding tasks. These tasks are intended to discover hidden failures. For an FF task to be applicable, functional failure must not be evident to the operating crew during performance of their normal duties.

3.7.6.5.2 Effective. A task that is applicable to a critical failure can be effective only if it reduces the risk of failure to an acceptable level. Other preventive tasks can be effective only if they are cost effective. Failure finding tasks can be effective only if they increase the availability of the affected function to an acceptable level.

3.7.6.5.3 Rationale and justification requirements for questions 4, 5, 6, and 7. The rationale and justification required for yes answers to questions 4, 5, 6, or 7 must address both the applicability and effectiveness of tasks identified.

(a) The applicability rationale for CD tasks must describe the potential failures that will be discovered by the tasks that will enable avoidance of actual failures.
(b) The applicability rationale for TD tasks must describe the adverse age and reliability relationship the proportion of units surviving to the age at which the task is performed, the risk of premature failure and how the task will restore the item to achieve higher reliability.
(c) The effectiveness rationale must address how the tasks reduce the risk of failure to an acceptable level. Questions 5, 6, and 7 (except for safety related hidden failures and infrequently used functions), must address the cost effectiveness of the tasks. This will require consideration of the estimated time between occurrence of potential failure and actual failure for CD tasks, and comparison of this interval with the task periodicity. Consideration of the cost effectiveness of tasks affecting mission related failures should include loss of system availability, as well as a comparison of resource requirements to do the tasks and repairs, versus repairs only without the preventive task.

3.7.6.5.4 Determination of maintenance interval. There are no practicable mathematical methods for selecting the "right" interval for a preventive maintenance task using the kinds of failure data normally available. A periodic task will not be effective unless it discovers or arrests a reduction in functional failures. When there is a threat to safety and the associated failure is time-related, a conservative approach based on past experience is required because the analyst must ensure a high level effectiveness. When there is no direct adverse effect on safety, the analyst is advised to keep in mind that he has an opportunity to explore without affecting safety. The interval of CD tasks depends upon the expected time for a potential failure to progress to functional failure. The interval of TD tasks depends upon the change of failure rate with time. The interval of FF tasks depends on the confidence the user desires to have that, when he wishes to use a hidden or infrequently used function, it will be available. Failure finding tasks do not improve future reliability. Failure finding tasks only assure the user that he will not be surprised by failures that exist but have not been discovered.

3.7.6.5.4.1 Importance of periodic task selection. In all cases, selecting any periodic task means that you believe from careful consideration of the available information that the user will be better off by doing it than by not doing it.

3.7.6.5.5 Reliability centered maintenance decision logic tree - question 4. Is there an applicable and effective preventive maintenance task (or combination of tasks) that will prevent functional failures?

(a) This question is asked about safety related functional failures. The occurrence of such failures should be avoided if possible, regardless of cost. An applicable task can be effective only if it reduces the risk of failure to a very low level. If this question receives a no answer, a safety related design change recommendation must be identified.

3.7.6.5.6 Reliability centered maintenance decision logic tree - question 5. Is there an applicable and effective preventive maintenance task (or combination of tasks) that will prevent functional failures?

(a) This question is asked about functional failures that affect operating capability. This branch of the decision logic tree relates to functions that are in regular, frequent use and affect the ability of the ship to perform intended missions. An applicable task can be effective only if the value of the resulting increase in reliability clearly exceeds the total cost of the task. A task should not be specified unless it is both applicable and effective.

3.7.6.5.7 Reliability centered maintenance decision logic tree - question 6. Is there an applicable and effective preventive maintenance task (or combination of tasks) that will prevent functional failures?

(a) This question is asked about functional failures that affect support functions and that are in regular, frequent use, but do not directly provide operating capability. An applicable task can be effective only if the costs are clearly less than the direct costs of the failures it prevents. A task should not be specified unless it is both applicable and effective.

3.7.6.5.8 Reliability centered maintenance decision logic tree - question 7. Is there an applicable and effective preventive maintenance task (or combination of tasks) that will prevent functional failures?

(a) This question is asked about functional failures that are not evident to the crew while performing their normal duties. These may be safety, mission, or support related functions. The analyst must consider applicability and effectiveness as previously described for similarly related on-line functions.

3.7.6.6 Reliability centered maintenance decision logic tree - question 8. Is a scheduled FF task available and justified?

(a) This question is asked about hidden functional failures for which no applicable and effective preventive tasks exist. The failure in question here may be safety, mission, or support related. The analyst must determine first if there is an applicable FF task. If there is, he must evaluate the reliability of the item specifically related to this failure mode, the effects of this failure mode remaining undetected until the function is next needed, and the benefits of performing the task. A task should not be specified unless it is both applicable and effective. If the failure mode in question is safety related, a safety related design change recommendation should be identified if no task is available or if the task does not provide sufficient confidence that the safety function will be available when needed.

3.7.6.7 Completing the logic tree analysis form. The Logic Tree Analysis form (see figure 6) will be completed as follows:

(a) Block 1 - SWAB number. Duplicate the entry on the FFA or the Additional FSI Selection form, block 1. (Start a new form for each item.)
(b) Block 2 - Nomenclature. Duplicate the entry on the FFA or Additional FSI Selection form, block 2.
(c) Block 3 - Ship class. Duplicate the entry on the FSI Index form, block 3.
(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, block 7 - Revision. See instructions for the Master Systems and Subsystem Index form in 3.7.2.2d through 3.7.2.2g.
(e) Block 8 - Functional failure and failure mode(s). Enter functional failures and related failure modes receiving a YES in block 12 of the FMEA; number each as numbered in the FMEA.
(f) Block 9 - Criticality analysis. Enter Y or N to signify a yes or no answer to each of the first three logic tree questions. Possible alternatives are:

Question			Assign
1	2	3	Criticality Class
Y	Y	N/A	A
Y	N	Y	B
Y	N	N	C
N	N/A	N/A	D

(g) Block 10 - Criticality class. Enter A, B, C, or D, based on the answers in block 9. These letters identify the four main branches of the logic tree as follows:

(1) Class A - operating safety
(2) Class B - operating capability
(3) Class C - other regular functions
(4) Class D - hidden or infrequent functions

(h) Block 11 - Periodic maintenance (PM) task. Enter a Y or N to signify a yes or no answer to questions 4, 5, 6, or 7 in the logic tree. If the criticality class for this failure is A, the task must be able to reduce the risk to an acceptable level; cost is not a consideration. If no task is available, a safety related design change recommendation must be identified in block 13.

(i) Block 12 - FF task. Enter Y or N signifying a yes or no answer to question 8 in the logic tree.

(j) Block 13 - Design recommendation. Enter yes if one was identified for this failure, otherwise enter no.

(k) Block 14 - Task description. Enter a brief description of the applicable and effective tasks.

(l) Block 15 - Periodicity. Enter the periodicity (see 3.11.5) for accomplishment of tasks in block 14.

(m) Block 16 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2).
(3) Segment 3 - enter the number 120 to indicate the Logic Tree Analysis form, followed by a slant (/).
(4) Segment 4 - enter the SWAB number from block 1.

3.7.6.7.1 Decision logic tree questions rationale and justification documentation. The rationale and justification for the answers to the decision logic tree question will be documented in free form simple narrative on plain paper sheets attached to the Logic Tree Analysis form. The rationale and justification for the questions pertinent to each functional failure analyzed should be identified by functional failure number and description.

3.7.7 Phase 6 - Servicing and lubrication analysis. The developer shall perform a servicing and lubrication analysis and prepare a Servicing and Lubrication Analysis form (see figure 7). Servicing and lubrication are preventive maintenance tasks that should be analyzed through the FMEA and decision logic tree processes, but since the benefits of such tasks are fairly obvious, an abbreviated analysis based on existing servicing and lubrication requirements shall be performed.

3.7.7.1 Preparation guidelines. A servicing and lubrication analysis shall be performed on all the systems and subsystems identified in phase 1. Collect existing requirements for servicing and lubrication from the appropriate MRCs and technical manuals for these systems and subsystems.

3.7.7.2 Servicing and lubrication periodicities. The RCM servicing and lubrication analysis is a simple, common sense evaluation of existing requirements to justify performance of specific tasks at specific periodicities. Current periodicities are frequently based only on manufacturers' recommendations and may be excessive. The goal here is to determine the tasks that really are applicable and effective and determine their correct periodicity. In evaluating these tasks, the following considerations should be made:

(a) Are there evidences from existing data on failed hardware of insufficient or excessive servicing or lubrication?
(b) What is the actual periodicity at which this task is really performed, and what materials and procedures are really used?
(c) Can the current method be improved?
(d) Can an approved alternative material be used? When practical, common periodicities and materials should be established so that several items can be serviced or lubricated at once and the number of different materials required can be minimized.

3.7.7.3 Selection of lubricants and hydraulic fluids. Lubricants and hydraulic fluids for hull, mechanical, and electrical equipment must be selected from the approved list in accordance with MIL-HDBK-267. Lubricants and hydraulic fluids for all other applications will be selected from the Planned Maintenance System Lubricants, Compounds, and Cleaning Agents Cross Reference Guide or OD3000.

3.7.7.4 Completing the servicing and lubrication analysis form. The Servicing and Lubrication Analysis form (see figure 7) shall be completed as follows:

(a) Block 1 - SWAB number. Enter the SWAB number of the system under analysis, as defined in phase 1 on the Master Systems and Subsystems Index, block 8.
(b) Block 2 - Nomenclature. Enter the nomenclature of the system under analysis from block 9 of the Master Systems and Subsystems Index.
(c) Block 3 - Ship class. Duplicate the entry from block 3 of the Master System and Subsystems Index.
(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, and block 7 - Revision. See instructions for the Master Systems and Subsystems Index form in 3.7.2.2d through 3.7.2.2g.
(e) Block 8 - Item and task description. Enter the nomenclature of each item and beneath that the description of each servicing and lubrication task pertinent to that item, including MRC SYSCOM control numbers where appropriate.
(f) Block 9 - Location. Enter the compartment number(s) where the task is performed.

(g) Block 10 - Quantity. Enter the quantity of the items upon which the task is performed that are installed in the system under analysis.

(h) Block 11 - Previous periodicity. Enter the most recently used periodicity for this task on this or similar items. If this is a new item, enter the manufacturer's recommendation.

(i) Block 12 - Material specification. Enter the specification and symbols of any material used; for example, oil, grease, fluid.

(j) Block 13 - Analysis decision. Enter action taken by analysis; NC-no change, OM-omit, CM-change material, CP-change procedure; and the revised periodicity, if appropriate.

(k) Block 14 - Explanation. Enter rationale and justification for the analysis decisions in block 13; outline revised procedures, and specify new materials as appropriate.

(l) Block 15 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2)
(3) Segment 3 - enter the number 121, indicating the servicing and lubrication analysis form (see figure 7), followed by a slant (/).
(4) Segment 4 - enter the SWAB number from block 1.

3.7.8 Safety related design recommendations. For safety related failure modes for which no applicable tasks exist or for which the available tasks do not provide the required levels of effectiveness, recommendations for a safety related design change must be identified and so indicated on figure 6.

3.7.9 Phase 7 - Audit and preparation of the maintenance requirement index. The developer shall assemble the phase 1 through phase 6 deliverables into a package and audit the analysis to ensure that it is complete and accurate. The developer shall indicate his quality assurance of the administrative accuracy of the forms preparation and the technical accuracy of his analysis by signing the "Reviewed By" blocks of each form. The developer shall summarize the tasks generated by preparing a maintenance requirement index form (see figure 8). This form shall be used to list all tasks for the systems identified in the logic tree analysis and the servicing and lubrication analysis. It shall reference existing MRCs that satisfy the requirments of each task, indicating clearly tasks not covered by an existing MRC, tasks requiring a combination of existing MCRs necessary to satisfy the task requirements, and revisions of existing MRCs necessary to satisfy task requirements.

3.7.9.1 Preparation guidelines. A maintenance requirement index will be prepared for each subsystem identified and approved in phase 1 of the development.

3.7.9.2 Completing the maintenance requirement index form. The maintenance requirement index form (see figure 8) shall be completed in SWAB order, with tasks listed in order of increasing periodicity, as follows:

(a) Block 1 - SWAB number. Enter the highest indenture level SWAB number for the development group assigned. If an entire group is assigned, this number is a level 1 SWAB number, a three-digit number containing two zeroes; for example, 100, 200.

(b) Block 2 - Nomenclature. Duplicate the entry on the master systems and subsystems index form, block 2.

(c) Block 3 - Ship class. Duplicate the entry on the master systems and subsystems index form, block 3.

(d) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, and block 7 - Revision. See instructions for the Master Systems and Subsystems Index form in 3.7.2.2d through 3.7.2.2g.

(e) Block 8 - Analysis reference. Enter the serial number of the form which documents the requirement for each task.

(f) Block 9 - Location. Enter the compartment number where the task will be performed (refer to additional FSI selection form, block 9).

(g) Block 10 - Equipment nomenclature (AN, MK/MOD/APL/CID) maintenance requirement. Enter the SWAB number and nomenclature of each item from the FSI index. Block 10 includes a brief description of the tasks for that equipment.

(h) Block 11 - Periodicity. Enter the periodicity for each task. Refer to the form which generated the task.

(i) Block 12 - Reference MRC. Enter the SYSCOM control numbers of MRCs that satisfy the task requirements or can be revised to do so. Indicate combinations of MRCs by prefacing the group of MRC SYSCOM control numbers with the abbreviation COMB. Indicate tasks not covered by an existing MRC with NEW. Indicate division of MRCs by prefacing the MRC SYSCOM control number with the abbreviation PART.

(j) Block 13 - Serial number. Enter a four-segment number as follows:

(1) Segment 1 - see 3.7.2.2j(1).
(2) Segment 2 - see 3.7.2.2j(2).
(3) Segment 3 - enter the number 123, indicating the maintenance requirement index form (see figure 8), followed by a slant (/).
(4) Segment 4 - enter the SWAB number from block 1.

3.7.10 Phase 8 - Method study and procedure evaluation for new tasks and revised MRCs. When directed by the PMS Coordinating Activity, the developer shall perform a method study and a procedure evaluation in accordance with 3.10, for tasks not covered by existing MRCs and tasks requiring revisions of existing MRCs.

3.7.11 Phase 9 - Maintenance requirements task definition. Upon completion of phase 8 review and approval, the PMS Coordinating Activity shall direct the developer to prepare task definition forms (see figure 9). The task definition process collects sufficient information about the detailed procedures of each task so that a decision can be made as to the appropriate maintenance level organization, intermediate, or depot) to perform the tasks and to write the MRCs. The task definition form resembles an MRC verification draft, with a few extra blocks for additional information.

3.7.11.1 Preparation guidelines. Task definition forms shall be prepared for tasks generated by the decision logic tree analysis and specifically designated for further development by the PMS Coordinating Activity. The tasks so designated will be those which the PMS Coordinating Activity considers candidates for organizational level maintenance, based on information collected during the analysis. Some tasks generated by the analysis may obviously be more appropriate for off ship accomplishment and these would not be designated for task definition. They will be forwarded by the PMS Coordinating Activity to the cognizant planning authority for incorporation into ship class maintenance plans. After the task definition phase has collected more information about each remaining task, some of these will also be more appropriate for off ship accomplishment and will be forwarded to the cognizant planning authority. Selecting the echelon (organizational or off ship) that will perform each maintenance task is an integral part of the task definition process. If the task frequency required to ensure safety and mission capability requires on ship performance, the task must be assigned to the organizational level. If the task frequency permits performance by off ship resources, a choice must be made. This choice will be constrained by the ability of the ship's crew to do the task without external skills, materials, tools, or equipment.

3.7.11.2 Completing the task definition form. The Task Definition form (see figure 9) shall be completed as follows:

(a) Tasks covered by existing MRCs. For tasks covered by existing MRCs, a copy of the MRC may be attached to the task definition form in lieu of filling in blocks 9, 10, 11, 12, 13, 14, 15, 16 and 17.

(b) Block 1 - SWAB number. Duplicate the entry from block 1 of the maintenance requirement index form.

(c) Block 2 - Nomenclature. Enter the nomenclature of the item upon which the task is performed from block 2 of the maintenance requirement index form.

(d) Block 3 - Ship class. Duplicate entries from block 3 of the maintenance requirement index form.

(e) Block 4 - Prepared by, block 5 - Reviewed by, block 6 - Approved by, and block 7 - Revision. See instructions for the master systems and subsystem index form in 3.7.2.2d through 3.7.2.2g.

(f) Block 8 - Equipment SWAB and nomenclature. Enter the SWAB number and nomenclature of the item upon which the task is performed from block 10 of the maintenance requirement index form.

(g) Block 9 - Quantity installed. Enter the installed quantity of the item on which this task must be performed.

(h) Block 10 - Reference MRC. Enter the SYSCOM control number of the MRC listed in block 12 of the maintenance requirement index form.

(i) Block 11 - Maintenance requirement description (task). Enter a brief description for the tasks from block 10 of the maintenance requirement index in accordance with 3.11.10.

(j) Block 12 - Safety precautions. Enter appropriate information for this task in accordance with 3.11.11.

(k) Block 13 - Periodicity. Enter the periodicity of this task from block 11 of the maintenance requirement index form.

(l) Block 14 - Rates and man-hours (M/Hs). Enter appropriate information for this task in conformance with 3.11.6 and 3.11.7.

(m) Block 15 - Total M/Hs. Enter the sum of the M/Hs from block 14.

(n) Block 16 - Elapsed time. Enter appropriate information in block 16 (see 3.11.9).

(o) Block 17 - Tools, parts, materials, test equipment. Enter required items for this task in accordance with 3.11.12 and other specific guidance provided by the PMS Coordinating Activity.

(p) Block 18 - Procedure. Enter the appropriate step-by-step procedure for this task in conformance with 3.11.13.

(q) Block 19 - Ships crew (yes or no). Enter a YES or NO answer to the question. "Can this task be done by the ship's crew without external skills, materials, tools, or equipment?"

(r) Block 20 - Level.

(1) Enter the lowest maintenance echelon at which this task can be done.

(2) Enter the level at which it should be done, if organizational workload must be minimized.

(s) Block 21 - Location. Enter the compartment numbers of the spaces where the item on which this task is performed are located.

(t) Block 22 - Serial number. Enter a four-segment serial number as follows:

(1) Segment 1 - see 3.7.2.2.j(1).

(2) Segment 2 - see 3.7.2.2.j(2).

(3) Segment 3 - enter the number 124, indicating the task definition form (see figure 9), followed by a slant (/).

(4) Segment 4 - enter the SWAB number for the item listed in block 1, composed of the item number previously assigned in the analysis, followed by a dash (-) and a sequential task number for the item.

3.7.12 Phase 10 - Inactive Equipment Maintenance (IEM) documentation. Inactive equipment maintenance requirements documentation shall be developed and prepared. Upon completion of the IEM analysis the IEM requirements will be subjected to procedure evaluation as specified in 3.10.

3.7.12.1 Inactive equipment maintenance analysis. Inactive equipment maintenance analysis shall be the basis for determining the maintenance requirements to be performed when equipment is inactivated for periods of prolonged idleness. Maintenance requirements shall prepare the equipment for the inactive period (lay up maintenance), prevent equipment deterioration during the inactive period (periodic maintenance), prepare the equipment to become operational (start up maintenance), and ensure that the equipment is completely operational at the end of the inactive period (operational test). The analysis shall identify: the maintenance actions required, the source of the required actions, for example, from existing PMS or technical manuals, and the required procedures not available. The IEM analysis will assume that the equipment is in an operable condition when the procedures to inactivate the equipment are implemented and shall be performed using an inactive equipment maintenance requirement analysis form (see figure 11). The analysis is a continuation of the requirements investigation process. At the top of the IEM analysis form, enter the equipment item name or nomenclature, the date, and the page number. The form shall be filled out as follows:

(a) Column 1. List what degradation will occur if equipment is inactive while ship is (a) operational, and (b) in an industrial environment. For example, Regular Overhaul (ROH), Restricted Availability (RAV), modernization. Consider separately the equipment's internal workings, external surfaces, attachments, connecting lines, piping, or valves. Under the industrial environment, consider what the effects will be under conditions such as lack of power and heating or cooling problems. Consider the effects if the equipment is exposed to abnormal conditions. For example, having the bulkhead, overhead, and decking removed; or industrial work in progress in the immediate area such as welding, chipping, sandblasting, or painting.

(b) Column 2a. Considering location and equipment design, state maintenance actions with alternatives to protect and prevent degradation of the equipment under the conditions listed in column 1. As many alternatives as possible should be presented. The actions listed shall prescribe the steps necessary to lay up the equipment and maintain it in an inactive state for a period of prolonged idleness. State the actions as maintenance requirements; for example.

(1) Remove equipment and place in a protected area.
(2) Lubricate and cover exposed areas.
(3) Inactivate radar set.

(c) Column 2b. State what maintenance actions are required to reactivate equipment that has been idle for a prolonged period. Provide start-up maintenance where necessary and specify what tests are required to ensure the operational readiness of the equipment.

(d) Column 3. Considering cost and resource expenditures, determine the effectiveness of each requirement listed in column 2. State whether or not the procedure would satisfy all requirements and give the reason. Justification is required for each alternative Only the most cost effective requirement should survive the justification. Justification may recommend more than one alternative under different environmental conditions during a shutdown period.

(e) Column 4. Establish the IEM periodicity; lay up maintenance (LU), periodic maintenance (PM), start up maintenance (SU), or operational test (OT), for each requirement fully justified in column 3. A MR may be used under more than one IEM periodicity. For periodic maintenance, identify the periodicity of performance required by adding a code to the PM indicator; for example, PM(W); PM(M). Justify each periodicity decision. If a requirement is to be performed in an industrial environment only, indicate by the notation (I); for example, LU(I). This MR shall be entered on the MIP with a note to describe the circumstance.

(f) Column 5. Review and list available maintenance procedures that could satisfy the requirements justified in columns 3 and 4. Maximum use of existing maintenance procedures is required. Apply existing procedures as written or modify as necessary. Maintenance procedures requiring modifications and maintenance actions which must be developed should be flagged by circling. Indicate the source of existing procedures. Some of the sources will be technical manuals (TMs), ordnance publications (OPs), existing MRCs, or MRCs to be developed as a result of phase 9.

(g) Column 6. Assign a recommended periodicity for each requirement justified in column 4. If there are no MRs justified in column 4, indicate with the word none. This column contains the key information required in developing the IEM portion of the MIP.

(h) Column 7. This column provides a summary and check-off list of the development work required for IEM. Opposite each MR listed in column 6, indicate what must be done to complete the IEM development with one of the following:

(S) - the MR procedure exists on the PMS section of the MIP and is to be used as written.

(M) - the MR procedure exists on the operational maintenance portion of the MIP; but, the procedure for periodicity must be modified for IEM.

(N) - a complete new procedure must be developed to satisfy the MR and shall be subjected to procedure evaluation, (see 3.10).

3.7.12.2 System level IEM. Maintenance index pages that list system level tests as a combination of equipment and system level MRs shall include an IEM section. System level tests shall be preceded by the following note: "The following tests shall be scheduled for accomplishment after completion of all equipment level SU and OT."

3.7.13 Phase 11 - Unscheduled maintenance (UM). Unscheduled maintenance documentation shall be prepared only when directed by the acquisition document in accordance with the provisions of 3.9.

3.7.14 Phase 12 - Maintenance index page and maintenance requirement card development and preparation. The PMS Coordinating Activity will direct the contractor to develop verification draft MIPs and MRCs for specifically designated tasks defined in phases 9, 10, and 11. The tasks so designated will be those that the PMS Coordinating Activity determines are appropriate for organizational level accomplishment.

(a) The PMS Coordinating Activity shall provide the developer with specific guidance concerning the SWAB level (see appendix E) at which MRCs shall be assembled into MIPS. Maintenance requirement cards requiring servicing and lubrication (replenishment or replacement of consumables) shall not contain tasks requiring tests, inspections, adjustments, alinement, calibration; separate MRCs shall be prepared for these tasks.

(b) Maintenance index pages and MRCs shall be prepared as specified in 3.11 and 3.12.

3.8 RCM documentation control. The requirements investigation process will produce a multitude of documents which eventually must be assembled into a into a cohesive, understandable package. RCM documentation control sheets have been designed to provide an index of the forms completed for a development at every stage of the development. The control sheets provide a column for listing the forms prepared in a development phase by serial number, with provisions to connect related forms with straight lines to form a flow chart of that development. The completed control sheets list serial numbers of all documents in the development package and shall relate each form to its predecessor and successors in the analysis (see figure 24).

3.8.1 Completing the RCM documentation control sheet. The RCM documentation control sheet (see figure 10) shall be completed as follows:

(a) Block 1 - Development group. Enter the development group number and name.

(b) Block 2 - Ship/class. Enter the class or ship hull number upon which the development is based.

(c) Block 3 - Developer. Enter the developing organization name.

(d) Block 4 - Contract number. Enter the contract number under which this development was conducted, if applicable.

(e) Block 5 - Revision. Enter ORIGINAL, or A, B, or C for subsequent revisions of the development.

(f) Block 6 - Date. Enter the date when the entire development was completed or revised.

(g) Phase 1. Enter 114, the last three segments of the Master Systems and Subsystems Index form serial number.

(h) Phase 2. Enter 116, the last three segments of the FFA form serial number.

(i) Phase 3. Enter 117, in the left column, adjacent to the FFA form serial number for the system or subsystem containing the FSI candidate, the last three segments of the FSI Selection form serial number. If an FSI candidate was not selected as an FSI and not listed on the FSI index, enter NSI below or to the right of the FSI Selection form serial number. Enter 118, in the right column, above or below the horizontal line between the FFA form and FSI form serial number, the last three segments of the FSI index form serial number prepared for each subdivision. Draw connecting lines between related FFA form and FSI Selection form serial numbers.

(j) Phase 4. Enter 119, the last three segments of the FMEA form serial number, adjacent to the associated FSI Selection form serial number for the items. Draw connecting lines between the FSI Selection form and FMEA form serial numbers. If none of the functional failures of an item were selected for further analysis, enter TERMINATED, below or to the right of the FMEA form serial number for the item.

(k) Phase 5. Enter 120, in the left column, the last three segments of the Logic Tree Analysis form serial number. Align with associated FMEA serial numbers for each item. Draw connecting lines to the associated FMEA serial number. If the logic tree analysis did not determine a requirement for any tasks related to the item, enter NO TASKS below or to the right of the Logic Tree Analysis form serial number. If safety related design change recommendations were submitted, enter 122, in the right column, the last three segments of the form serial number of such recommendations, adjacent but not on the same line as the Logic Tree Analysis form serial number.

(l) Phase 6. Enter 121, the last three segments of the Servicing and Lubrication Analysis form serial number. Horizontally align with the FSI Index form serial number for the associated system and subsystem. If no servicing and lubrication tasks (see 6.3.25) were required, enter NO TASKS below or to the right of the Servicing and Lubrication Analysis form serial number.

(m) Phase 7. Enter 123, the last three segments of the Maintenance Requirement Index form serial number. Horizontally align with the entry in the Phase 1 column for the system and subsystems.

(n) Phase 9. Enter 124, the last three segments of the Task Definition form serial number. Enter adjacent to the RCM Logic Tree Analysis form serial number or alined with the Servicing and Lubrication Analysis form serial number that determined the task was required. Draw connecting lines to appropriate serial numbers. If no MRC was prepared for a task definition, enter NO MRC below or to the right of the task definition form serial number.

(o) Phase 12. Enter in the left column, the SYSCOM MRC control number of each MRC prepared during this phase. Align with the associated task definition form serial number and draw connecting lines. Enter the MIP number for each group of MRCs in the right column. Draw connecting lines between the MIP numbers and associated SYSCOM MRC control numbers.

3.8.2 Deliverables. The developer shall assemble and deliver to the PMS Coordinating Activity, a final documentation package in accordance with the data ordering document specified in the acquisition document (see 6.2.2 through and including 6.2.2.2.

3.9 Development of UM analysis and requirement tasks. The acquisition document (see 6.2.1) shall specify the procedures for determination of UM analysis and requirement tasks. The UM requirement task, shall be documented on MRCs and MIPs as specified in 3.11.22 and 3.12.16.

3.9.1 Functions of the UM. Unscheduled maintenance requirements are those documented actions required to return system or equipment to an operational condition within predetermined tolerances or limitations. Unscheduled maintenance actions evolve from system or equipment failures or other indications of system or equipment degradation. Unscheduled maintenance includes alignment, adjustment, replacement, and repair procedures. Testing and other actions, such as "open and inspect," not required as scheduled maintenance actions may also be included as part of the UM. Unscheduled maintenance shall not include maintenance actions which must be scheduled for performance on a repetitive basis; for example, an alignment or adjustment that must be accomplished monthly would be classified as scheduled maintenance and would be included within the scheduled MIP/MRCs.

3.9.2 Unscheduled maintenance documentation. Unscheduled maintenance procedures are documented on unscheduled MRCs (UMRCs) designated by a U periodicity. Unscheduled maintenance requirement cards will be listed on separate MIPs itemizing only UM procedures. However, UMRCs may be included on the same MIP as scheduled MRCs when approved by the PMS Coordinating Activity.

3.10 Procedure evaluation. Each MR that evolves from the requirements investigation process (see 3.6) or IEM (see 3.7.12) shall be subjected to a procedure evaluation. The procedure evaluation is a method study technique that will:

(a) Determine the most practical method of accomplishing the task.
(b) Ensure that possible hazards and their elimination are considered.
(c) Ensure that the procedure developed is the best from an engineering standpoint commensurate with resources available to the user.
(d) Ensure that actions that do not support accomplishment of the MR are eliminated.

3.10.1 Methodology for conducting the study. The methodology for conducting the method study is contained in the following paragraphs:

3.10.1.1 Procedure evaluation sheet (PES). The method study shall be documented on PES (see figure 12). A PES shall be prepared for each MR that is to be developed. When more than one page is required, the PES may include continuation pages. The PES may be handwritten or printed with a black pen. Heading information shall be completed across the top of the PES as follows:

(a) SHIP SYSTEM, SUBSYSTEM OR EQUIPMENT BLOCK. Enter the nomenclature of the ship system, subsystem, or equipment.
(b) ACTIVITY/CONTRACT NO. BLOCK. Enter the activity or contract number.
(c) LOCAL CONTROL NO. BLOCK. Enter the local control number.
(d) DATE AND PAGE BLOCK. Enter the date and page number.
(e) MRC CODE BLOCK. Enter the MRC code.

(f) DEVELOPER BLOCK. Enter the developer of the PES.

(g) MAINTENANCE REQUIREMENT DESCRIPTION BLOCK. Enter a description of the maintenance requirement. NOTE: When filling in the following information, the entries in all the columns must be related. For example, the entries in the SYMBOL, TIME, EXAMINATION, etc., columns must be related to the entry in the first line in the PRESENT METHOD column.

3.10.2 Record column. Maintenance requirements shall be method studied in periodicity sequence as established by maintenance analysis. More frequent periodicities shall be method studied first; for example, weekly requirements before monthly requirements.

3.10.2.1 Present method column. A step-by-step method required to accomplish the MR stated in PES heading shall be entered. When available, previously developed methods shall be used. If there are no previously developed methods, a proposed method shall be entered.

3.10.2.2 Symbol column. Each step in the present method column shall be carefully examined to determine primary and secondary action. Primary actions are limited to the step or steps which actually accomplish the maintenance action described in the MR. For example, for the MR "Lubricate Pedestal Bearing," only the steps actually pertaining to the lubrication of the bearing are primary actions. All other steps that support the accomplishment of the primary action are considered secondary actions. The appropriate operation processing chart (OPC) symbol of ◯ for an operation and ☐ for an inspection shall be recorded after each corresponding step in the method. Larger symbols shall be used to identify each major step and small symbols to identify substeps. Each symbol shall be numbered according to the type of symbol; for example, ① ② ③ [1] ④ ⑤ ⑥ [2] [3] indicating six operation actions and three inspection actions.

3.10.2.3 Time column. Opposite each action symbol, enter the estimated or observed time to perform the action in minutes and seconds.

3.10.3 Examination column. The method that is recorded in the first column of the PES shall undergo close analysis and be exposed to extensive what, where, when, how, and why questioning.

(a) Once each primary action contained in the present method has been determined, the following questions shall be asked to assist in determining the answers to the basic five questions:

(1) What is accomplished (by the action in the procedure, not the MR description)?
(2) Why should it be done (the action in the procedure)?
(3) Could anything else be done that would satisfy why it should be done (the action in the procedure)?
(4) Where is it being done? Why at that particular place?
(5) When should it be done (in the procedure, not the periodicity of the MR description)?
(6) Why then (in that sequence of the procedure)?
(7) Could it advantageously be done anywhere else (in the procedure)?

(8) How is it done (the manner in which it is performed in the procedure)?
(9) Why is it done that way (in the procedure)?
(10) Is there a better way that it could be done?

(b) Answers and remarks to questions about primary actions in the present procedure shall be brief statements only, and not improved steps or procedures. Statements shall be entered that may assist in developing a better step or procedure in the create and develop phase of the PES. Entries are not required on the PES for a step in the present procedure which remains unchanged after questioning, but entries pertaining to elimination or changes to procedural steps shall be entered to the right of the symbol reflecting the present procedural action. When the questioning and the entering of remarks has been completed for each primary action in the present procedure, remaining secondary actions in the procedure shall be examined to see how they have been affected. Elimination of primary actions should eliminate or change most supporting steps. Any secondary actions remaining in the present method column shall be questioned for necessity and appropriate remarks entered in the examination column of the PES.

3.10.3.1 Examination checkoff. Before proceeding to the final phase of the method study, significant points of the examination shall be reviewed. The following statements shall serve as a checkoff for these points:

(a) The primary actions of the present method have been identified and analyzed, and pertinent remarks have been noted on the PES.
(b) Secondary actions of the present method have been examined for their necessity, and pertinent remarks have been noted on the PES.
(c) Questioning of all facets in the present method has been concerned with the procedure for accomplishing the MR and not the MR description itself.

3.10.4 Create and develop columns. The maintenance procedure and all other data elements for an MRC shall be created and developed in this final phase of method study.

(a) A step-by-step maintenance procedure for accomplishing the MR by a new "improved" method shall be developed and entered on the PES. Information shall be entered for each procedure pertaining to: time, tools, parts, materials, and test equipment; warnings, cautions, notes; related maintenance, and the number of men and their skill levels.

3.10.4.1 Improved method column. Develop the new procedure by:

(a) Eliminating unnecessary steps in the procedure which do not support the accomplishment of the primary actions.
(b) Simplifying tasks.
(c) Changing the sequence or rearranging actions.
(d) Combining tasks when possible.

3.10.4.1.1 Procedural modification. As the new procedure is developed, it shall be entered by symbols in the Symbol column. Symbols and respective items shall be transferred from the record columns to the create and develop columns for steps that are not eliminated. A no change note shall be entered when a step remains the same in the improved method. When steps are combined, the word combine shall be entered in the improved method column. A step that is simplified shall be entered in the simplified version with its symbol and number from the Record column and the new time entered as appropriate.

3.10.4.2 Time. Enter the time, in minutes and seconds, for each step in the procedure as it is developed. The time shall be entered immediately to the right of the symbol for the step developed. When the improved method is completed, the time entered for each step shall be totaled by rate on the last PES. The total shall be converted to hours and tenths of hours. This time shall appear on an MRC to indicate the time required for each rate involved to perform the procedure in the improved method. When MRs of the same periodicity utilize similar procedures and the total elapsed time does not exceed 3.5 hours they shall be documented on the same MRC.

3.10.4.3 Tools, parts, materials, and test equipment. Across from each applicable step in the procedure being developed, indicate the tools, parts, materials, and test equipment necessary to accomplish the maintenance (see 3.11.12).

3.10.4.4 Warnings, cautions and notes. Warnings, cautions, and notes shall be entered horizontally across from the applicable procedural step on the PES and shall be used as specified in 3.11.1.11, 3.11.13.2, and 3.11.13.3.

3.10.4.5 Related maintenance. The purpose of this phase of the method study is to identify related maintenance. A maintenance action is related when one or more of the following conditions exist:

(a) If a maintenance action can be performed before, in conjunction with, or immediately after the task described in the MRC, resulting in a substantial savings in time.
(b) If the equipment can be opened once for the accomplishment of more than one MR.

3.10.4.5.1 Related maintenance types. There are two types of related maintenance:

(a) A mandatory related maintenance action that must be performed concurrently or in conjunction with another maintenance action because it is an integral part of that procedure.
(b) A convenience related maintenance action that may be performed concurrently to effect a savings in M/Hs or materials.

3.10.4.5.2 Criteria. To be classified as related maintenance, the following criteria shall apply:

(a) When scheduled concurrently or in conjunction with another task, the execution of the related maintenance shall yield a savings of manpower or material resources.

(b) Related maintenance may be used to take advantage of procedural steps from another MRC which would otherwise be repetitious. This is especially true for procedures available as situation requirements or UM.

(c) The periodicity of the requirement under development shall be equal to or less frequent than the related requirement. For example, an annual requirement may have a quarterly requirement specified as related maintenance, but the quarterly (more frequent) requirement cannot specify the annual requirement as related maintenance. Performance of the annual requirement each time the quarterly requirement is accomplished would in effect make the annual MRC a quarterly MRC.

(d) A complete situation requirement MRC (see 3.11.5.3) may be related to periodic MRCs when the situation requirement is applicable to more than one periodic MRC within the MIP. To qualify, the situation requirement must avoid lengthy redundant procedures; for example, a lengthy turn on procedure for a combat system may be documented on a situation requirement MRC and be related to several periodic MRCs.

(e) Reference to another MRC for conditional use is not related maintenance. For example, reference to another MRC for corrective action when performance of a procedure does not meet a tolerance requirement is not related maintenance.

(f) Related maintenance requirements shall normally be from the same MIP. To relate MRCs from another MIP, approval of the PMS Coordinating Activity shall be obtained.

3.10.4.5.3 Determining and identifying related maintenance. Related maintenance information shall be investigated and sought throughout the development cycle of maintenance procedures. When a documented related maintenance requirement exists that may avoid repetition of a lengthy action description, it shall be identified in the related maintenance column of the PES. Also to be considered and entered as related maintenance are tasks which, in part, do or re-do some of the steps of the task being developed and through proper identification would result in a savings of manpower or material resources. Related maintenance procedures may be available within an MRC set, or may be available within MRCs listed on other scheduled or unscheduled MIPs. Related maintenanace shall be determined and identified as follows:

3.10.4.5.3.1 More frequent periodicity MRs. A MR with the more frequent periodicity requirement shall be method studied before those of less frequent periodicities (see 3.10.2). When this sequence is followed, certain repetitive maintenance actions will either appear in more than one procedure, or similar (closely related) actions will become evident. In either case, these actions shall be analyzed to determine if the procedures in which they appear can be classed as "related maintenance requirements." The MR with the less frequent periodicity shall identify the periodicity code of the more frequent requirement as the related maintenance requirement so that proper advantage can be taken during scheduling of the requirements. The periodicity code; for example, W-1, S-2, of the more frequent periodicity shall be entered on the PES when it has been determined:

(a) That a bonafide relationship with a savings in M/H or material exists.
(b) The procedure under development is of a less frequent periodicity. When no related maintenance items are applicable, the word none shall be entered in the related maintenance column on the PES.

3.10.4.5.3.2 Related maintenance requirements. Related maintenance requirements shall be identified by the MRC code in the tools, parts, materials, test equipment block; for example, MRC EL-12:M-8; and, if required, in the procedural step of the MRC that will be developed from the PES. When it is important that the related task be accomplished at a specific point in the procedure, that action shall be included as a procedural step, for example, adjust flyback contact assembly as described on MRC EL-12:M-8. In addition to relating maintenance actions to effect a savings in M/H or material, maintenance may be related to take advantage of steps which would otherwise become repetitious. This is especially true for procedures available as situation requirements or UM requirements. When the repetitious procedure is less than 10 procedural steps in length, it shall be repeated in the subject procedure rather than referred to as related. When the accomplishment of the related maintenance is mandatory because it contributes directly to the maintenance described on the MRC being developed, it shall be identified on the MIP by the symbol # following the periodicity entered in the related maintenance column.

3.10.4.6 Number of men and rate. As each step is being developed in the improved method, determine an appropriate rate (see 3.11.6) associated with the procedural step and enter the rate and the quantity of men required in the rate column on the PES.

3.11 Preparation of MRC verification draft. For each development or redevelopment, the PMSDA shall submit to the PMS Coordinating Activity a verification draft of each MRC in accordance with the data ordering document specified in the contract or purchase order (see 6.2.2.). The verification draft shall be in the format of the appropriate form (see figures 15, 16, and 17). Although the verification draft shall be typed, strike overs or the correction of minor errors will be acceptable. The MRC verification draft shall comply with the following.

3.11.1 Style of text. Text shall be prepared in accordance with the style specified in the following paragraphs and in appendices A through D.

3.11.1.1 Wording of text. The procedural steps shall be factual, clear, concise, and not susceptible to misinterpretation (see appendix A). This includes, but is not limited to, the following requirements:

(a) Omit theory.
(b) Where possible, avoid phraseology requiring specialized knowledge. Technical phraseology will be used only when no other word or phrase will convey the intended meaning.
(c) Avoid superfluous words and phrases.

(d) Specify limits. When a measurement or adjustment is called for, the optimum value will be stated followed by a range if applicable; for example, 2000 (1995 or 2050) yards.

(e) Normally, removal and installation procedures shall be complete. Instructions such as reverse removal procedures shall not be used. If a removal or installation procedure is obvious, the primary step shall be given as a command; the details shall not be required. For example, the phrase, "Remove attaching bolts," is sufficient when the method of removal will be obvious to the technician.

3.11.1.2 Grammatical person and mode. The second person imperative shall be used for operational procedures; for example, "Remove rammer tank fluid filler can". The third person indicative shall be used for description and discussion; for example, "Ground indicator light will flash when position of S2 is changed".

3.11.1.3 Level of writing. The wording of MRCs shall be for a technician who has a reading ability and comprehension that corresponds to the training experience level of the rate required to accomplish the task.

3.11.1.4 Consistency. An MRC set shall be prepared to assure consistency and continuity of content.

3.11.1.5 Use of numerals. Use of numerals shall be in accordance with appendix C.

3.11.1.6 Nomenclature. Official nomenclature shall be used if assigned. Nomenclature shall be used to provide a consistent description of procedures and equipment. The following requirements will apply:

(a) Nomenclature consistency shall be maintained; for example, a part identified as a cover shall not be identified thereafter as a plate.

(b) Nomenclature and item name used in the text shall agree with nomenclature and item name on related engineering and design drawings and on identification plates, except it shall be used in its normal reading sequence; for example, Radar Set AN/SPG-55B.

(c) When nomenclature is other than official, lowercase letters shall be used; for example, parallax corrector, motor generator, antenna coupler.

(d) When two or more items have the same nomenclature, a modifier shall be added to clearly define the function of each item, its distinctive physical properties, or both; for example, signal data converter and frequency converter.

(e) The first time an equipment item appears, it shall be identified fully. Further references may omit official nomenclature modifiers where there is no possibility of confusion; for example, the name Missile Test Set Mk 1 Mod 1 introduces the equipment by its official nomenclature. Thereafter, the mark and mod designations may be omitted.

(f) Where more than one mod of equipment is described, each mod shall be indicated; for example, Magazine Mk 6 Mods 0 and 1.

3.11.1.7 Capitalization and punctuation. Unless otherwise specified herein, the United States Government Printing Office Style Manual shall be used as a guide for capitalization and punctuation (see appendices C and D).

3.11.1.8 Spelling. Unless otherwise specified herein, the United States Government Printing Office Style Manual shall be the authority for spelling. Words not in the style manual shall be spelled in accordance with Webster's New International Dictionary.

3.11.1.9 Abbreviations. The use of abbreviations shall be avoided whenever possible. If it is necessary to use an abbreviation, the only abbreviations employed shall be those in common usage and not subject to misinterpretation. Abbreviations that are not in common use and are to be used frequently in a MRC should be clarified when first used by spelling out the word or complete phrase, followed by the abbreviation in parentheses. Abbreviations shall be in accordance with MIL-STD-12, where applicable. Abbreviations not included in the MIL-STD-12 shall:

(a) Reflect general Navy usage.
(b) Be used when no doubt exists as to the interpretation by the rating specified on the MRC.
(c) Be approved by the PMS Coordinating Activity.

3.11.1.10 Signs and symbols. Signs and symbols shall be as listed in the United States Government Printing Office Style Manual. The following rules shall be observed in the use of symbols:

(a) Fire control symbols shall be in accordance with NAVSEA OP 1700. Deviations or extensions of these symbols require prior approval by the PMS Coordinating Activity.
(b) Chemical symbols shall not be used unless they form part of the nomenclature. In lieu of symbols, chemical names such as carbon dioxide and hydrogen peroxide shall be used.
(c) Graphic symbols shall be in accordance with ANSI Y32.2 for electrical and electronic diagrams, MIL-STD-17-1 and MIL-STD-17-2 for mechanical parts, and ANSI Y32.14 for logic diagrams.
(d) Reference symbols and designations for electrical and electronic parts and assemblies shall be as marked on the equipment (see 3.11.2.1). When not marked on the equipment, they shall be as specified in ANSI Y14.15, Y32.16 and supplements thereto.

3.11.1.11 Warnings, cautions, and notes. Warnings, cautions, and notes shall be used as adjuncts to the text and shall be used as sparingly as possible consistent with safety. Warnings, cautions, and notes are outlined as follows:

(a) WARNING: A statement used to call attention to an operating procedure or practice that, if not correctly followed, could result in injury or death.

(1) Warnings shall be listed in the safety precautions block (see 3.11.11).
(2) Warnings shall be repeated verbatim immediately preceding each step for the procedures involved.
(3) Warnings shall be in the same order in the safety precautions block as they appear in the procedure block.
(4) Maintenance steps that include safety procedures within the step need not be repeated as a warning or listed in the safety precautions block.
(5) Warnings shall not contain procedural steps.

(b) CAUTION: A statement used to call attention to a maintenance action that, if not correctly followed could result in equipment damage.

(1) Cautions shall precede the instruction for the procedure involved but shall not appear in the safety precautions block.

(c) NOTE: Any helpful information that will improve, facilitate, or provide supporting data for a task.

(1) Notes shall not contain procedural steps.
(2) Notes shall be used to amplify R periodicity codes (see 3.11.5.3).
(3) Notes shall be used to continue entries too numerous for the space provided by one of the fixed blocks (see 3.11.13.2).
(4) Notes shall normally precede the text to which they apply. Notes may follow the text if required for clarity. The only exception to this rule is that notes must precede alternate procedures (see 3.11.13.8).

3.11.2 References.

3.11.2.1 Equipment marking references. References to identifying numbers, switch positions, and panel markings shall be exactly as marked on the equipment; for example, spelling, abbreviations and capitalization. Where necessary, explanations of these markings may be included.

3.11.2.2 Figure references. The text shall refer to figures which support it. Figures shall be assigned figure numbers (see 3.14.5.1). When reference is made to a figure, the reference shall be to the figure number. Figures shall be numbered sequentially starting with figure 1 within each MRC.

3.11.2.3 Health hazard precaution data references. When hazardous chemicals or other adverse health factors are present in the environment or will appear during the use of the equipment and these health hazards cannot be eliminated, appropriate warnings shall be included. Necessary protective devices for personnel shall be listed on the MRC in the tools, parts, materials, test equipment block.

3.11.2.4 Figure item references. Where references are made in a given procedure to several items in the same figure, the figure number need be given only at the beginning of the references. Index numbers, letters, or reference symbols of the references shall be placed in parentheses in the body of the text where pertinent. Care shall be taken that such references are entirely clear.

3.11.2.5 Measurement references. References to units of measurement shall be specified in the same units to which the equipment was designed.

3.11.2.6 Model references. The procedural steps shall refer only to equipment covered by the MRC. To facilitate later incorporation of additional models, references to model designations or other unique identifiers shall be held to a minimum consistent with clarity. Any such references made shall be expressed in definite terms, such as model designation, part number, serial number range, or similar means. Such terminology as "on early serial numbers" or "on some late models" is not acceptable.

3.11.2.7 Other publication references. Each PMS MIP and MRC set shall be a complete, self-contained maintenance entity. Unless otherwise required herein, reference to other publications or instructions shall be approved by the PMS Coordinating Activity before inclusion in an MRC. References shall be restricted to an extreme minimum so that each MRC shall present a complete planned maintenance tool.

3.11.2.8 Maintenance requirement card references. When reference is made to text elsewhere within the MRC or to other MRCs, it shall be as specified in 3.11.13.4.

3.11.2.9 Specification and standard references. When a Government or military specification or standard is referenced, only the basic number shall be used. The revision letter-suffix shall be omitted unless it is essential. For example: P-C-444, MIL-C-5020, and MIL-STD-105.

3.11.2.10 Table references. When reference is made to tables, the reference shall be to the table number. Tables shall be numbered sequentially starting with table 1 within each MRC.

3.11.2.11 Temperature references. Temperature readings shall be written as indicated on the related instrument.

3.11.2.12 Tools, parts, materials, and test equipment references. All portable and non-installed tools, parts, materials, and test equipment required for the maintenance procedures on the MRC shall be listed under appropriate heading in the tools, parts, materials, test equipment block on the MRC.

3.11.3 Locator cards for classified MRCs. An unclassified single page locator card (see figure 25) shall be prepared for each classified MRC. The locator card shall be a duplicate of the classified MRC in all blocks except the procedure block. An exception to this rule is when entries in the tools, parts, materials, test equipment block compromise security. For example, a signal generator is listed among the test equipment required; the signal generator operates at a frequency which must be in the frequency of the prime

equipment, and the frequency of the prime equipment is classified. In cases of this type, the only entry in the tools, parts, materials, test equipment block will be the phrase, "See classified MRC." The procedure block shall include notes that are an extension of the data in the MRC Code and Rates M/H block. One of the following statements shall appear in the procedure block:

Maintenance procedure with the requirement is CONFIDENTIAL.
Maintenance requirement card is stowed in _____.

Maintenance procedure with this requirement is SECRET.
Maintenance requirement card is stowed in _____.

(a) If the periodicity code contains an R (see 3.11.5.3), a note explaining when the requirement is to be accomplished shall be in the first entry in the procedure block unless a note is necessary to extend entries in the MRC code and rates M/H blocks (see 3.11.5 and 3.11.6), in which case it would be the second entry.

3.11.4 Ship system, system, subsystem and equipment blocks. These blocks shall be filled in as specified in the following paragraphs. SWAB level nomenclature and numbers shall be as specified in 3.6.5.

3.11.4.1 Ship system block. Enter the SWAB level 2 nomenclature and number (see 3.6.5) for the functional group containing the item to which the MRC is applicable.

3.11.4.2 System block. Enter the SWAB level 3 nomenclature and number for the system containing the item to which the MRC is applicable.

3.11.4.3 Subsystem block. Enter the SWAB level 4 nomenclature and number for the subsystem containing the item to which the MRC is applicable.

3.11.4.4 Equipment block. Enter the SWAB level 5 nomenclature, the number of the equipment or component to which the MRC is applicable and the CDC. If the MRC is applicable to the entire subsystem or system, enter SWAB level 4, or level 3 nomenclature and number as appropriate.

3.11.5 Maintenance requirement card code block. Enter a two-segment code; for example, 4416 Q-2, 7211 Q-1, or A-100 Q-1. The first segment is the MIP series code which will be provided by the applicable PMS Coordinating Activity. MRCs applicable to more than one MIP series will have each MIP series entered in this block. If more than four MIP series are applicable, reference shall be made to a note. The note shall be numbered and appear in the procedure block block to provide the additional information. The second segment is the maintenance requirement periodicity code. The following are the only authorized periodicities:

(a) Calendar periodicity.

D - daily	S - semiannually
2D - every 2 days	A - annually
3D - every 3 days	18M - each 18 months
W - weekly	24M - each 24 months
2W - every 2 weeks	30M - each 30 months
M - monthly	36M - each 36 months
2M - every 2 months	48M - each 48 months
Q - quarterly	54M - each 54 months
	60M - each 60 months

(1) Calendar periodicities may be extended in 6-month increments. For example: 66M, 72M, 78M, and so forth, up to the scheduled modernization for applicable ship classes in the extended operability cycle program.

(b) Non-calendar periodicity.

R - situation requirement
U - unscheduled maintenance

(c) Inactive equipment maintenance.

LU - lay-up maintenance
PM - periodic maintenance
SU - start-up maintenance
OT - Operational test

3.11.5.1 Periodicity numbering. When more than one MRC is prepared with the same periodicity for the same equipment or system, each shall be coded individually; for example, D-1, D-2, D-3. Note that each MRC is assigned a periodicity code; however, one MRC may consist of several pages and include more than one MR. It is not acceptable to have two identically numbered periodicity codes; for example, W-2, W-2R or R-1, R-1W. When development analysis reveals that a system or equipment should be tested in several modes or configurations and each test can utilize the same procedure, it is unnecessary to provide several MRCs for each mode or configuration. For example, a communication receiver is to be tested to see if it has sufficient sensitivity in each of six frequency bands. The test procedure is the same for each frequency, but the switch setup, the test equipment required, and the desired meter indication may vary from band to band. The following method shall then be used:

(a) Develop one MRC to provide the step-by-step procedures.
(b) Assign the periodicity determined during requirements analysis, but change it to include all the accomplishments required by the varying equipment setup; for example, for a weekly requirement consisting of six separate tests which are to be scheduled individually to ensure all modes are tested, periodicity codes of W-1 through W-6 are assigned to the six MRCs.
(c) Include in the preliminary procedure a matrix or a note which associates each test with the proper equipment and parameters.

3.11.5.2 Dual periodicity. When configuration, environmental, or utility differences of a permanent nature exist between installations of the same system or equipment, a dual periodicity may be assigned if no other aspects of the MRC requires modification to fit both periodicities; for example:

(a) Equipment installed in a surface unit may see daily use, while the same equipment installed in a submarine may be idle for long periods of time because of the nature of the ship's mission. This long period of idleness may make it unnecessary to perform some MRs as frequently as in other installations. In this case, a dual periodicity such as M-1/Q-1 or Q-1/S-2 may be assigned.

(b) The paper tape unit of the input and output console in the TARTAR configuration is used much more frequently than the same paper tape unit in the TERRIER configuration. To prevent burdening the TERRIER maintenance technicians unnecessarily, a dual periodicity may be assigned to the paper tape unit MRs; for example, M-2/Q-3.

(c) Equipment is installed on the weather deck in one ship class, but is installed within a protected space in another ship class. To prevent excessive maintenance in the protected environment, a dual periodicity may be assigned; for example, W-1/M-1.

(d) Dual periodicities may also be assigned when ships operational tempo may allow reduced periodicities under specific conditions; for example, a test should be performed daily at sea but may only need be performed weekly in port. Likewise, some MRCs may be allowed to be performed less frequently when the ship is operating in CONUS than when the ship is deployed. Whenever dual periodicities are assigned, a note is required on the MIP and MRC to explain the conditions governing the dual periodicities. For example, for an M-1/Q-1, write: NOTE: SSBN, schedule quarterly; all others, schedule monthly. Delete unrequired periodicity by drawing a line through it. For a D-1/W-1, write: NOTE: Accomplish daily when deployed and weekly when in CONUS.

3.11.5.3 R periodicity. Calendar periodicities shall be assigned when possible. Requirements which cannot be scheduled on a calendar basis shall be assigned the situation requirement periodicity R. For example, maintenance actions required prior to cold weather operations, pre-firing tests, or inspection of a shaft and propeller when a boat is hoisted aboard. Situation requirements may also be used for procedures that are applicable to more than one MRC within the MIP. For example, a lengthy turn-on or shut-down procedure used with a number of MRCs. Situation requirements shall be explained in a note on MIPs and MRCs. The situation requirement code may also be used with a calendar periodicity for certain situations. These situations fall within two general categories:

(a) When the situation governs the scheduling of the requirement; for example, R-1W. An example of this type of requirement is a lubrication action that must be performed weekly when a ship is at sea, but is not required while the equipment is idle during an in-port period. This situation calendar requirement would be assigned a code of R-1W, and a note on the MIP and MRC would specify the following NOTE: When at sea, accomplish weekly.

(b) When the calendar periodicity governs the scheduling of the requirement; for example, Q-2R. The Q indicates that the longest time between accomplishment is quarterly and the requirement would be scheduled once each quarter. However, a situation could arise which would dictate that the requirement be accomplished other than as scheduled by the calendar code. When the situation was removed, scheduling would revert to the calendar basis. The calendar situation combination requires a note to explain the situation combination on the MIP and the MRC. The following are some examples of combination calendar and situation requirements:

(1) Quarterly or after every 600 hours, whichever occurs first
(2) Monthly or after each use
(3) Semiannually or after each upkeep period
(4) Weekly or before getting underway, whichever occurs first

3.11.5.4 U periodicity. Unscheduled MRCs shall use the letter prefix designator U for the periodicity code. An MRC with a U periodicity should not be scheduled in conjunction with a calendar or R periodicity. For equipment with 100 or more UMRCs, the first 99 MRCs shall be numbered U-1 through U-99 and the remaining shall be numbered using a two-character alphanumeric sequence numbering system. This system shall use the letters A through Z, excluding I and O, as the first character and the number 0 through 9 as the second character; for example, U-A0, U-A1, U-A9 and U-B0 instead of U-100, U-101, U-109, and U-110. Adjustment and alignment unscheduled MRCs will begin with U-1 and shall be numbered sequentially. The arrangement of the adjustment and alignment unscheduled UMRCs will be in a sequence to allow for the complete realignment of the equipment if required.

3.11.5.5 Inactive equipment maintenance periodicity. Maintenance requirement cards developed expressly for IEM will be assigned a periodicity code of LU, PM, SU, or OT, as appropriate (see 3.7.12).

3.11.6 Rates block. Identify and enter, by rate and rating, the number of persons required to perform the MR. Entries in this block shall be made as follows:

(a) The Navy Enlisted Classification (NEC) shall be entered if special skills are required. Appropriate special skill codes shall be determined by reviewing section II of NAVPERS 18068D.
(b) When both NEC and rates are important to the task, both shall be included. For example: GM2, with the NEC 0876 listed beneath the rate.
(c) A commissioned officer or warrant officer may be required to be present or available for a specific task indicated in a maintenance procedure. Titles for officers shall be the first entry in the block when applicable; for example, DCA, EMO, Eng Off.
(d) In cases where more than one rating is required, ratings shall be listed after the officers descending by rate within each rating category; for example, Eng. Off., BT1, BT2, DS2, MM1, MM2.

(e) When more than one person is required for a particular rate, the appropriate number shall precede the rate; for example, 2MR1, 2ST1, 3ET2. When two or more persons of the same rate are required and their time requirements are not equal, each person shall be listed separately. When additional personnel are required because of safety regulations, the rate and number of such personnel shall also be included.

(f) In cases where either of two similar rates can be assigned the work on an MRC, both rates shall be listed, separated by a slash. For example: BT/BR1, DS/ET1, GMG/FTG2, MM/BR2, ST/ET2.

(g) MRCs with a calendar periodicity or R periodicity shall include the necessary rates to perform the maintenance. MRCs with a U periodicity shall include rates when so directed by the PMS Coordinating Activity. Inactive equipment maintenance procedural MRCs (see 3.11.21.1) shall also include rates.

(h) In cases where more than five rate entries are required to perform the MRC, the rates block will direct the reader to a note (see 3.11.13.2).

3.11.7 Man-hours block.

(a) Man-hours (converted to hours and tenths of an hour) shall be entered immediately to the right of each rate in the rates block. When the M/H figure is less than one hour, a zero shall appear before the tenths of an hour portion; for example, 0.1, 0.4. When a commissioned officer or warrant officer is required, no M/H shall be assigned for that person.

(b) The time entered shall indicate the M/H required for each listing in rates block as if they were performing their tasks independently. When two or more of the same rate are required and their time requirements are equal, the M/H will be the sum of their requirements. When two or more persons of the same rate are required and their time requirements are not equal, each person shall be listed separately.

(c) Equipment warmup time of 30 minutes or less shall be included in the assigned M/H. Warmup time in excess of 30 minutes shall not be included unless the maintainer is required for constant observance.

(d) "Make ready" or "put away" time shall not be included in this block.

(e) When another MRC or procedure is referred to in the procedure block and only a portion of that MRC or procedure is to be accomplished, time required to do that portion shall be included in the M/H of the person accomplishing the task of the subject MRC. However, if the referenced procedure is an entire scheduled related MRC, the M/H of that MRC shall not be included.

3.11.8 Total M/H block. Total M/H shall be the sum of each entry in M/H block.

3.11.9 Elapsed time block. The entry in this block shall indicate the elapsed time, in clock hours and tenths of an hour, from start to finish of the maintenance procedure. The time involved for preparation to accomplish the task and cleanup time upon completion shall not be included. The elapsed time entry does not always duplicate the longest entry in M/H block. It may be longer when some personnel must wait for others to accomplish certain procedural steps.

3.11.10 Maintenance requirement description block. Each MR description shall be numbered. The first letter of the first word in the MR description shall be capitalized with all other words in lower case. When authorized abbreviations or proper nouns are included in the description, they shall be completely capitalized or initially capitalized as appropriate. The MR description shall be a complete sentence (second person imperative) and shall begin with an active verb; for example, inspect, test, calibrate, adjust, lubricate, clean, or replace. The description shall be as brief as possible and shall reflect precisely the task required. The description shall identify what is to be performed, leaving descriptions of performance in the procedure block.

3.11.10.1 Incidental words. Words such as disassemble, dismantle, remove, or open are incidental to accomplishment of the requirement and should appear as a step in the procedure, not in the MR description.

3.11.10.1.1 Identification of the complete maintenance action. The MR description shall clearly identify the complete maintenance action. For example: Clean and inspect sump; clean and lubricate antenna drive gears. A simple statement such as, "Clean radio transmitter," is not acceptable when the MRC procedure includes inspections not associated with cleaning the radio transmitter.

3.11.10.1.2 Intent of the maintenance task. The MR description shall reflect the intent of the maintenance task. Use of verbs describing ancillary or incidental functions to the main intent of the task is unacceptable. For example: clean off grease fittings on fire pump bearing, inject grease with a grease gun, and inspect the old grease expelled; should be described with the phrase, lubricate fire pump bearings. Do not use the phrase: Clean, inspect, and lubricate fire pump bearings.

3.11.10.2 Multiple requirements. When multiple requirements are called for on a single MRC, each specific requirement shall be identified and listed in chronological order of performance; for example:

(a) Measure preamplifier gain.
(b) Test bearing accuracy.

3.11.10.2.1 Combination of multiple actions into one requirement. Multiple actions shall be combined in one requirement only when they are so related that the accomplishment of one causes the other action to start or the actions are accomplished simultaneously. For example: 1. Clean and inspect sump; replace lube oil filter.

3.11.10.2.2 Exceptions in certain situations. An exception to this situation, however, is a MR description such as, "Inspect internal parts." This requirement includes the inspection of a quantity of individual items too numerous to attempt to cover in the MR description. Descriptive terminology is needed in the MR description for a complex system or equipment comprised of a

number of units. The overall system or equipment title may not be sufficiently descriptive enough to allow positive identification of the unit for which the MR is intended. In this case, the MR description shall include a noun name identification of the unit; for example:

1. Balance video receiver.
2. Measure audio receiver gain.
1. Calibrate transmitter program control circuits.
1. Clean and inspect motor-generators.

3.11.11 Safety precautions block. When all required safety precautions are explicitly included in technical documentation available to the maintainer, the first entry in this block shall identify that documentation by publication number and volume. For example: Observe standard safety precautions in accordance with Safety Summary in technical manual SW394-AC-MMA-010/LS10. When such assurance is not available, the first entry shall be: Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series; Shore Activities comply with Safety Precautions for Shore Activities, NAVMAT P-5100 series. When the documentation relates to a system or equipment which has no utility ashore, only the first sentence shall be entered. When utility will be shore only, the first sentence shall be omitted.

3.11.11.1 Additional warnings. Additional or more specific warnings shall follow when applicable and shall be listed in the order in which they appear in the procedure block.

3.11.11.1.1 Additional warnings requiring the use of additional personnel. For those actions which require additional personnel because of safety regulations (see 3.11.6e), the phrase "Do not work alone," shall be added to the applicable safety precaution. For example: Voltages dangerous to life are present when interlock switch is bypassed. Do not work alone.

3.11.11.1.2 Capitalization required. The first letter of the first word in each safety precaution shall be capitalized, with all other words in lower case, unless capital letters are required for another reason.

3.11.11.2 Submarine applications. In submarine application when sub-safe boundaries are to be violated, comply with current re-entry control requirements. The statement, "Comply with current QA/Sub-Safe Instructions," shall appear in this block.

3.11.11.3 Cleaning solvent. The following standard safety precaution is to be used whenever cleaning solvents are involved: Avoid prolonged contact with, or inhalation of, cleaning solvents. Avoid use near heat or open flame and provide adequate ventilation.

3.11.12 Tools, parts, materials, test equipment block. Enter and number the required test equipment, materials, parts, tools, and miscellaneous requirements, in that order (see figure 26). Each applicable category shall have a heading. Items within the category shall be numbered and identified by the applicable Standard PMS Item Name (SPIN) (see 6.4) number in brackets. When

space allows, a two-column listing shall be used. Entries in this block shall be selected from the SPIN and may be cross-referenced to the Standard PMS Materials Identification Guide (SPMIG) (see 6.4). These items are sorted into five basic categories which are defined as follows:

(a) Category 1 - Portable electrical and electronic test equipment (PEETE). Category 1 is used only for PEETE as specified in NAVSEA-TM-ST000-AA-1DX-010/PEETE. This equipment includes most general purpose PEETE that have potential PMS application. All items are assigned a sub-category code (SCAT) which groups test equipment models having the same test capability into one code. Aboard ship, the Ships Portable Electrical/Electronics Test Equipment Requirements List (SPETERL) established allowances for PEETE within each SCAT code. MRC test equipment requirements must be synchronized with the SPETERL.

(b) Category 2 - Consumables.

(1) Consumables constitute a majority of materials required to support PMS. Category 2 includes a wide range of administrative and housekeeping items which may or may not in fact be consumed in use. Some consumable items (grease, oils and solvents) are consumed each time the maintenance action is performed whereas others (pails, funnels and ladders) are not. Tools are not included in category 2 even though some tools may fit the general description of a consumable item.

(2) Examples of consumable items include ropes, rags, oil, cleaning solvents, brushes, corrosion protection agents, sealants, and protective coatings. Bulk gasket and packing materials are considered repair parts (category 3) since these are APL worthy items and must be listed on APLs. By definition, any item appearing on an APL is considered a repair part.

(c) Category 3 - Repair parts.

(1) For purposes of MRC development, repair parts are defined as any item which is an integral part of the equipment. For example: gaskets, mechanical seals, packing material, O'rings and filters. In general, any item listed in a technical manual or drawing parts list is considered a repair part. An official definition of a repair part is any item appearing on an Allowance Parts List (APL). Although in some cases repair parts will not appear on the APL, this does not necessarily mean the item is not a repair part. In fact, it is a good indication the APL may be technically deficient in that it does not list all maintenance significant repair parts.

(2) Although repair parts constitute a relatively small percentage of the total PMS MRs of a ship, they are probably the most critical of all requirements. A maintenance action requiring parts cannot be effectively completed unless those parts are readily available from an onboard

supply department stock. In many cases, the non-availability of a specific consumable, tool, equipage, or even test equipment may not jeopardize the successful completion of a maintenance action because use of alternative materials is often possible, although certainly not desirable. With respect to most repair parts, however, a specific item must be used; there are no real alternatives. The medium for identification of PMS repair part requirement to the Navy Supply System is the APL.

(d) Category 4 - Tools

(1) Category 4 covers hand tools of all types except "special tools." Special tools are by definition equipment-unique tools that are designed for a particular piece of equipment by the manufacturer. Such tools always have a manufacturer's part number and Federal Supply Code for Manufacturers (FSCM). In accordance with NAVSEA/NAVSUP policy, special tools will be listed on an APL and are, therefore, classified as repair parts.

(2) Category 4 includes common hand tools typically found in any work center tool box as well as other less common use tools. For example: precision measuring devices, dial indicators, micrometer, torque wrenches, and gages. Equipage items are category 5 even though some may be used as a tool; for example, Jacking gear.

(e) Category 5 - Equipage and special materials.

(1) Category 5 covers all equipage items as well as any other special materials not otherwise covered under categories 1 through 4. As a general rule, all items which are identified and supported through Allowance Equipage Lists (AELs) will be considered category 5. Not all category 5 items are AEL applicable. Typical examples of category 5 materials are as follows:

a. Test equipments not listed in the TEI which, therefore, do not qualify as category 1.
b. Radiac equipment or dosimeters.
c. Sound powered phones, binoculars, telescopes, boresights, and portable equipage items of all types; for example, fans, pumps or blowers.
d. Boiler feedwater testing equipment. Feedwater chemicals are category 2.
e. Lube or fuel oil sampling kits, centrifuges, and testing apparatus.
f. All items designated as controlled equipage.
g. Safety harness, lanyards, and other safety equipment.
h. Special clothing items including rubber gloves, and other items designated to protect users from chemical or toxic agents.
i. Vacuum cleaners of all types.

j. Chain falls, jacking gear devices, and other handling equipment except common hydraulic jacks which are considered category 4.
k. Special test tapes, diagnostic tapes, alignment or tapes.
l. Special connecting and adapting devices necessary to rig test equipment to prime equipment if such items are not supplied with the test equipment.
m. Special software and support documents including supplemental MRCs, equipment technical manuals, handbooks, guides, and Naval ships technical manuals.

3.11.12.1 Non-SPMIG tools, parts, materials, test equipment. Entries in the tools, parts, materials, test equipment block not covered by the SPIN or SPMIG, shall be determined and listed as follows:

(a) Electronic and electrical test equipment shall be selected from MIL-STD-1364. Test equipment will be identified by noun name, nomenclature, and SCAT code according to NAVSEA ST000-AA-IDX-010/PEETE. When SCAT codes are not established, identify by noun name, manufacturer, model number, and AEL number.
(b) Materials include lubricants, greases, solvents, cleaning agents, and other consumables, such as tape, safety tags, or pencils. Lubricants, greases, solvents, and cleaning agents will be identified by Military, Federal or Navy specification military symbol and the item name. For example: Oil, MIL-L-22851; Silicone compound, VV-D-1078. The Planned Maintenance System Lubricants, Compounds, and Cleaning Agents - Cross Reference Guide (see 6.4) shall be the source of these nomenclatures. Other consumables shall be identified in accordance with the nomenclature specified in the alphabetic index of NAVSUP Publication 4400.
(c) Parts include all repair parts such as gaskets or O-rings. Repair parts will be identified by generic name, manufacturer's part number, and the FSCM. The illustrated parts breakdown, manufacturer's pamphlets, supply catalogs, APLs, AELs are sources for these nomenclatures.
(d) Special tools such as gage pieces or thrust bars shall be identified by name, manufacturer's part number, and FSCM.
(e) Common tools shall be identified using the nomenclature format as listed in the alphabetic index of NAVSUP Publication 4400.
(f) Miscellaneous requirements such as MRCs, technical manuals, or forms, shall be identified by standard nomenclature or generic name.
(g) When the MRC procedure refers to another MRC or technical manual for a step-by-step procedure, that MRC or technical manual shall be listed.
(h) Quantities in excess of one and units of measure shall be enclosed in parenthesis following the nomenclature and complete description of the item. For example: Wrench, adjustable 8" (2); Baking soda (2 lbs).

(i) Symbols of ", ', °, and % shall be entered for inch, foot, degree, and percent. Fractions shall be typed with the numerator and denominator separated by a slash; for example, 1/2, 1/4, 1/6.

(j) The term "or equivalent" shall not be used with any item listed in the block. Equivalent items, if authorized, shall be specified as a note in the procedure block.

(k) A zero shall be placed before the decimal point when another figure does not precede the decimal. This shall occur even if there is a zero after the decimal point: for example; Wire, nonelectrical, 0.051.

(l) A national stock number (NSN) shall not be included. National stock numbers, when authorized, shall be specified as a note in the procedure block.

(m) The solvents used aboard nuclear submarines shall be in accordance with NAVSHIPS 0938-LP-011-4010. MRCs for nuclear submarine applications shall use the phrase, "approved safety cleaning solvent." For other ship applications, specific cleaners shall be identified. For documentation which will be used in both nuclear submarine and other ships, a double statement will be used; for example, Nuclear Submarines: Approved safety cleaning solvent; other ships: Solvent, P-D-680, type II.

(n) When sub-safe boundaries are to be violated in submarine applications, current re-entry control requirements shall be complied with and the Sub-Safe Re-entry Control Form - QA Form 9 (NAVSHIPS 9080/1) shall be included.

(o) When fabrication of a unique tool is required, specifications for fabrication shall be included on the MRC.

(p) Only portable and non-installed equipment required to perform the maintenance procedures shall be listed in the tools, parts, materials, and test equipment block. Installed equipment required to support the maintenance procedures shall not be listed. This equipment shall be specified in the appropriate procedural step.

(q) Each entry shall consist of one item only; for example, if an oiler with MIL-L-6068 oil is required, the oiler will be listed under the tool heading, and the oil will be listed under the material heading (see figure 26). If more than one oil is required, the procedural step shall specify which oil is required for that step.

(r) In the event that entries in this block must be continued to the second page, the heading information, Tools, Parts, Materials, Test Equipment, shall be printed on the second page.

(s) In the event that entries are to be provided by another activity; for example, SMMS Site Team, the entry will be followed by the phrase, in parentheses (see NOTE 1) and an explanation provided in the note in the procedure block (see figure 27).

3.11.13 Procedure block. This block shall contain step-by-step procedures to accomplish the MR. Entries in this block shall conform to the following standards:

(a) The language used shall be free of vague and ambiguous terms and shall use the simplest words and phrases that will convey the intended meaning.
(b) Sentence structure shall be short and concise to facilitate understanding and retention of thought. Steps shall be straightforward and simple. Steps with compound clauses shall be converted into sub-steps.
(c) Consistency in choice of words and terminology and organization of material is mandatory.
(d) Steps shall be written to consider the technical qualifications of the rating required to do the task.
(e) Inspection and measurement steps shall clearly specify limits so that a condition can be easily determined to be acceptable or unacceptable.
(f) When extensive punctuation is necessary for clarity, the step(s) shall be rewritten to eliminate that need.

3.11.13.1 Safety. Ensure that all procedures are safe. Whenever possible, maintenance actions shall be accomplished with equipment in a shutdown condition. Procedural steps directing removal of voltage or pressure shall be explicit as to which switches or valves are intended and shall include tag-out action in the same step; for example, De-energize unit and tag-out 400 Hz exciter voltages. Where components capable of holding a charge are included in the circuitry, a procedural step shall be provided to direct discharge of such components; for example, short high-voltage, high-capacitance components to ground using shorting probe.

3.11.13.2 Notes. Notes shall be used to supply needed information that is not an action step (see 3.11.1.11). Excessive verbiage shall be avoided and the note shall be limited to necessary specifics. Notes shall be sequentially numbered if there are more than one. Tolerances and clearances shall not be given as notes but shall be included in the procedural step in which they are observed.

3.11.13.2.1 Maintenance requirement cards having R periodicity code. Maintenance requirement cards having an R included in the periodicity code shall have notes as specified in 3.11.5.3. This note shall be the first item in the procedure block and also appear following the requirement on the MIP.

3.11.13.2.2 Maintenance requirement card procedural exceptions. When a block of an MRC (see figure 28) is too small to enclose all required entries, insert in parentheses the phrase, (see NOTE 1). In that note, list the entries normally made in the block. For this purpose, rates and M/H shall be considered as one block, and the total M/H and elapsed time entered in their assigned space.

3.11.13.3 Warnings and cautions. Warnings and cautions shall be included as necessary in the procedure block as specified in 3.11.1.11. Warnings and cautions shall not be numbered.

3.11.13.4 References. References to other publications shall be as specified in 3.11.2.7. References to text elsewhere within the MRC or to other MRCs shall be as follows:

(a) When writing procedural steps, it is permissible to use the phrase, "repeat step(s)." The reference shall be to procedural step numbers only; for example, repeat steps 2.d. through 2.f. to ensure accurate measurement. Unless the sequencing is very clear and understandable, the phrase, "repeat step(s)," should not be used. Repeat steps which send the reader to a step which is already a repeat step shall not be used.

(b) When certain tasks are to be accomplished in a specific sequence in the subject MRC and the procedure exists on another MRC, that task and MRC may be referenced to avoid repetition. The referenced MRC may have a calendar, R or U periodicity.

(1) When the referenced MRC is to be accomplished in its entirety, it shall:

a. Be referenced as a step in the procedure; for example; Lubricate unit as described on MRC Q-1.
b. Appear in the tools block; for example, MRC Q-1.
c. Appear in the related maintenance column on the MIP; for example, as Q-1#, with the following notation on the MIP, following the scheduling aid: # Mandatory scheduling required.

(2) When only a portion of the referenced MRC is to be accomplished and the repetitious procedure is 10 procedural steps or more in length, it shall:

a. Be referenced as a step in the procedure; for example, Accomplish steps 1.h. through 1.t. as described on MRC R-3.
b. Appear in the TEMPTE block as MRC R-3 but not in related maintenance column on the MIP since it cannot be scheduled and marked as completed.
c. Reflect the time required to accomplish that portion of the referenced MRC in the M/H block of the subject MRC.
d. Reflect in the TEMPTE block the test equipment, materials, parts, tools and miscellaneous items required to accomplish the referenced steps.

(3) When the repetitious procedure is less than 10 procedural steps in length, it shall be repeated in the subject procedure rather than referred to as related maintenance.

(c) Unscheduled maintenance requirement cards shall be referenced in scheduled MRCs when it is desirable to establish a relationship between the two. To do this, the appropriate step in the scheduled MRC shall include a statement similar to the following: If measured value is not within prescribed range, perform MRC U-2 (or steps 1.a. through 1.k. of MRC U-3) and repeat this measurement.

3.11.13.5 Fill-in blanks. Fill-in blanks are justified in the procedure when the data concerns values that vary from ship to ship due to installation or configuration variances.

(a) Two categories of blanks subject to fill-ins are acceptable for use in the Procedure block of an MRC when approved by the applicable PMS Coordinating Activity.

(1) Fill-ins for values or locations which are pertinent to the procedural step and which vary from installation to installation.

(2) Those blanks which require fill-in data to complete the blocks of a table from which other computations are made. A horizontal line of the appropriate length shall be inserted in the proper location to accommodate the fill-in information; for example:

Add the following values to determine MDS:

a. Signal generator output attenuator _____dBm
b. RF cable attenuation _____dB
c. Directional coupler attenuation _____dB

(b) When safety requires that switches either remote to the system or equipment being maintained or not considered as associated with that system or equipment be set to the OFF position, these switches shall be listed by item name and a fill-in provided in which user personnel shall fill in data pertinent to the individual installation; for example:

De-energize and tag main power supply switch located _____
De-energize and tag gyro input at _____
De-energize and tag heater supply switch located _____

When it is determined that a fill-in blank shall be utilized, it shall be mandatory that the following notation be applied to the controlling MIP as a scheduling aid:

MRC(s) _____ contain(s) blanks to be filled in by ship's force before implementation. Until these fill-in data elements are applied, the MR cannot be effectively accomplished. Advise via PMS feedback report if the required fill-in data is not available to ships' force.

3.11.13.6 Preliminary. When steps are necessary to prepare the system or equipment for the maintenance action(s) prior to beginning the MR, the MRC will contain a preliminary procedure. Typical preliminary steps are: energizing equipment, warming-up equipment, positioning switches, opening doors, establishing communication, preparing setup of test equipment, and ensuring safe conditions.

(a) Preliminary steps shall be listed under the heading Preliminary and shall appear before the first MR description.
(b) The first letter of the word Preliminary shall be capitalized, the entire word underlined or in boldface, and it shall not be punctuated.
(c) The word Preliminary shall be followed by a minimum of one line of text before continuing to the second page. If space does not permit the one line of text, the preliminary heading will be started on page 2 of the MRC.
(d) Preliminary steps are preparational actions and shall not include disassembly or other action steps that are part of the requirement.
(e) Steps in the preliminary procedure shall be identified by alphabetical letters in lower case and punctuated by a period. For example, a., b., c.
(f) Preliminary information shall be concise and presented as "do steps." Tables, figures, and notes may be included as required.
(g) The time required to accomplish these steps shall be included in M/H as specified in 3.11.7.
(h) For system-level MRCs, the preliminary steps may also include a matrix listing equipment with manning requirements, matrix for alternatives, and similar information.

3.11.13.7 Maintenance requirements. Maintenance requirement descriptions from the MR description block shall be repeated, word-for-word, and all words except articles, conjunctions, and prepositions shall be initially capitalized (see appendix A).

(a) Each MR description shall be underlined or in boldface; for example, 1. Clean, Inspect, and Lubricate Fueling Rig Blocks and Fittings. Following the MR description, list the step-by-step procedure. The format shall be as specified in 3.14.4.
(b) Maintenance requirement cards which require "orders" and "responses," procedural steps may be prepared in columnar format using the layout, headings, and numbering method shown on figure 29. When clarity will be improved, indicate where the task is to be performed. For example: d. At UD 101, position S305 to OFF.
(c) If procedure evaluation concludes that a close-out statement dependent on the ship's operational readiness condition is required, use the statement, "Return equipment to readiness condition." Use of this statement does not release the developer from including procedural steps which return equipment to the condition in which it stood before commencing the MR. The close-out phrase is not to be used as a "catchall" for example, reinstalling covers, removing test equipment or removing safety tags.

3.11.13.8 Alternate procedures. Alternate procedures shall be provided only in cases where a minor configuration difference or the absence of required tools or test equipment causes the preferred method to be unworkable or unproductive. Before incorporation of alternate procedures in final documentation, approval of PMS Coordinating Activity is required. When alternate procedures are provided, a note to that effect shall precede the preferred procedure. Alternate procedures require the same care in preparation as do preferred procedures. When alternate procedures are provided, they shall be positioned on the MRC to follow the preferred procedure. They shall be separated from the preferred procedure only by a note which describes the condition under which the alternate is to be used.

3.11.14 Figures. Figures may be used when they present procedural data more clearly than text. Figures used in lieu of text shall constitute an integral part of the procedure and shall be clearly related within the text. Figures used to augment the text shall depict exactly the condition described in the text. Location instructions shall be as specified in 3.14.5.1. The PMSDA shall attach a copy of the figure to the MRC verification draft and indicate on the figure the MRC and the step(s) to which it applies. Figures will be in the form of original line art unless otherwise authorized by the NAVSEACEN.

3.11.14.1 Line art standards. Line drawings shall be of a quality suitable to be scanned and digitalized for computer composition and shall conform to the following:

(a) Size. Unless otherwise authorized by the NAVSEACEN artwork will be the same size as the area it will occupy on the MRC. Art work should be positioned so that it can be read in the same plane as the procedural step (see figure 30). When this cannot be done, the illustration shall be positioned so that a 90 degree clockwise turn of the MRC page will place the illustration in the proper attitude for viewing (see figure 31). A minimum of 1/4 inch shall be allowed between illustrations and adjacent text and borders. When an illustration is of such a size that it cannot be legibly reproduced within the maximum image area, it shall be arranged for production on an oversized reproducible form as a foldout page (see figure 17). If it cannot be legibly reproduced in this manner, it shall be divided for production into two or more figures.

(b) Standards. Artwork will be done in black ink or tape on a white matte background extending the full width of the artwork. Line widths on the artwork shall not be less than five mils (0.005 inch). Adjacent line separation should be 10 mils (0.010 inch) or more. Captions, callouts, legends, and footnotes shall be in boldface capital letters equal in size to 10 points or more.

3.11.14.2 Halftones. Halftones will only be authorized by the NAVSEACEN when photographs are the only medium that can clearly convey the required information to shipboard personnel. When used, halftones shall be screened (85 line, 35 percent shadow dot, 15 percent highlight dot).

3.11.15 Tables. Tables will be used to present data when the data can be presented more clearly in tabular form. References in the procedural block shall make the purpose of the table clear. Tables of one line shall not be used; instead, the information shall be presented in a procedural step. Tables shall be located as specified in 3.14.6.1.

3.11.15.1 Table size. Vertical tables are limited to 64 characters across and 59 lines in length. Horizontal tables are limited to 99 characters across and 35 lines in length. A 1/2 inch space maximum shall be allowed vertically between tables and adjacent text and a 1/4 inch space minimum shall be allowed horizontally. When a table is of such a size that it cannot be legibly reproduced within the prescribed image area, it shall be arranged for reproduction on a foldout page. If it cannot be reproduced in this manner it shall be divided for reproduction as two or more tables.

3.11.16 Location block. This block shall be left blank unless fill-in data is provided by the NAVSEACEN.

3.11.17 Date block. The date will be left blank unless provided by the NAVSEACEN.

3.11.18 Page numbers block. All sheets that comprise one MRC shall be identified by completing the block titled "Page ____ of ____" on the right side of the page.

3.11.19 Vertical coding block. This block shall be left blank unless code is supplied by NAVSEACEN.

3.11.20 Maintenance requirement cards for system operability test (SOT). The intent of the MRC for SOTs is to provide a fully detailed test procedure to the maintenance personnel in as understandable a format as possible. To achieve this goal it may be necessary to include artwork on the MRC document showing the different complex switch and test equipment arrangements for each test to be performed. Furthermore, it is a requirement that MRCs for SOTs explain the exact procedures for the actual system configuration on each ship. References to other documents and reliance of maintenance personnel's knowledge of system setup procedures are unacceptable. MRCs for SOTs shall comply with the requirements as specified in the acquisition document (see 6.2.1).

3.11.21 Preparation of MRCs for IEM. Maintenance requirement cards for IEM are generated only when:

(a) IEM analysis identifies requirements not available in existing PMS or not projected for development after scheduled maintenance requirement analysis.
(b) A scheduling MRC is needed as specified in 3.11.21.2.

3.11.21.1 Inactive equipment maintenance procedure MRCs. Maintenance requirement cards required to provide maintenance procedures for IEM that are not available as scheduled MRC(s) (see figure 28) shall be developed as specified in 3.11.1 through 3.11.19.

3.11.21.2 Inactive equipment maintenance scheduling MRC. Normally, information pertaining to the scheduling of IEM will be included on the MIP by citing MRCs and providing supporting information in the form of scheduling notes. However, some complex equipment may require a large number of MRs combined with scheduling notes to control sequencing of scheduling. In these cases, an IEM scheduling card shall be prepared (see figure 32). The scheduling card shall provide scheduling information only and shall not include maintenance procedures (see 6.2.1). Block content of the scheduling card shall be in accordance with the following:

(a) Ship system, system, subsystem, and equipment blocks. Entries shall be in accordance with 3.11.4.
(b) Maintenance requirement card code block. This is a two-segment code (see 3.11.5). The first segment is the MIP series which will be provided by the NAVSEACEN. The second segment will be an IEM periodicity; for example, LU, PM, SU or OT. The scheduling card shall always be the first entry on the MIP and be the first card of the series; for example, LU-1, PM-1, SU-1, OT-1.
(c) Rates, M/H, and elapsed time blocks. These blocks shall be left blank.
(d) Maintenance requirement description block. This block shall describe the type of maintenance scheduling information. For example: 1. Lay-up Maintenance.
(e) Safety precautions block. The standard entry in this block shall be as follows: 1. Observe safety precautions as specified on scheduled MRCs.
(f) Tools, parts, material, test equipment block. The word none will be entered.
(g) Procedure block. The first entry shall be a note; for example, NOTE: This is a scheduling card. Schedule and perform listed MRCs for (LU, PM, SU, or OT, as appropriate). The entry following the note shall be the MR description. Each step following the MR description shall be a statement of what is to be accomplished, followed by reference to the appropriate MRC or document containing the procedures (see figure 32). Notes may be used to provide such information as sequencing, special personnel, and services requirements.

3.11.22 Preparation of MRC verification draft for UMRCs. Preparation of UMRC verification drafts shall not be undertaken until directed by the PMS Coordinating Activity. The UMRC verification draft will be prepared in the manner as specified in 3.11.1 through 3.11.19 with the following exceptions:

(a) Maintenance requirement card code block. Unscheduled MRCs shall use the letter prefix designator U for the periodicity code (see 3.11.5.4).
(b) Rates block. This block shall be left blank unless otherwise directed by the PMS Coordinating Activity or acquisition document.
(c) Man-hour block. This block shall be left blank unless otherwise directed by the PMS Coordinating Activity.

(d) Unscheduled MRCs may make reference to other MRCs to avoid redundant documentation, to lead into appropriate follow-on corrective action, or to lead into test requirements verifying the corrective action. When the reference is made to other MRCs, the reference shall be by MRC code rather than by SYSCOM card control number or page.

3.12 Preparation of MIPS. The MIP is designed to provide a clear, concise index and cross-reference to all MRCs within a set and shall contain only unclassified information. Maintenance index pages developed for scheduled maintenance shall list both operational and IEM. Unscheduled maintenance may also be included when approved by the PMS Coordinating Activity (see 3.9.2). Inactive equipment maintenance shall be separately titled and listed in a separate section of the MIP (see 3.12.15 and figure 33). Maintenance index pages verification copy shall be typed on maintenance index forms (see figures 13 and 14), however erasures and strikeovers are permissible. The PMS Coordinating Activity shall provide the developer with specific guidance concerning the SWAB level at which MRCs will be assembled into MIPs at this point. The following procedures shall be applicable for preparing MIPs.

3.12.1 Ship system, system, subsystem, or equipment block. Enter the nomenclature and SWAB number (see 3.6.5) for the lowest level to which all the listed requirements apply.

3.12.2 Reference publications block. Where directed by the PMS Coordinating Activity, enter the identifying number of the publication providing the most comprehensive maintenance information for the system or equipment for which the PMS documentation is being prepared; for example, OPs, NAVSEA instruction books, manufacturer's pamphlets, NAVSEA technical manuals, and so forth. If additional space is required, enter the phrase, "See Note". A note will be entered in the MR description block to provide the additional referenced publications.

3.12.3 Date block. This date shall be left blank unless provided by the NAVSEACEN.

3.12.4 Configuration block. Maintenance index pages that index MRs for SWAB levels 1, 2, or 3, or those that combine more than one SWAB level 4 grouping, shall contain the level 4 SWAB numbers and nomenclatures. The level 5 item numbers and nomenclature shall be included. When directed by the PMS Coordinating Activity, enter the change configuration of system or equipment for which documentation is intended. Each FIELD CHANGE, SHIPALT, ORDALT, or other officially authorized hardware change considered in the development will be included. Each change that affects maintenance procedures shall be preceded by an asterisk; for example, ORDALTS: *7167, 7380, *7662. When individual elements which make up the system or equipment being documented are not readily identifiable as part of the system or equipment, these elements and their individual change configuration shall be listed in this block. When other information regarding the composition of the system or equipment being documented will facilitate maintenance or management, it will be included in this block.

Use brief statements such as LORA configuration or serial numbers 7-30 only. If additional space is required, the configuration data will be continued in the MR description block by use of a note. When the configuration data is so voluminous as to be impractical to include on the MIP, enter the identification of the publication from which configuration data can be obtained. In those cases where configuration data is not required, this block will not be included on the MIP.

3.12.5 Test column. Each MRC that contains a test requirement shall be assigned one of the following codes that will be entered in the test column on the MIP.

B - test is at the intermediate (I) level only.
K - test is performed at the organizational (O) and I levels and results are monitored by the Submersible Ship Ballistic Nuclear (SSBN) Submarine Maintenance Monitoring Support Office (SMMSO).
A - test is performed by shore activity only.
1 - test is scheduled at the O level only and was developed for SWAB level 1 testing.
2 - test is scheduled at the O level only and was developed for SWAB level 2 testing.
3 - test is scheduled at the O level only and was developed for SWAB level 3 testing.
4 - test is scheduled at the O level only and was developed for SWAB level 4 testing.
5 - test is scheduled at the O level only and was developed for SWAB level 5 testing.
6 - test may be scheduled at both O and depot (D) levels and developed for level 1 (ship system) testing; for example, OCSOT MIP CS-3/4 is being used under the Combat System Test and Certification program.
7 - test may be scheduled at both O and D levels and was developed for level 3 testing.
8 - test may be scheduled at both O and D levels and was developed for level 4 testing.
9 - test may be scheduled at both O and D levels and was developed for SWAB level 5 (equipment or component) testing.

3.12.6 Other column. Enter the specialized management code, as applicable, listed below. If the MRC is also classified, a two-character code will be entered. The second character space will identify the MRCs security classification. If there is no applicable specialized management code but the MRC is classified, the classification code will be in this column.

R - denotes an MR on Deep Submergence Recovery Vehicles (DSRV) systems and equipment that is within the scope of certification.
RC - denotes an MR on DSRV systems and equipment that is within the scope of certification and is also a confidential MRC.
K - denotes an MR (not test) developed under the cognizance of SMMSO.
C - confidential
S - secret

3.12.7 SYSCOM MRC control number column. In the SYSCOM MRC control number column, enter the control number of any reapplied MRCs as recorded on the MRC. In the case of newly developed MRCs, make no entries. The control number will be applied by the NAVSECEN. In the IEM section of the MIP (see 3.12.15), enter SYSCOM control numbers for only those MRCs which are assigned an IEM periodicity code.

3.12.8 Maintenance requirement column. When the MRCs aggregated on a MIP are applicable to a number of systems or equipment or units lower than the one shown in the MIP heading, the specific system or equipment unit shall be entered in bold type (or underlined) on the line preceding the actual MR (see figure 34). Both item name and nomenclature designation shall be provided. The MR description shall be written exactly as it appears on the applicable MRC. The first line of the first maintenance description shall be two spaces below the scheduling aid or column border if no scheduling aids apply.

3.12.8.1 Notes. Notes shall be used to define R requirements in the operational maintenance section of the MIP and to continue entries too numerous for the space provided in the Reference publication and configuration blocks. In addition, notes shall be used to provide management information applicable to a specific MRC; for example, NOTE: This MRC applicable to Mod 1 only. The note(s) shall be placed immediately after the last MR description for that MRC and shall be unnumbered. If more than one note is required for the same MRC, the note defining the R requirement shall be listed first.

3.12.8.2 Scheduling aids. All notations affecting the scheduling of MRs shall be located in the MR column preceding the first MR description. When scheduling aids include more than one topic, they shall be numbered under a scheduling aid heading; for example:

(a) Scheduling aids:

(1) Schedule MRC Q-3 for accomplishment only when dockside.
(2) Review Maintenance Requirements A-9 and A-11. Omit MRC(s) which do not apply; no feedback report required.

(b) Asterisks and the symbol # will be used to call attention to specific scheduling information as follows:

* This is a Safety of Ship item.
** For scheduling purposes only; no MRC is provided.
\# Mandatory scheduling required.

3.12.8.2.1 Scheduling notations. The first scheduling notation shall be located at least two spaces below the top line which borders the MR column.

3.12.9 Periodicity column. Enter the periodicity code as shown on the MRCs. The MRCs shall be listed in the following sequence of decreasing frequency: D, 2D, 3D, W, 2W, M, 2M, Q, S, A, 18M, 24M, 30M, 36M, 48M, 54M, 60M, R, and U. Within each periodicity group, list the MRCs in numerical sequence: D-1, D-2, D-3, W-1, W-2, M-1, M-2, Q-1R, Q-2, A-1, 18M-1, R-1, R-2, U-1, U-2.

When reapplying previously developed MRCs, the condition may occur where the existing MRC is applicable but the number associated with the periodicity falls out of consecutive order. Skipping of sequential code numbers is acceptable; for example: Q-1, Q-3, Q-4, Q-7. Asterisks are used in the periodicity column to call attention to scheduling aids applicable to specific MR. The standard use of the asterisk is:

(a) A single asterisk (*) is used to indicate safety of ship items (see 6.3.37). The use of the term "safety of ship" is restricted to submarines. The designation of safety of ship items will be recommended by Maintenance Requirement Development Activity (MRDA) by annotation on the verification copy of MIP, for example, Q-1*. The safety of ship notation shall be entered on the verification copy.

(b) The double asterisk (**) is used to indicate that the requirement is listed for scheduling purposes only and there is no MRC. The double asterisk shall be placed beneath the applicable periodicity code in this column, and the notation entered in the MR column.

3.12.10 Rates column. Enter the rates required as shown on the MRCs.

3.12.11 Man-hour column. Enter the M/H for each rate as shown on the MRCs.

3.12.12 Related maintenance column. Enter the periodicity codes for MRCs which are identified as related during the procedure evaluation process. Entries in the related maintenance column shall be listed only with the MRC of the longest periodicity; for example, if a weekly and a monthly MRC are related, only the monthly MRC would indicate the related maintenance. If two MRCs of the same frequency are related, the related MRC shall be entered with both MRCs. When the related MRC is from the same MIP, list only the periodicity code; for example, M-3. When it is of another MIP, list the MIP series of the code also; for example, EL-10:M-3. When the accomplishment of the related MRC is mandatory, a # shall be placed after the periodicity code; for example, M-3#. When the related MRC is merely a convenience, the # shall be omitted. When there is no related maintenance, the word "None" shall be entered.

3.12.13 Page number. All sheets that comprise one MIP shall be identified by completing the entry Page ___ of ___ on the bottom of the sheet.

3.12.14 SYSCOM MIP control number. This block shall be left blank unless the number is provided by the appropriate NAVSEACEN.

3.12.15 Inactive equipment maintenance requirements. The IEM requirements shall be listed on the MIP following the operational maintenance requirements (see figure 33). The requirements will be separated from the operational requirements by double horizontal lines and use of boldface print. The IEM section shall be titled Inactive Equipment Maintenance. The first entry following the title shall be: "The following requirements will be scheduled when equipment is inactivated for periods of prolonged idleness". When no IEM requirements are justified during IEM analysis, enter the words, "None required". The IEM requirements shall be entered as follows:

(a) The IEM requirements shall be grouped under the following sub heads: Lay-Up Maintenance, Periodic Maintenance, Start-Up Maintenance, Operational Test. The subheads shall be initial caps underlined or boldface print.

NOTE: When LU MRCs are prepared to support system or equipment periods of prolonged idleness, SU MRCs shall be required suitable for system or equipment operation or activation.

(b) Within each subheading, the first card entered will be the scheduling card, if applicable (see 3.11.21.2). Each MR description shall be numbered. Applicable MRCs listed in the operational maintenance section of the MIP shall be reapplied by relisting the MR followed by a note; for example, NOTE: Use MRC M-5. If the periodicity of accomplishment for IEM periodic maintenance differs from the operational requirement, the note shall specify the frequency; for example, NOTE: Accomplish MRC W-1 monthly. When IEM analysis requires use of only a specific section of the operational MRC, that section will be identified by use of parentheses following the MRC; for example, NOTE: Accomplish MRC Q-3 (MR-1).

(c) The word "None" shall be entered for any subhead where IEM does not apply.

3.12.15.1 Inactive equipment maintenance-periodicity column. For new MRCs developed exclusively to satisfy IEM requirements, enter the periodicity code as shown on the IEM MRC. Maintenance requirements referring to an operational equipment MRC or IEM scheduling MRC will not have an entry in the periodicity column. The MRCs shall be listed in the following sequence: LU, PM, SU, and OT.

3.12.15.2 Inactive equipment maintenance-rates and M/H columns. Inactive equipment MRs making reference to equipment operational MRCs and IEM scheduling cards do not require an entry in the Rates and M/H column.

3.12.16 Unscheduled maintenance requirement MIP entries. When authorized by the NAVSEACEN, UM requirements may be included on the operational maintenance MIP following the scheduled requirements. When indicated by the acquisition document, UM requirements may also be prepared on separate MIPs. The UM requirements on scheduled MIPs or separate UM MIPs shall be prepared in the same manner as specified in 3.12, with the following exceptions:

3.12.16.1 Unscheduled maintenance-rates and M/H column. This column shall be left blank unless directed by the PMS Coordinating Activity.

3.12.16.2 Unscheduled maintenance-related maintenance column. This column shall be used to identify series MRs and to identify mandatory related UMRCs; for example, an alignment on one UMRC may necessitate an adjustment for a different unit detailed on another UMRC. When the related MRC is from the same MIP, list only the periodicity code; for example, U-3. When it is of another MIP, list the MIP series segment of the code also; for example, 5BBC000:M-1.

3.12.16.3 Unscheduled maintenance-notes. Notes may be used to provide management information applicable to the UMRC.

3.13 Documentation validation. The contractor is responsible for accomplishing on site validation procedures as specified in the acquisition document (see 6.2.1).

3.14 Composition and layout requirements.

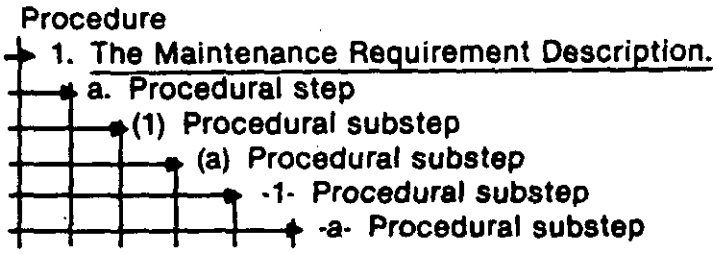
3.14.1 General. The following are the requirements for composition and layout of MIP and MRC verification drafts and camera ready copy for new developments. Camera ready copy format shall be identical to the verification draft requirements specified in 3.11 and 3.12 and the layout requirements specified herein. Forms to be used for the verification draft are available from the NAVSEACEN. The verification draft will be used as input to composition; therefore, while the draft must be readily legible, strikeovers and pen and ink corrections will be accepted. Camera ready copy will be 20 percent larger than the final printed size of 5 inches by 8 inches for MRCs and 8 inches by 10-1/2 inches for MIPs.

3.14.2 Type size and face. Unless otherwise specified by the acquisition document (see 6.2.1), a typewriter with 12-pitch spacing, approximately 10-point type face (IBM Selectric, Prestige Elite 72 type, or equivalent face and size) shall be used to type information on the MRC and MIP forms. Security classification, when required, shall be placed on both verification (review) and camera ready copy in boldface capital letters equal in size to 14 point.

3.14.3 Spacing. Maintenance procedure text copy on MRC forms shall be prepared in single column or multicolumn format. For single column format, spacing requirements shall be in accordance with figure 35. Single spacing shall be used between steps except where the acquisition document (see 6.2.1) or PMS Coordinating Activity specifies double spacing to enhance readability. Spacing requirements for multicolumn format shall be as specified in 3.11.13.7 and figure 29. A double space shall precede and follow notes, cautions, warnings, and columns with heading titles. The left margin on MRCs shall always be one space in from the left borderline. There shall be an exception when it is necessary to list 10 or more items in the first column of the Tools, parts, materials and test equipment block; in this case the left margin spacing for that particular page of the MRC shall be two spaces in from the borderline, so that there is always a full space between the left borderline and any typed material. All typed material on an MRC shall be arranged to align with this margin. Maintenance index pages shall be prepared with single spacing between lines of a given MR entry and between MRs of the same MRC. A double space shall separate MRC entries (see figure 36).

3.14.4 Indentation and numbering of text. Following the MR description, the step-by-step procedure shall be entered in continuous numerical and alphabetical sequence, using the following letters and numbers to identify steps and substeps as necessary:

Set margin stop 2 spaces in
Set 1st tab 5 spaces in
Set 2nd tab 8 spaces in
Set 3rd tab 12 spaces in
Set 4th tab 16 spaces in
Set 5th tab 20 spaces in



When the alphabet is used through z and steps still remain to be identified, continue: aa., ab., and ac. When az is reached, continue ba., bb., and bc. The second and succeeding lines of any step shall be flush left-aligned with the first line of that step. For MRCs prepared in multicolumn format, see 3.11.13.7 and figure 29.

3.14.5 Figures. Figures shall be used only when essential to a clear presentation of the maintenance procedure (see 3.11.14). Figures shall be in accordance with MIL-M-38784 and MIL-P-38790. Figures shall be numbered; for example, figure 1. When a figure is not adjacent to related text, or when otherwise required for clarity, a title shall be added.

3.14.5.1 Figure location. Figures shall be positioned so that they lie in the same reading plane as the procedural steps. When this cannot be done, figures shall be positioned so that a 90 degree clockwise rotation of the MRC will position it for normal viewing. Artwork should be placed following the procedural step to which it refers; however it is unacceptable to allow large blank spaces or to otherwise waste space because of artwork placement throughout the MRC solely to cause the illustration to follow a specific procedural step. If illustrations are large and their location would interfere with correct sequencing of procedural steps and cause difficulty in understanding or interpretations, they may be placed in numeric sequence on pages at the end of the procedure.

3.14.6 Tables. Tables shall be used to present data when the data can be presented more clearly in tabular form. Elaborate or complicated tables shall be avoided. Lines shall be used between columns only. Tables shall be numbered; for example, table 1. A descriptive title shall be added when required for clarity in the procedure. The table number and title shall be placed below the table. Positioning instructions are the same as for figures (see 3.14.5.1).

3.14.6.1 Table location. A table should be placed following the procedural step containing the first reference to it. When this is not possible because of space limitations, it may be placed at the beginning of a succeeding page, on a separate page, or at the end of the procedural steps. When tables and figure(s) are sequential, the table(s) shall precede the figure(s).

3.14.6.1.1 Troubleshooting tables. When test MRCs contain tables designed to assist in locating troubleshooting fault isolation procedures applicable to malfunctions discovered during the test accomplishment, the table shall be located at the end of the procedure block. As a minimum, the table shall identify the procedural steps applicable, publication number containing the

troubleshooting or fault isolation procedures, and identifying information for the applicable procedures within the technical publication. Specific page or paragraph numbers of the referenced publication will not be provided.

3.15 Changes to PMS documentation. When changes to existing PMS documentation are required, the method of preparing the changes shall be as follows:

3.15.1 Revised MRCs. Revised MRCs may be prepared in several formats. The original MRC may be reproduced with the MRC page on one-half of the page. This will allow ample room for making appropriate and legible changes (see figure 37). Revised MRCs may also be prepared as marked up original MRCs or retyped pages. The following requirements apply:

(a) Do not write over the original text when revising. A single line should be drawn through the original text in such a manner that the original text is still readable.
(b) When revisions are written in the margin or to the side of the MRC, draw a small arrow to show where the new information is to be inserted.
(c) Do not erase. Erasures leave a mark and it is unclear as to whether it should be included or not. Simply cross out words to be deleted.
(d) When deleting a paragraph, or anything larger than three lines, cross out the deleted section with an X. When deleting a line, cross out with a single line.

3.15.2 Revised MIPs. A revised MIP verification sheet shall be prepared to provide a total listing of all MRCs (both existing and revised). The revised MIP may be a marked-up copy of the existing MIP, or a new MIP verification sheet (see figure 38). The vertical coding column for the SYSCOM MRC control number of the revised or changed cards shall be lined out or left blank. MRCs that have not been revised are identified on the MIP verification sheet by the SYSCOM MRC control number.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 In-process review. The PMS Coordinating Activity may perform in-process reviews, where necessary. The PMSDA shall provide support and materials as required to facilitate in-process reviews specified in the acquisition documents (see 6.2.1).

4.2 Planned maintenance system development activity quality program requirements. The PMSDA shall establish and maintain a quality assurance program to ensure that the editorial quality, technical accuracy, correctness of composition, and graphic quality are consistent with the requirements of this specification. The quality assurance check sheets (see figures 18, 18a and 18b) exhibit minimum recordkeeping requirements for MRCs and UMRCs needed to administer this portion of quality assurance.

4.2.1 Quality program organization. Effective management for quality shall be clearly defined by the PMSDA. Personnel performing quality functions shall have the responsibility, authority, and organizational freedom to identify problems and to initiate, recommend, and provide solutions. Management shall review the status and adequacy of the program throughout each development phase.

4.2.1.1 Initial quality planning. The PMSDA, during the earliest practical phase of contract performance, shall conduct a complete review of the development requirements. This review shall identify and make timely provisions for any special skills, processes, methods, and procedures to assure the quality of the development; and the preparation, inspection, verification, and validation of the documentation.

4.2.2 Government-furnished material and data. The PMSDA shall conduct a review of Government-furnished material and data to determine compliance with the terms of the contract and the adequacy of the source material. The PMSDA shall report deficiencies which will impair the quality of the planned maintenance procedures to the PMS Coordinating Activity.

4.2.3 Inspection of documentation. Documentation that is submitted by terms of the acquisition document as deliverable items, shall be inspected by the PMSDA for compliance with Section 3.

4.2.4 Inspection for preparation for delivery. The packaging, packing, and marking shall be inspected by the PMSDA for compliance with Section 5.

5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.2.1.)

5.1 Packaging. Unless otherwise specified in the acquisition document (see 6.2.1), packaging, packing, and marking for shipment shall be in accordance with MIL-M-38784.

6. NOTES

6.1 Intended use. The MRCs and MIPs produced in accordance with this specification are intended for use in the PMS of the Navy 3-M program. They apply to inspecting, cleaning, lubricating, replacing, adjusting, aligning, calibrating, functional testing, and system testing.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Identification of system, subsystem or equipment for which the MRCs and MIPs are to be prepared (see 3.6).
(c) Security classification of material to be used in MRC development (see 3.4).
(d) Schedules and identification of applicable tasks described in this specification; these include applicable development phases, preparation of the verification draft, documentation validation, and shipment of deliverable items (see 3.7, 3.11, 3.13 and 6.2.2.2).
(e) Identification and address of PMS Coordinating Activity (see 3.2).
(f) Designation of validation site and procedures (see 3.13).
(g) Requirement for in-process review support (see 4.1.1).
(h) Requirements for SOTs, MRCs (see 3.11.20).
(i) Requirements for UM analysis and requirement tasks (see 3.9).
(j) Approval for use of double spacing between MRC text procedural steps (see 3.14.3).
(k) Exceptions to methods for preparation for delivery (see 5.).
(l) Exceptions to type size and type face (see 3.14.2).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of FAR 52.227-7031 are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

Paragraph no.	Data requirement title	Applicable DID no.	Option
	Planned Maintenance System (PMS)	DI-L-2202	----
3.7.2	Functional Block Diagram Form		
3.7.2	Planned Maintenance System	DI-L-2203	----
	Master System and Subsystem Index Form		
	Planned Maintenance System (PMS)	DI-L-2205	----
3.7.3	Functional Failure Analysis Form		
3.7.4	Additional FSI Selection Form	DI-L-2207	----
3.7.4	Functionally Significant Item Index Form	DI-L-2206	----
	Planned Maintenance System (PMS)	DI-L-2204	----
3.7.5	Failure Modes and Effects Analysis Form		
3.7.6	Logic Tree Analysis Form and Rationale Back-up Sheets	DI-L-2208	----
3.7.7	Servicing and Lubrication Analysis Form	DI-L-2209	----
3.7.9	Maintenance Requirement Index Form	DI-L-2210	----
	Planned Maintenance System (PMS)	DI-L-2211	----
3.10	Procedure Evaluation Sheet Form		
	Planned Maintenance System (PMS)		
3.7.11	Task Definition Form	DI-L-2212	----
3.7.12	Inactive Equipment Maintenance (IEM) Analysis Form	DI-L-2213	----
	Planned Maintenance System (PMS)	DI-L-2215	----
3.7.14	Maintenance Requirement Cards		
3.7.14	Maintenance Index Pages	DI-L-2216	----
3.8	RCM Documentation Control Sheet Form	DI-L-2214	----
4.2	Quality Assurance Check Sheet	DI-L-2217	----

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5000.19L., Vol. II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.2.2.2 Delivery stages for developments using the requirements investigation process for RCM maintenance methodology as specified in table I.

TABLE I. RCM deliverable documentation.

Deliverable 1/	Phase	Documents
1	1	Master Systems and Subsystems Index forms, related Functional Block Diagrams.
2	2	Functional Failure Analysis form.
	3	Additional FSI Selection and FSI Index forms.
3	4	FMEA forms.
	5	Logic Tree Analysis Forms and back up rationale sheets.
	6	Servicing and lubrication Analysis forms.
	7	Maintenance Requirement Index forms.
4	8	Procedure Evaluation sheet form.
5	9	Task Definition forms.
	10	Inactive Equipment Maintenance (IEM) Analysis forms and Procedure Evaluation form.
	11	Unscheduled Maintenance documentation (see 3.9).
6	12	MIP and MRC documentation and the Documentation Package.

1/ This grouping of documentation into deliverable packages may be varied by the PMS Coordinating Activity.

6.2.2.4 Assembly of the documentation package. Each set of MIPs and MRCs covering an approved system shall be accompanied by 2 sets of approved documentation of the analysis assembled into an integrated, cohesive package for that system:

(a) Covering title sheet identifying the system analyzed, PMSDA, and the contract number under which the development was accomplished.
(b) Documentation Control Sheet (see figure 10).
(c) Master Systems and Subsystems Index form (see figure 1) for the system(s) analyzed.
(d) Functional block diagrams.
(e) Functional Failure Analysis form (see figure 2).
(f) Additional Functionally Significant Item Selection form (see figure 3).
(g) Functionally Significant Item Index form (see figure 4).
(h) Failure Modes and Effects Analysis form (see figure 5).
(i) Logic Tree Analysis form (see figure 6) with rationale and justification backup sheets.
(j) Servicing and Lubrication Analysis form (see figure 7).
(k) Maintenance Requirement Index form (see figure 8).
(l) Procedure Evaluation Sheets form (see figure 12).
(m) Task Definition form (see figure 9).
(n) Camera-ready copy MIPs and MRCs (see figures 13 through 17).

6.2.2.5 Completed documentation package. The completed package for each system will be retained by the cognizant Naval Sea Support Center and the cognizant technical activity as a corporate history of the PMS development, rationale, justification, and analysis procedure and shall be referred to during subsequent feedback and revision processes.

6.3 Terminology. The following definitions supplement those covered in applicable documents and apply to terms used in this specification.

6.3.1 Acquisition document. Documentation used to task a Planned Maintenance System Development Activity to develop PMS documentation. This includes, but is not limited to, contracts, purchase orders, task assignments, SEATASKS, and technical manual contract requirements. This document is prepared by the contracting activity.

6.3.2 Active function. A function which requires activity of an item.

6.3.3 Applicable task. A task which reduces the probability of the occurrence of a failure mode.

6.3.4 Characteristic. Any specific quality, property, capacity or trait of a system/equipment.

6.3.5 Condition-directed task. Preventive maintenance tasks performed to compare conditions with an appropriate standard to indicate the need for corrective maintenance tasks to ensure continued operation. A CD task is an inspection or test to discover a potential failure condition which can be corrected before failure occurs.

6.3.6 Dependent failure. A failure of an item which is caused by failure of an associated item.

6.3.7 Development. The act of researching, examining, and writing PMS documentation.

6.3.8 Distribution. All the procedures involved with forwarding PMS documentation to user activities and maintaining records.

6.3.9 Dominant failure mode. A failure that is important because of its frequent occurrence or the serious consequences of the failure.

6.3.10 Economics. The consideration of all forms of resource expenditure versus the value to the user achieved through this resource expenditure.

6.3.11 Effective tasks. An applicable task which reduces the probability of the occurrence of a failure mode to an acceptable level for safety-related failures; for other than safety-related failures, an applicable task that is cost-effective.

6.3.12 Failure. The presence of an unsatisfactory condition. What constitutes an unsatisfactory condition must be specifically identified for each function.

6.3.13 Failure effects. The consequences of a failure mode. Failure effects begin at the indenture level where the independent failure occurs and may progress to higher indenture levels.

6.3.14 Failure-finding task. A maintenance task which is a periodic inspection or test to discover the functional failure of off-line and hidden functions prior to these functions actually being needed.

6.3.15 Failure mode. The specific condition causing a functional failure (often best described by the condition after failure).

6.3.16 Finalization. All the procedures involved with standardizing, coding, and printing PMS documentation.

6.3.17 Function. Any action or operation which an item is intended to perform.

6.3.18 Functionally significant item. An item whose failure would have a significant impact on the availability of a required function or life-cycle costs.

6.3.19 Hard-time task or TD task. Preventive maintenance tasks which are performed at some interval without consideration of other variables. This interval may be based on calendar time, operational time, or the number of reoccuring events (rounds fired, cycles, starts, stops), etc.

6.3.20 Hidden function. A function provided by an item for which there is no immediate indication of malfunction or failure. The demand for such functions usually follows another failure or unexpected event.

6.3.21 Indenture level. A level of relative importance in a hierarchical set. The levels progress from the general to the specific.

6.3.22 Independent failure. A failure of an item which occurs without being caused by the failure of any other items.

6.3.23 Item. A system, subsystem, equipment, component, assembly, subassembly, or part, depending on the indenture level under discussion.

6.3.24 Life-limit task. A TD preventive maintenance task which operates by periodically replacing an old item with a new item before failure occurs and discarding the old item.

6.3.25 Lubrication task. A preventive maintenance task which consists of periodic application of or determination of need for a lubricant (grease, oil, graphite, etc.).

6.3.26 Planned Maintenance System Development Activity. Activity (commercial contractors, ISEAs, NAVSEACENs, etc.) which develops PMS documentation.

6.3.27 Minimum maintenance. The least amount of care and the longest time between accomplishment which will ensure an acceptable degree of reliability and availability.

6.3.28 Mission-critical item. An item whose failure degrades the capability of the ship to satisfactorily perform its mission.

6.3.29 Passive function. A function which requires an item to be inactive.

6.3.30 Planned Maintenance System Coordinating Activity. Activity which funds, authorizes, manages, monitors, or coordinates PMS documentation developed by commercial contractors, ISEAs, NAVSEACENs, etc.

6.3.31 Preventive maintenance task. A maintenance task which by its performance reduces the probability of occurrence of a particular failure mode.

6.3.32 Redundancy. The design practice of duplicating the sources of a function so that the function remains available after the failure of one or more items.

6.3.33 Reliability centered maintenance. A method for determining preventive maintenance requirements based on the analysis of the likely functional failures of hardware having a significant impact on safety, operations, and support functions. A decision logic tree is used to identify the need for specific tasks.

6.3.34 Requirements investigation process. Technique used to determine scheduled maintenance requirements.

6.3.35 Rework task. A TD preventive maintenance task which operates by periodically overhauling or refurbishing an item to restore the item to design specifications.

6.3.36 Safety critical item. An item whose failure directly threatens the life, limb, and/or health of the crew or others.

6.3.37 Safety of ship item. A maintenance action vital to the maintenance of a submarine's watertight integrity or to its ability to return safely to the surface.

6.3.38 Scheduled maintenance requirements. Those maintenance actions essential to maintaining the system/equipment in a state of operational readiness commensurate with its design characteristics.

6.3.39 Time-directed task. A hard-time task (see 6.3.19).

6.4 Application for copies of OPNAV forms and other documents (CDC, SPIN, SPMIG and PMS Cross Reference Guide specified within should be addressed to Naval Sea Support Center, Pacific, P.O. Box 85548, San Diego, CA 92138; or Naval Sea Support Center, Atlantic, St. Juliens Creek Annex, Portsmouth, VA 23702.

6.5 The analysis process of the RCM methodology encompasses all classification types, classes and levels of maintenance development. Therefore specifying the classification types, classes and levels of maintenance development, as required in the basic issue of this specification, are no longer required and have been deleted in this revision.

6.6 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Review activities:
Navy - EC, OS

Preparing activity:
Navy - SH
(Project MNTY-N002)

1. SWAB GROUP NUMBER	2. GROUP NOMENCLATURE	3. SHIP CLASS	SH OF
4. PREPARED BY DATE	5. REVIEWED BY DATE	6. APPROVED BY DATE	7. REVISION DATE
8. SWAB SUBGROUP/SYSTEM/ SUBSYSTEM NUMBER	9. SUBGROUP/SYSTEM/SUBSYSTEM NOMENCLATURE		
		10. SERIAL NUMBER	

MASTER SYSTEMS AND SUBSYSTEMS INDEX
OPNAV 4790/114 (ED 2-63)

FIGURE 1. Master systems and subsystems index (Form OPNAV 4790/114).

1. SWAB NUMBER	2. NOMENCLATURE	3. SHIP CLASS	SH OF

4. PREPARED BY	5. REVIEWED BY	6. APPROVED BY	7. REVISION
DATE	DATE	DATE	DATE

8. SOURCES OF INFORMATION

9. DESCRIPTION (Add additional sheet, if necessary)

10. FUNCTIONS AND OUT INTERFACES

11. SYSTEM IN INTERFACES

12. FUNCTIONAL FAILURES

13. SERIAL NUMBER

FUNCTIONAL FAILURE ANALYSIS
OPNAV 4790/116 (ED 3-85)

FIGURE 2. Functional failure analysis (Form OPNAV 4790/116).

1. SWAB NUMBER	2. NOMENCLATURE FSI CANDIDATE	3. SHIP CLASS	SH OF
4. PREPARED BY DATE	5. REVIEWED BY DATE	6. APPROVED BY DATE	7. REVISION DATE
8. DESCRIPTION		9. LOCATION	
			10. QTY
11. FUNCTIONS ARE ANY OF THESE FUNCTIONS NECESSARY FOR SAFETY, MOBILITY, OR MISSION?			11A. IMPACT? (Y/N)
12. FUNCTIONAL FAILURES DO ANY OF THESE FAILURES HAVE A DIRECT ADVERSE IMPACT ON SAFETY?			12A. IMPACT? (Y/N)
13. RELIABILITY IS THE ESTIMATED CORRECTIVE MAINTENANCE RATE GREATER THAN 1 PER YEAR?			13A. IMPACT? (Y/N)
14. COST IS THIS ITEM'S PURCHASE COST GREATER THAN $5000?			14A. IMPACT? (Y/N)
15. MASTER FSI INDEX TRANSFER? (Y/N)		16. SERIAL NUMBER	

ADDITIONAL FUNCTIONALLY SIGNIFICANT ITEMS SELECTION
OPNAV 4790/117 (REV. 3-85)

FIGURE 3. Additional functionally significant items selection (Form OPNAV 4790/117).

1. SYS/SUBSYS SWAB NUMBER	2. SYSTEM/SUBSYSTEM NOMENCLATURE		3. SHIP CLASS	SH OF
4. PREPARED BY DATE	5. REVIEWED BY DATE	6. APPROVED BY DATE	7. REVISION DATE	

8. SWAB NUMBER	9. NOMENCLATURE	10. LOCATION

11. SERIAL NUMBER

FUNCTIONALLY SIGNIFICANT ITEMS INDEX
OPNAV 4790/118 (ED 3-88)

FIGURE 4. Functionally significant items index (Form OPNAV 4790/118).

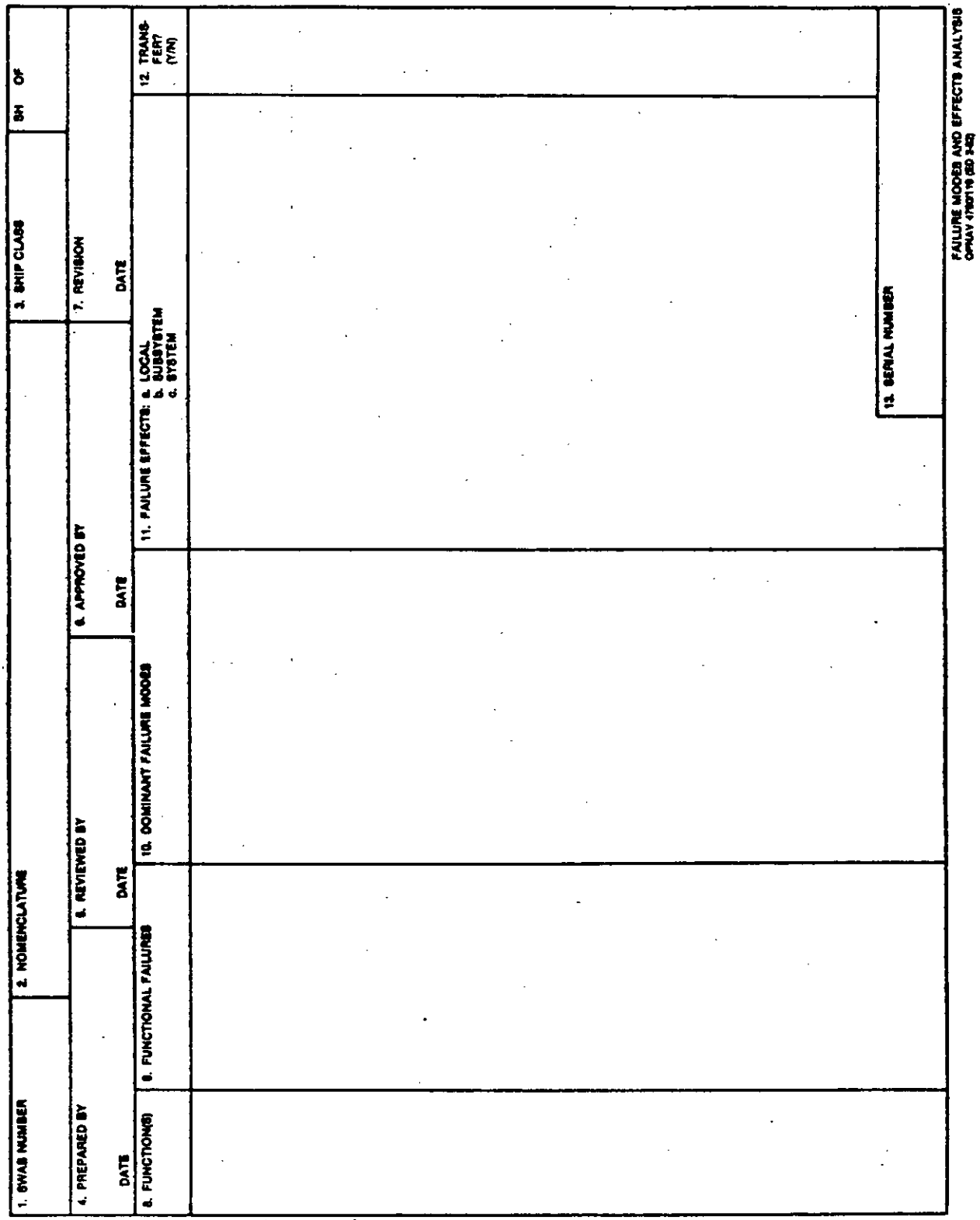


FIGURE 5. Failure modes and effects analysis (Form OPNAV 4790/119).

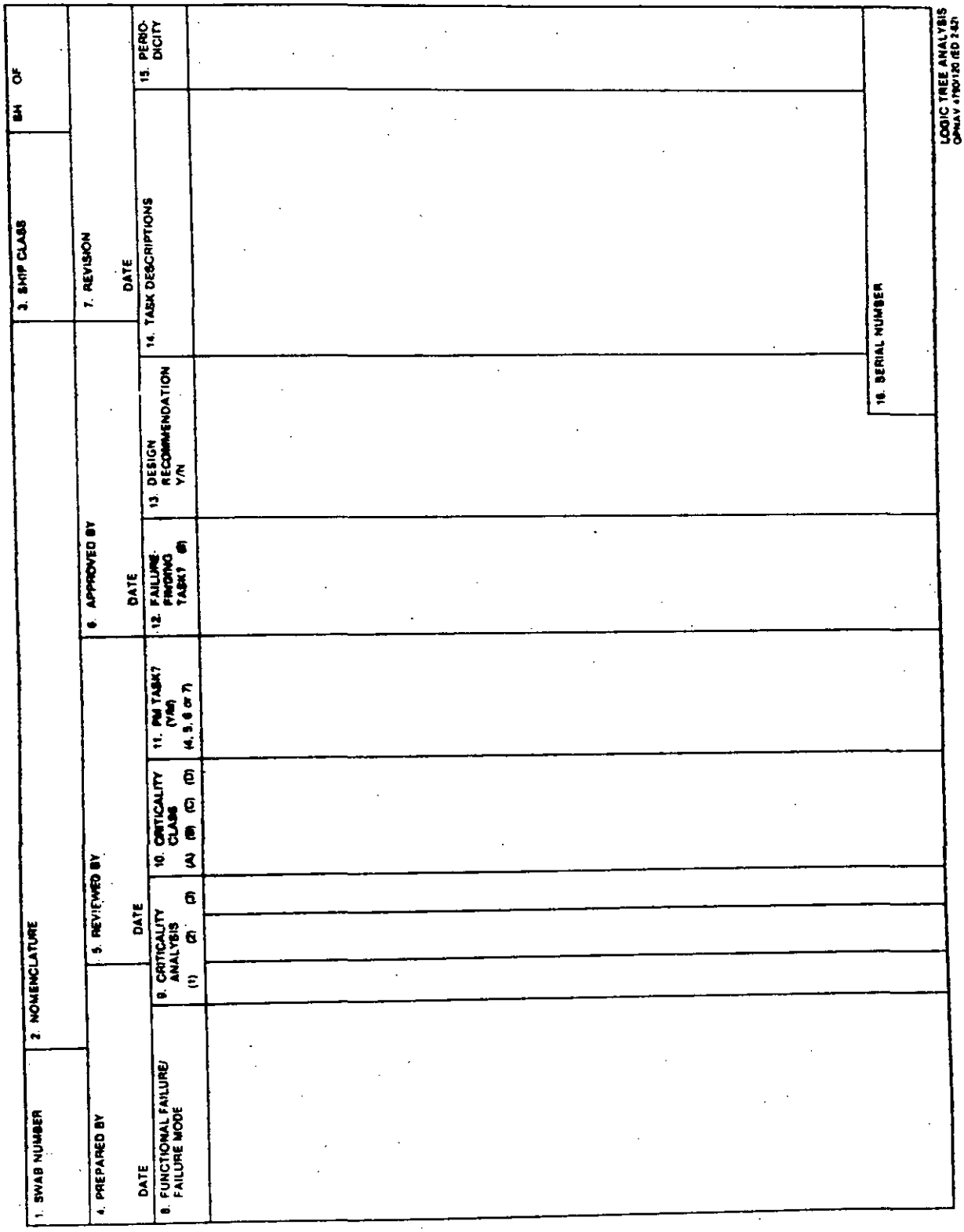


FIGURE 6. Logic tree analysis (Form OPNAV 4790/120).

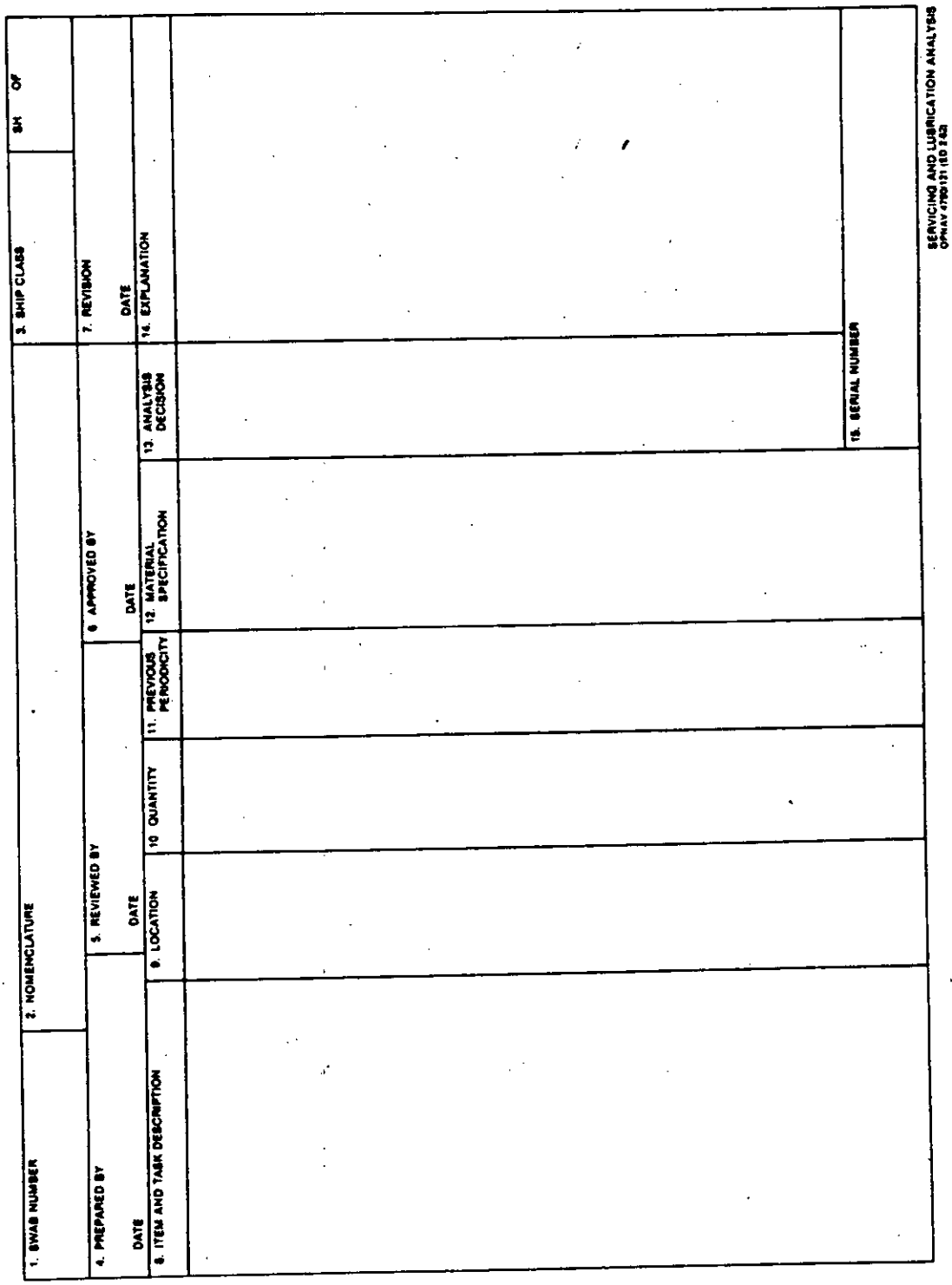


FIGURE 7. Servicing and lubrication analysis (Form OPNAV 4790/121).

1. SWAB NUMBER	2. NOMENCLATURE			3. SHIP CLASS	SH OF
4. PREPARED BY DATE	5. REVIEWED BY DATE		6. APPROVED BY DATE	7. REVISION DATE	
8. ANALYSIS REFERENCE	9. LOCATION	10. EQUIPMENT NOMENCLATURE (AN,MR/MODL APL/CID, MAINTENANCE REQUIREMENT		11. PERIODICITY	12. REF MRC
			13. SERIAL NUMBER		

MAINTENANCE REQUIREMENT INDEX
OPNAV 4790/123 (SD 3-82)

FIGURE 8. Maintenance requirement index (Form OPNAV 4790/123).

1. SWAB NUMBER	2. NOMENCLATURE		3. SHIP CLASS	SH OF
4. PREPARED BY DATE	5. REVIEWED BY DATE	6. APPROVED BY DATE	7. REVISION DATE	
8. EQUIPMENT SWABNOMENCLATURE		9. QTY. INSTALLED	10 REFERENCE MRC	
11. MAINTENANCE REQUIREMENT DESCRIPTION (TASK)			13. PERIODICITY	
12. SAFETY PRECAUTIONS			14. RATES	MH
			15. TOTAL MH	
			16. ELAPSED TIME	
17. TOOLS, PARTS, MATERIALS, TEST EQUIPMENT				
18. PROCEDURE				
19. SHIP'S CREW? (Y/N)	20. LEVEL: (M) (N)			
21. LOCATION		22. SERIAL NUMBER		

TASK DEFINITION
OPNAV 4790/124 (SD 2-02)

FIGURE 9. Task definition (Form OPNAV 4790/124).

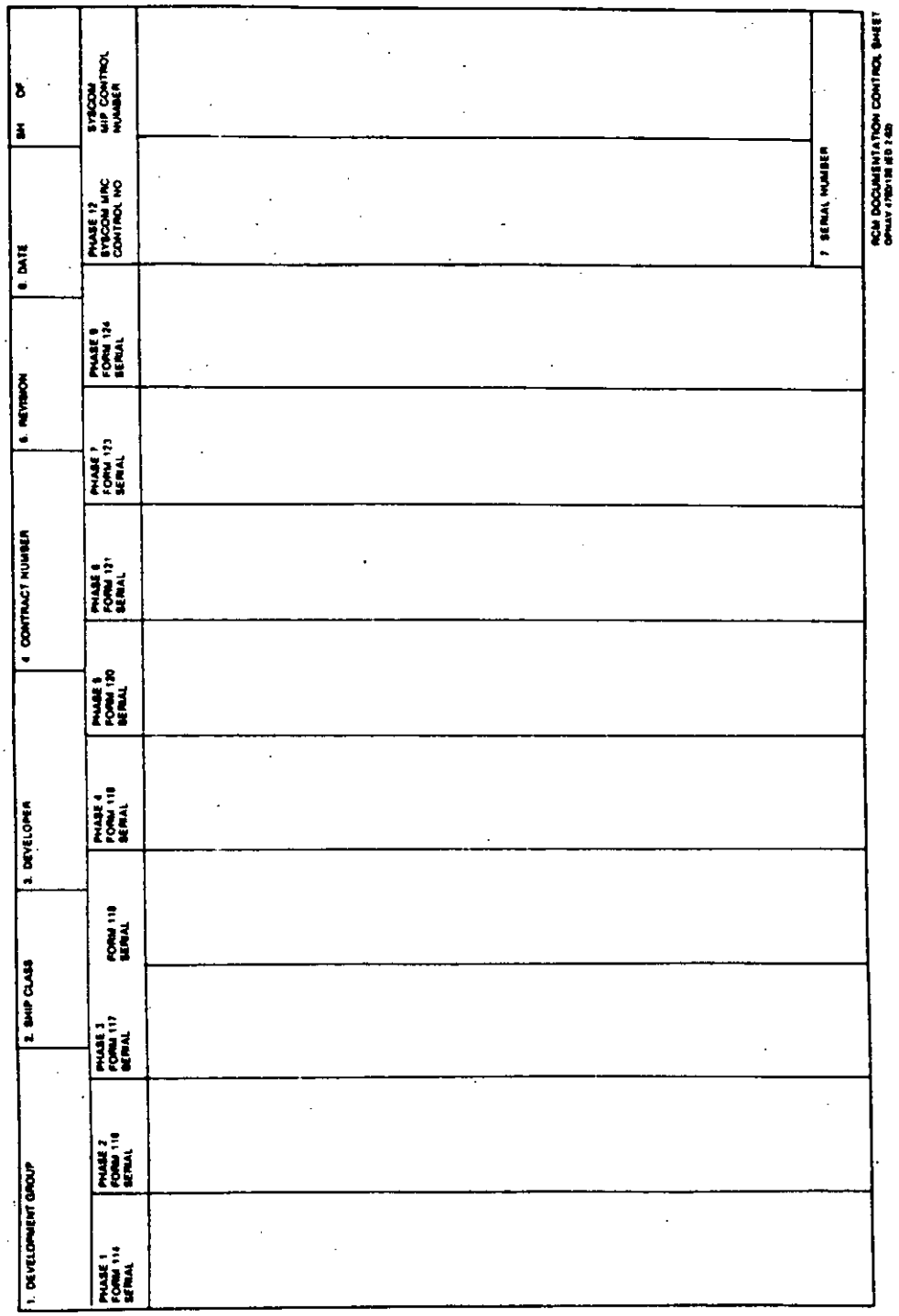


FIGURE 10. RCM documentation control sheet (Form OPNAV 4790/125).

INACTIVE EQUIPMENT MAINTENANCE REQUIREMENT ANALYSIS

OPNAV 4790/129 (4-69)

EQUIPMENT:

ACTIVITY/CONTRACT NO:

LOCAL CONTROL NO:

Date _____
Page _____ of _____

1. What degradation will occur if equipment is inactive while ship is (a) operational? (b) in an industrial environment?	2. Determine IEM requirements.		3. Considering cost and resource expenditures, are the requirements of columns 2a and 2b worthwhile?		4. Establish IEM categories (LU, PM, SU, OT) for justified MRs in column 3. Establish periodicity for PM requirements.		5. List available maintenance procedures that will satisfy justified requirements of columns 3 and 4. Indicate source (TM, OP, MRC, etc.)	6. Recommended IEM periodicities.	7. Source for IEM: (S) Existing MR (M) Modified MR (N) New develop
	2a. What maintenance actions will protect and maintain inactive equipment?	2b. What maintenance actions are required to reactivate equipment?	Yes / No	Justify	Periodicity	Justify			

FIGURE 11. Inactive equipment maintenance requirement analysis (Form OPNAV 4790/129).

PROCEDURE EVALUATION SHEET

OPNAV 4790/130 (ED 2-82)

SHIP SYSTEM, SYSTEM, SUBSYSTEM, OR EQUIPMENT:

ACTIVITY/CONTRACT NO.:

LOCAL CONTROL NO.:

DATE ____
PAGE ____ OF ____

MAINTENANCE REQUIREMENT DESCRIPTION:

MRC CODE

DEVELOPER

RECORD			EXAMINATION	CREATE AND DEVELOP						
PRESENT METHOD	○ OP ☐ IMEP		ANALYZE	IMPROVED METHOD	○ OP ☐ IMEP		TOOLS, PARTS, MATERIALS TEST EQUIPMENT	WARNINGS CAUTIONS NOTES	RELATED MAINT	NO. OF MEN AND RATE
	SYMBOL	TIME	WHAT WHERE WHEN HOW WHY	ELIMINATE SIMPLIFY COMBINE CHANGE SEQUENCE	SYMBOL	TIME				

FIGURE 12. Procedure evaluation sheet (Form OPNAV 4790/130).

SHIP SYSTEM, SYSTEM, SUBSYSTEM, OR EQUIPMENT	REFERENCE PUBLICATIONS	DATE

CONFIGURATION

		SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT DESCRIPTION	PERIODICITY CODE	RATES	MAN HOURS	RELATED MAINTENANCE

MAINTENANCE INDEX PAGE (MIP)
OPNAV 4790/84 (REV 7-62)

PAGE OF

SYSCOM MIP CONTROL NUMBER

FIGURE 13. Maintenance index page, first page (Form OPNAV 4790/84).

		SYSCOM MPC CONTROL NO.	MAINTENANCE REQUIREMENT DESCRIPTION	PERIO-DICITY CODE	RATES	MAN HOURS	RELATED MAINTE-NANCE

MAINTENANCE INDEX PAGE (MIP)
OPNAV 4790/85 (REV 1-85)

PAGE OF SYSCOM MIP CONTROL NUMBER

FIGURE 14. MIP continuation page (Form OPNAV 4790/85).

SHIP SYSTEM	SUBSYSTEM	MRC CODE
SYSTEM	EQUIPMENT	RATES / M/H
MAINTENANCE REQUIREMENT DESCRIPTION		TOTAL M/H ELAPSED TIME

PAGE OF

LOCATION	DATE

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 (REV. 3-82)

FIGURE 15. Maintenance requirement card first page (Form OPNAV 4790/82).

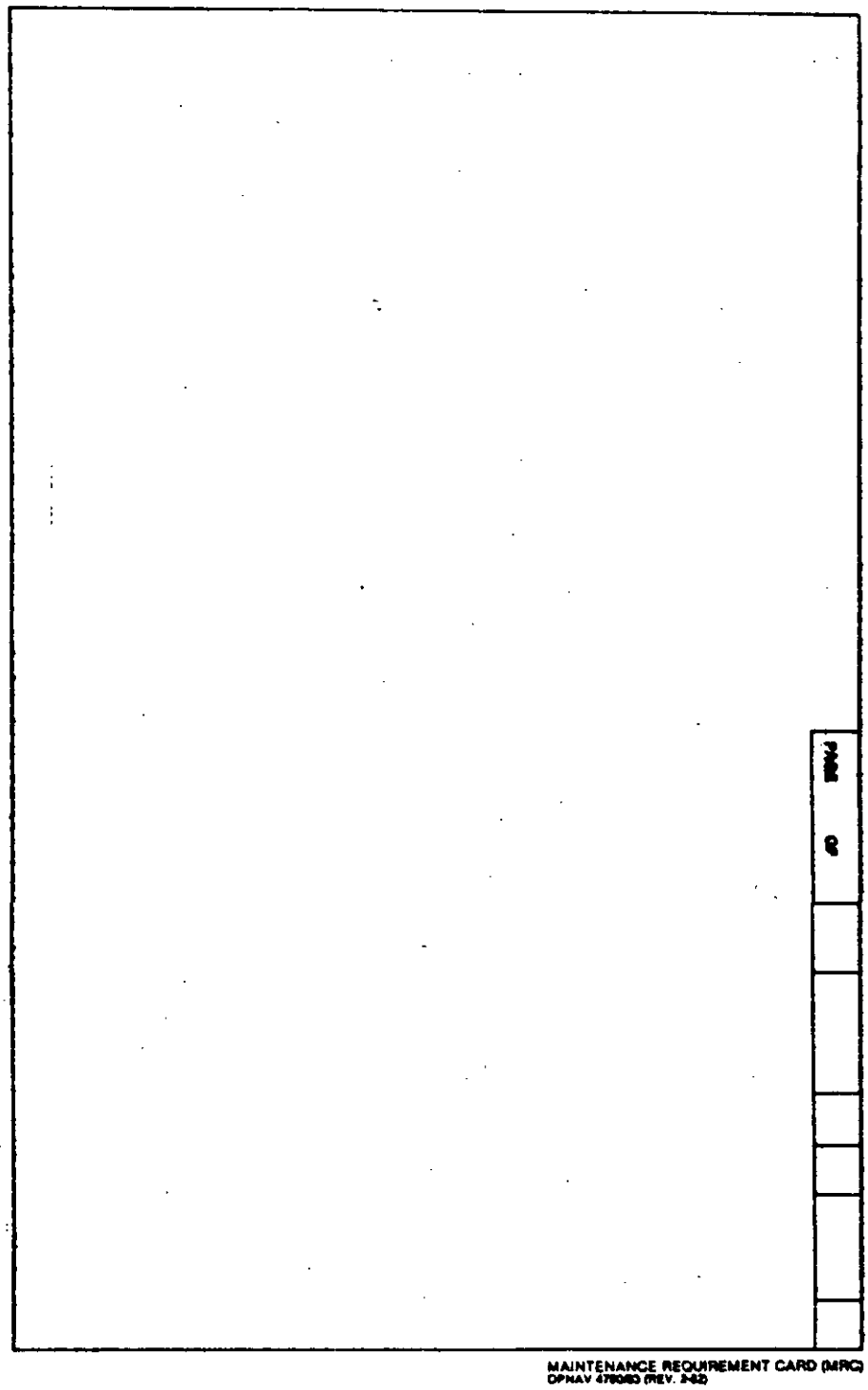


FIGURE 16. MRC continuation page (Form OPNAV 4790/83).

PAGE	AND	OF						

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/131 (REV 2-82)

FIGURE 17. MRC continuation page foldout (Form OPNAV 4790/131).

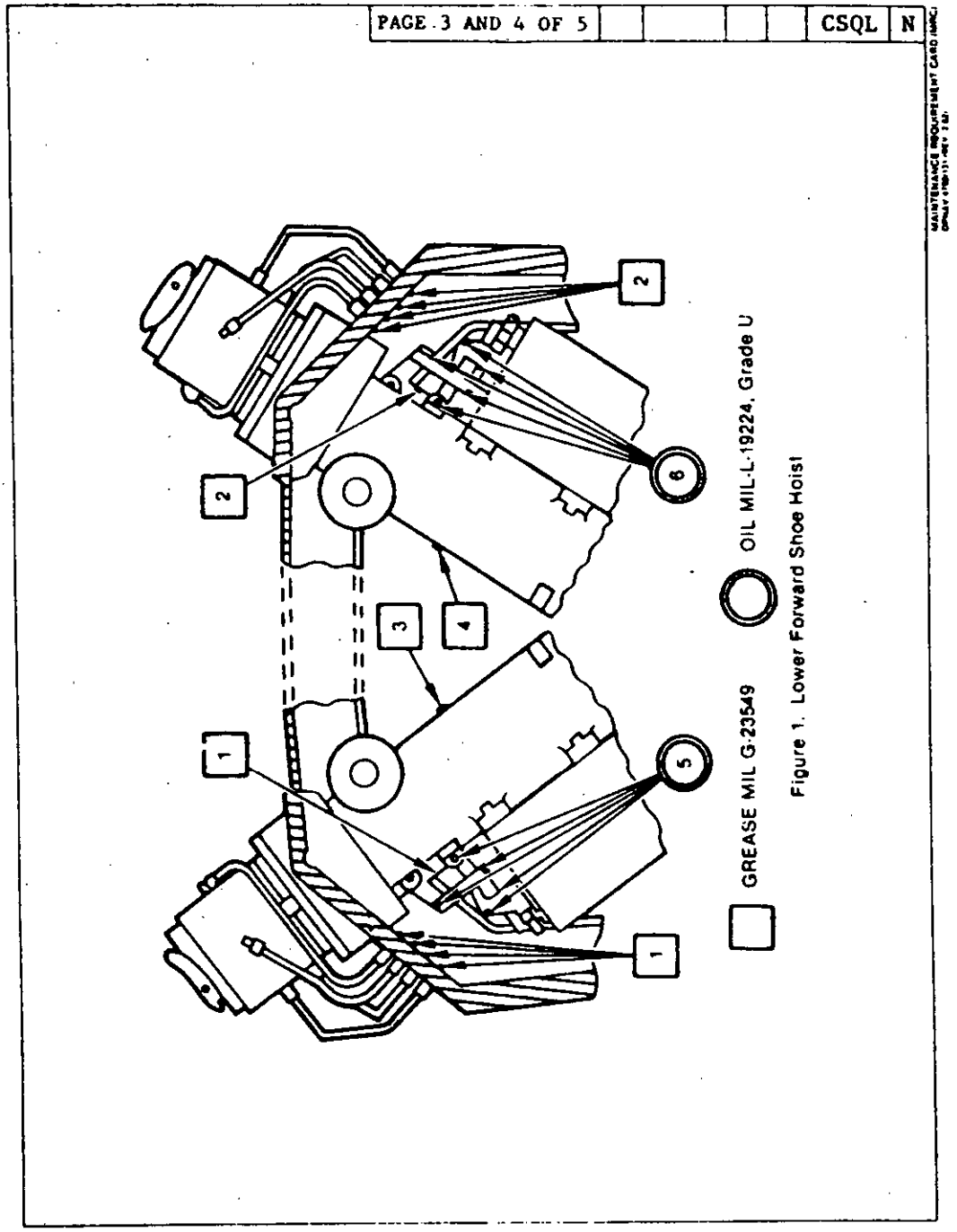


FIGURE 17. MRC foldout page (Form OPNAV 4790/131). - Continued

SYSTEM/EQUIPMENT	MIP Series	MRC No.

PRELIMINARY		FINAL		No.	DESIRED STANDARD CONDITION	Reference Paragraph in Spec.
Checked By	Date	Checked By	Date			
				1	Correct nomenclature is in Ship System, System, Subsystem, and Equipment blocks.	3.11.4
				2	SWAB level is in Ship System, System, Subsystem, and Equipment blocks.	3.11.4.1 3.11.4.2 3.11.4.3 3.11.4.4
				3	Correct MIP series is in MRC Code block.	3.11.5
				4	Correct periodicity code is in MRC Code block.	3.11.5
				5	Rates block is filled in.	3.11.6
				6	M/H block is properly filled in.	3.11.7
				7	Preliminary time is included in M/H block.	3.11.13.6 3.11.7
				8	Total M/H and Elapsed Time blocks are correctly computed and filled in.	3.11.8 3.11.9
				9	MR Description block is properly filled in (complete sentence, second person imperative, and beginning with an action verb).	3.11.10
				10	Safety Precautions block is properly filled in (first precaution refers to a manual or instruction).	3.11.11
				11	All other specific warnings in Safety Precautions block are in the same order in which they appear in the procedure block.	3.11.11
				12	Cautions do not appear in Safety Precautions block.	3.11.11.1
				13	For submarine applications, Safety Precautions block contains re-entry control statement as required.	3.11.11.2
				14	Safety Precautions block contains cleaning solvent statement when required.	3.11.11.3
				15	Safety Precautions block contains the "do not work alone" statement, and Rates/M/H blocks contain the suitable number of personnel, when required.	3.11.11.1.1 3.11.6 3.11.7
				16	Tools, Parts, Materials, and Test Equipment block is properly filled in in the following order: test equipment, materials, parts, tools, and miscellaneous.	3.11.12
				17	SCAT codes and nomenclature for test equipment are listed.	3.11.12a 3.11.12.1a
				18	Tools are listed by proper nomenclature.	3.11.12d 3.11.12.1e

MRC QUALITY ASSURANCE CHECK SHEET
OPNAV 4790/132 (ED 2-82)

FIGURE 18. Quality assurance check sheet (Form OPNAV 4790/132).

PRELIMINARY		FINAL				
Checked By	Date	Checked By	Date	No.	DESIRED STANDARD CONDITION	Reference Paragraph in Spec.
					THE FOLLOWING CHECKS CONCERN PROCEDURE BLOCK	
				19	Materials and lubricants are identified by government spec. number, item name, and nomenclature if possible.	3.11.12b 3.11.12.1b
				20	Page number block is properly filled in	3.11.18
				21	Repair parts are properly listed.	3.11.12c 3.11.12.1c 3.11.12.1d
				22	Equipage and special materials are properly listed.	3.11.12e 3.11.12.1f 3.11.12.1g
				23	Classification markings, if applicable, are properly filled in.	3.4
				24	Language, sentence structure, steps, and terminology meet standard criteria	3.11.13
				25	Notes are not used for action steps	3.11.13.2
				26	Notes are numbered if MRC contains more than one	3.11.13.2
				27	Warnings and cautions precede applicable step in which hazard is encountered.	3.11.1.11
				28	Repeat steps are used properly.	3.11.13.4a
				29	References to other publications are restricted.	3.11.2.7
				30	Scheduled MRC references are properly made	3.11.13.4
				31	Unscheduled MRC references are properly made	3.11.13.4c
				32	Fill-in blanks are used properly.	3.11.13.5
				33	All initial "make ready" steps, such as energizing equipment, warmup, positioning switches, opening doors, and establishing communications, are included in Preliminary	3.11.13.6
				34	MR description is exactly as in MR Description block with initial capitals and underlined, or in boldface	3.11.13.7
				35	All steps within each MR are in continuous alpha-numerical sequence.	3.14.4
				36	Alternate procedures are preceded by a note	3.11.13.8
				37	Tables are numbered and referenced in text.	3.11.15 3.14.6
				38	Close-out statement is included at completion of procedure if applicable	3.11.13.7
				39	Procedural steps are factual and concise, and are not susceptible to misinterpretation.	3.11.1.1
				40	Optimum value is stated, followed by a range, when a measure or adjustment is specified.	3.11.1.1d
				41	No words are misspelled	3.11.1.8

MRC QUALITY ASSURANCE CHECK SHEET
OPNAV 4790/132 (ED 2-82)

FIGURE 18. Quality assurance check sheet (Form OPNAV 4790/132). - Continued

PRELIMINARY		FINAL				
Checked By	Date	Checked By	Date	No.	DESIRED STANDARD CONDITION	Reference Paragraph in Spec.
					THE FOLLOWING CHECKS CONCERN PROCEDURE BLOCK	
				42	Abbreviations used are approved.	3.11.1.9
				43	Signs and symbols are standard.	3.11.1.10
				44	Figures are numbered and referenced in text.	3.11.14 3.14.5.1
				45	Spacing and format meet standard criteria.	3.14.3
				46	Preferred words and expressions are used.	Appendix A
				47	Capitalization meets standard criteria.	Appendix C
				48	Line art meets standards.	3.11.14.1

MRC QUALITY ASSURANCE CHECK SHEET
OPNAV 4790/132 (ED 2-82)

FIGURE 18. Quality assurance check sheet (Form OPNAV 4790/132). - Continued

TASK APPLICABILITY AND EFFECTIVENESS CRITERIA

TASK	APPLICABILITY	EFFECTIVENESS
Time-Directed		
Scheduled Rework (RW)	Probability of failure must increase at an identifiable age. A large proportion of units must survive to that age.	For critical failures: The task must reduce the risk of failure to an acceptable level. For all other failures: The task must be cost-effective.
Scheduled Life Limit (LL)	For safe-life items: Probability of failure below life limit must be zero. For economic-life items: Probability of failure must increase at an identifiable age. A large proportion of units must survive to that age.	A safe-life limit must reduce the risk of failure to an acceptable level. An economic-life limit must be cost-effective.
Condition-Directed (CD)	Reduced failure resistance for a specific failure mode must be detectable. Rate of change in failure resistance must be reasonably predictable.	For critical failures: The task must reduce the risk of failure to an acceptable level. For all other failures: The task must be cost-effective.
Failure Finding (FF)	Occurrence of functional failure must not be evident to the operating crew during performance of their normal duties.	The task must increase availability of the affected function to an acceptable level.

FIGURE 19. Task applicability and effectiveness criteria.

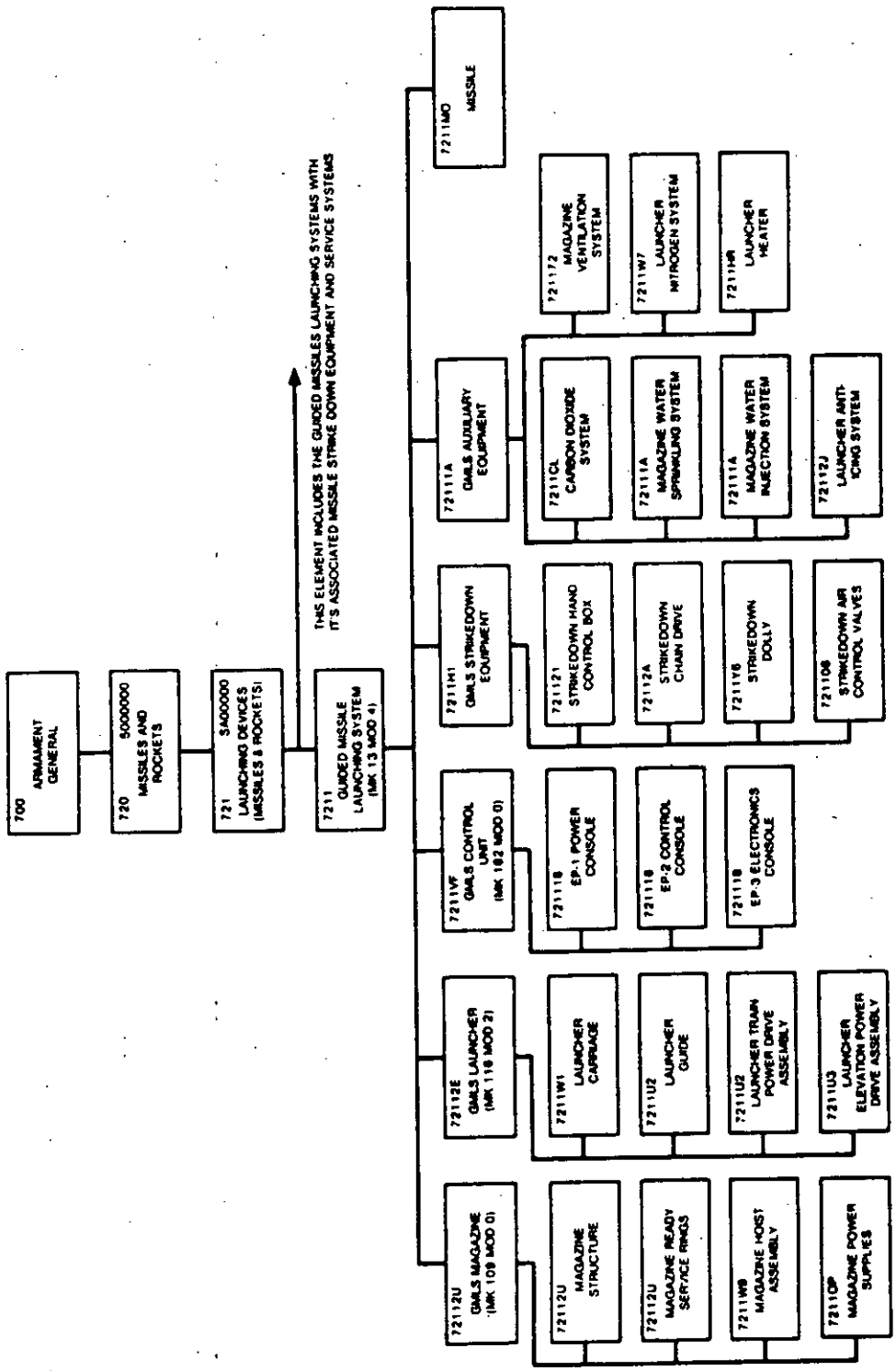


FIGURE 20. Typical SWAB system breakdown.

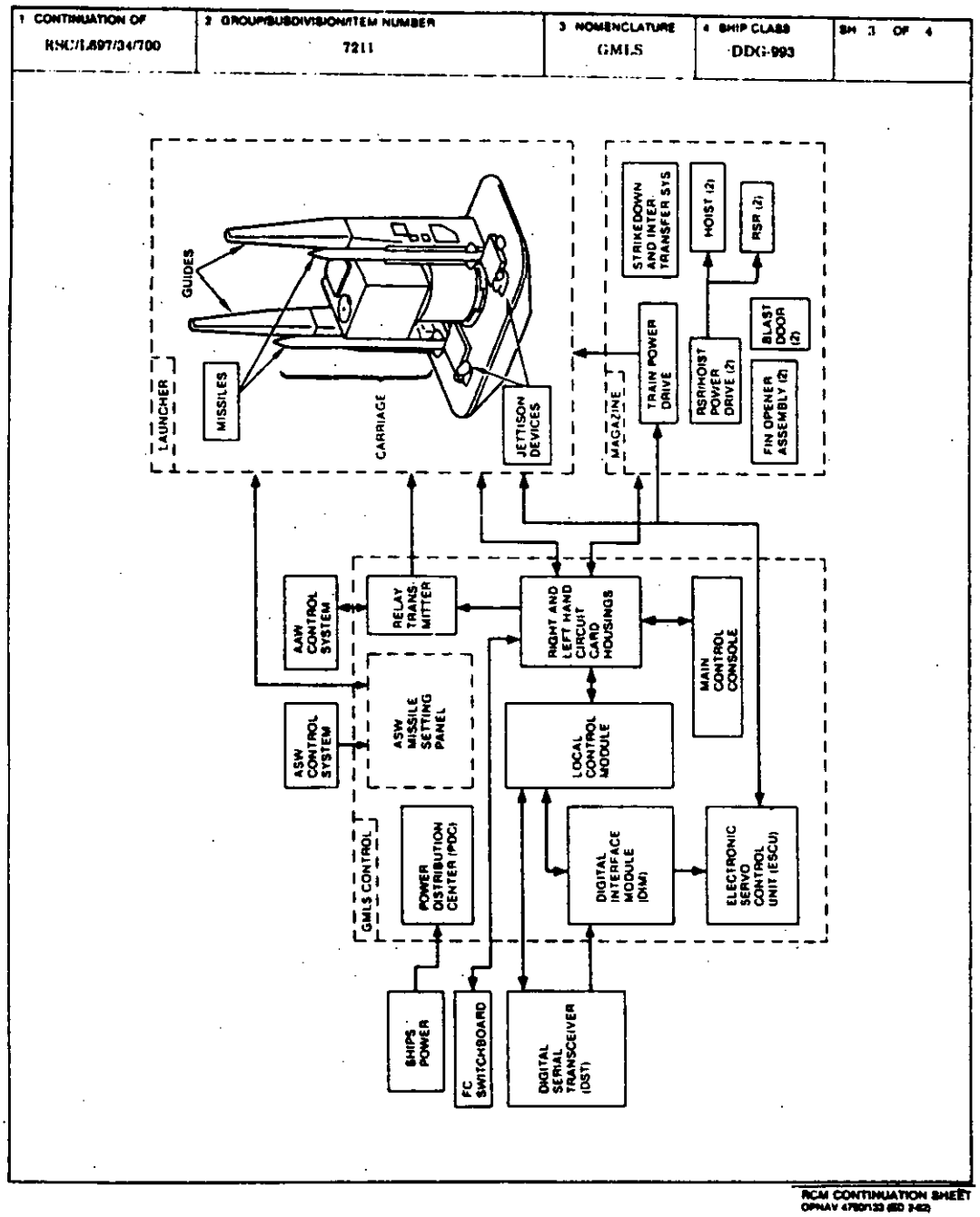


FIGURE 21. Functional block diagram (Form OPNAV 4790/133).

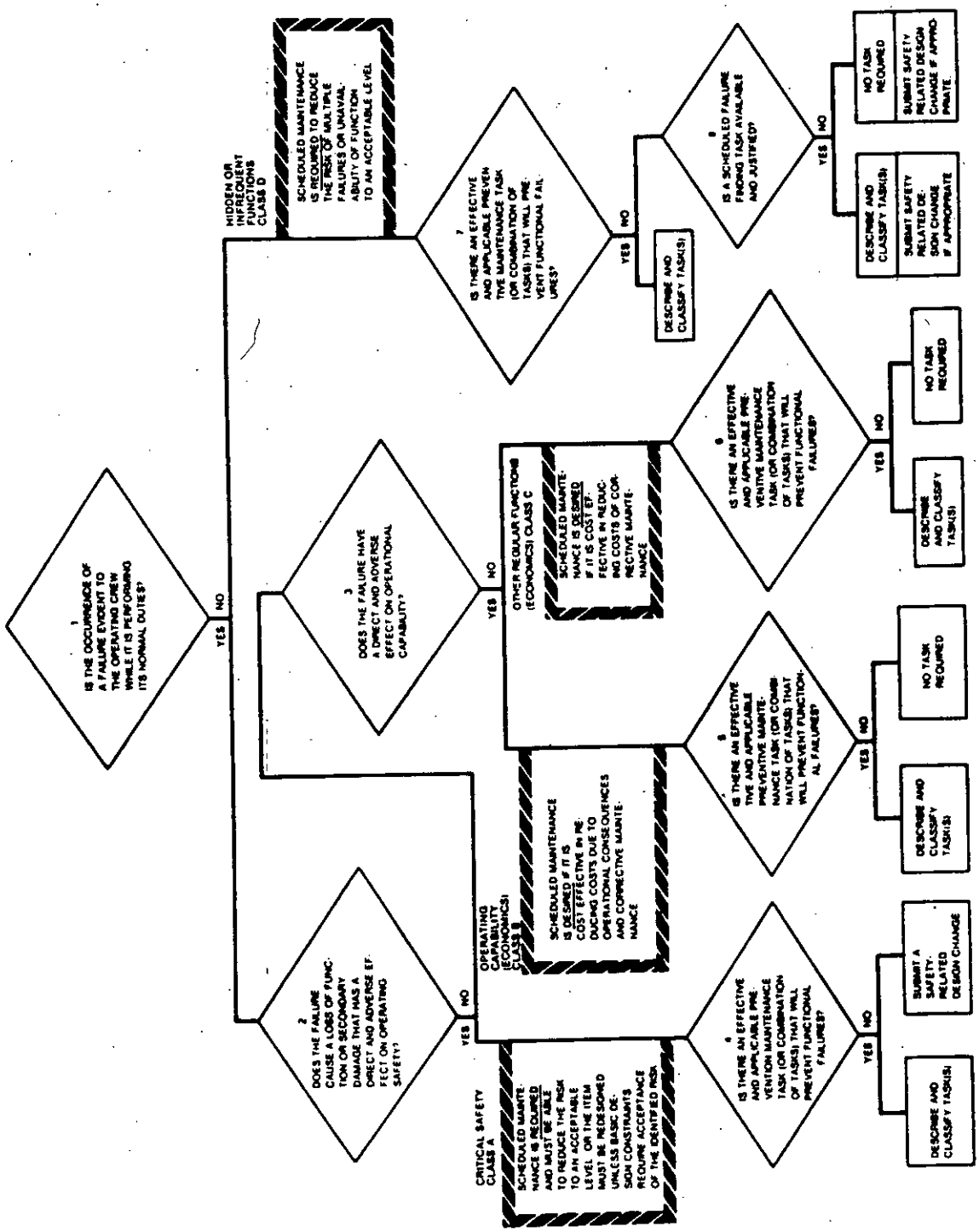


FIGURE 22. RCM decision logic tree.

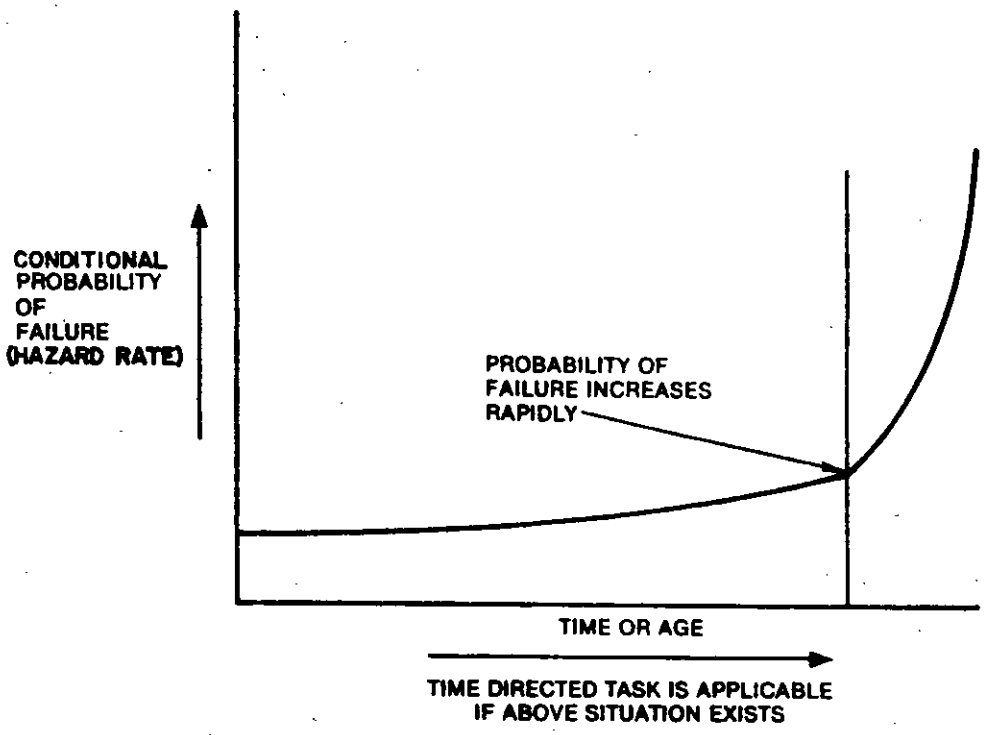


FIGURE 23. Characteristics of an item for which hard-time tasks are applicable.

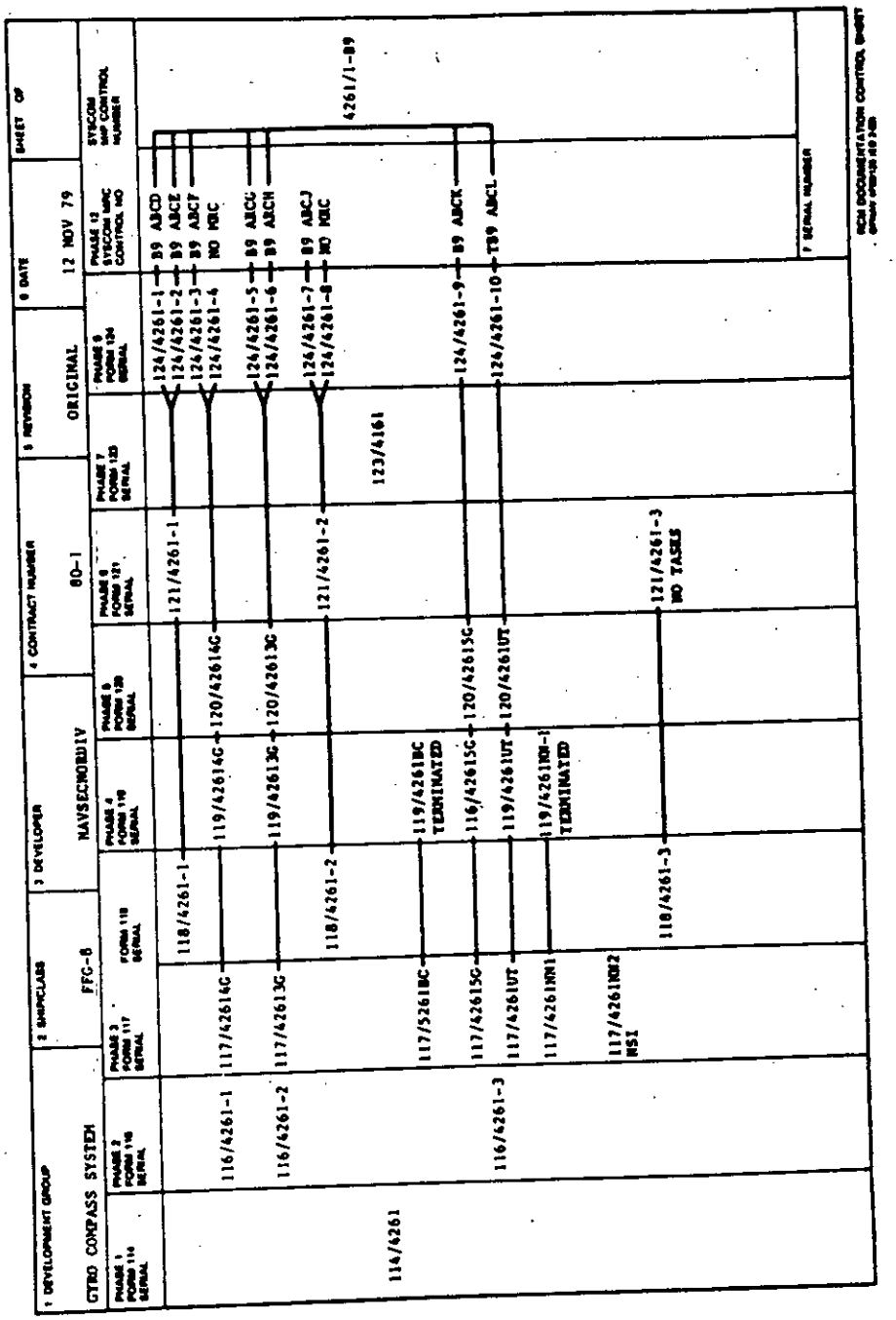


FIGURE 24. Completed RCM documentation control sheet (Form OPNAV 4790/125).

SHIP SYSTEM	SUBSYSTEM	MRC CODE
		R-28 M-1
SYSTEM	EQUIPMENT	RATES / M/H
	AN/SPS-39A Radar Set	FTM3 3.9 FTMSN 3.9 TOTAL M/H 7.8 ELAPSED TIME 3.9

MAINTENANCE REQUIREMENT DESCRIPTION

1. Test coordinate data computer and display console angle accuracy.
2. Test display console range accuracy.
3. Test azimuth gated variable ELSCAN operation.

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.
2. When BATTLE SHORT switch is on, protective interlock switch is bypassed and voltages dangerous to life are present. Do not work alone.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

TEST EQUIPMENT

1. [0945] Oscilloscope, 50 MHz 7 ns (SCAT 4308)
2. [1529] Voltmeter, Diff AC/DC (SCAT 4208)

MISCELLANEOUS

1. [0637] Headset-chest set, electrical, type H-200/U, sound-powered

NOTE: Numbers in brackets can be referenced to Standard PMS Materials Identification Guide (SPMIG) for stock number identification.

PAGE 1 OF 10

PROCEDURE

Maintenance procedure with this requirement is CONFIDENTIAL. Maintenance Requirement Card is stowed in _____.

C A1 CBP1

LOCATION	DATE
	October 1981

N

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 (REV. 2-82)

FIGURE 25. Locator MRC (Form OPNAV 4790/82).

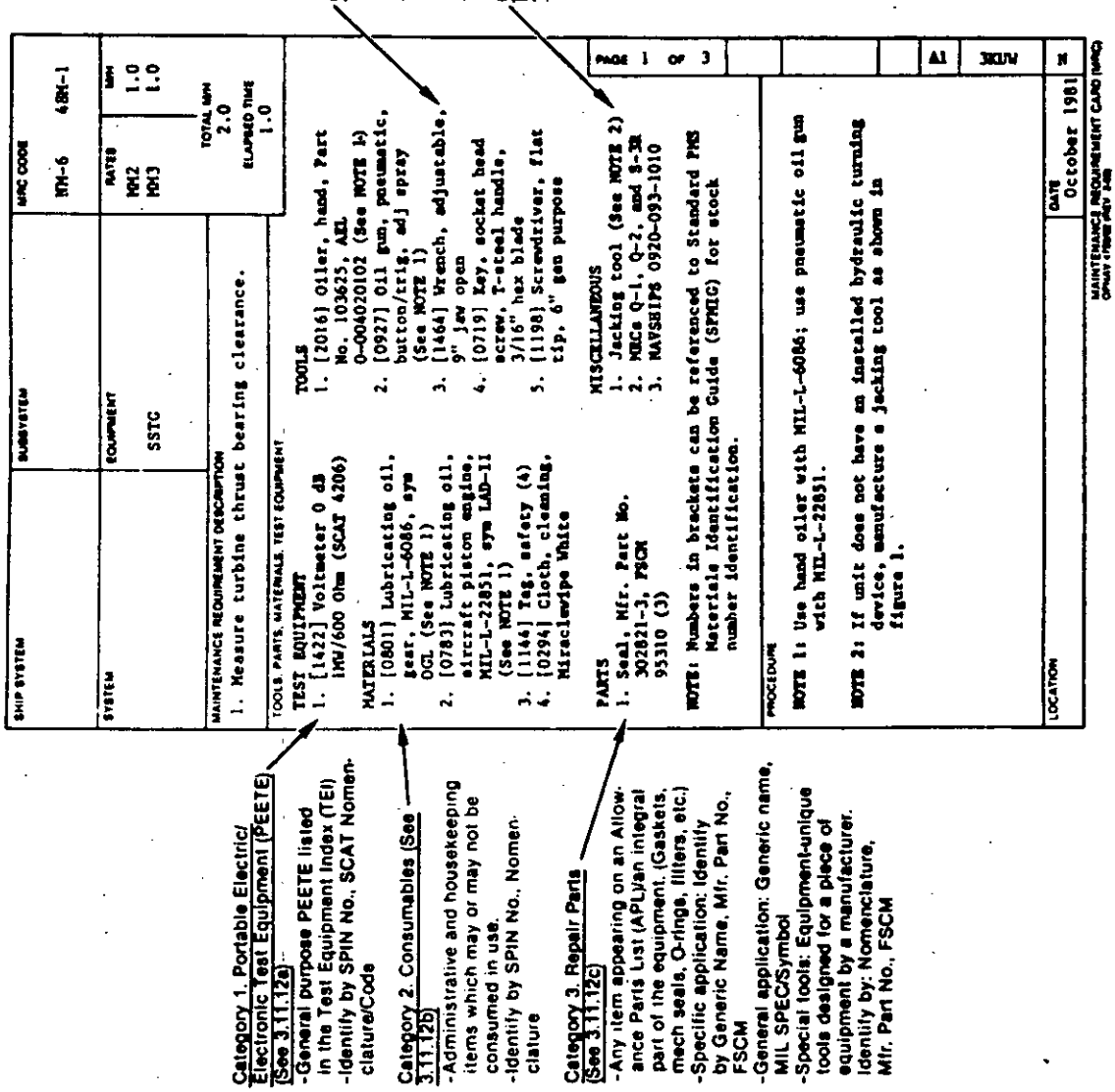


FIGURE 26. MRC material categories (Form OPNAV 4790/82).

SHIP SYSTEM	SUBSYSTEM	MRC CODE A-1 U-1
SYSTEM	EQUIPMENT Steering and Diving Rams	RATES / M/H TOTAL M/H ELAPSED TIME

MAINTENANCE REQUIREMENT DESCRIPTION
1. Determine steering and diving ram leakages.

SAFETY PRECAUTIONS
1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.
2. Ensure rudder and planes are clear of personnel and equipment. Have word passed to stand clear of rudder and planes during tests.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MATERIALS
1. [1408] Tubing, nonmetallic, flexible rubber (See Note 1)
2. [0120] Beaker, laboratory, 250 ml (See Note 1)
3. [2274] Pail, utility, plastic (See Note 1)
4. Bleeder extension (See Note 1)

TOOLS
1. [0719] Key socket head screw, 3/16" (See Note 1)

MISCELLANEOUS
1. Supplemental Report form
2. [1327] Stopwatch

NOTE: Numbers in brackets can be referenced to Standard PMS Materials Identification Guide (SPMIG) for stock number identification.

PROCEDURE

NOTE 1: Provided by SMMS Site Team.

NOTE 2: MR will be performed when directed by SMMSO only on ships equipped with bleeder extenders per drawing SSBN 619-516-170917.

Preliminary

a. Obtain permission of cognizant officer(s) to perform MR.
b. Line up steering and diving hydraulic system for emergency (vital) operation.

1. Determine Steering and Diving Ram Leakages.

WARNING: Ensure rudder and planes are clear of personnel and equipment. Have word passed to stand clear of rudder and planes during tests.

PAGE 1 OF 4

31 B14Y U

LOCATION	DATE March 1981

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 (REV. 2-82)

FIGURE 27. Unscheduled MRC (SMMS reference) (Form OPNAV 4790/82).

SHIP SYSTEM	SUBSYSTEM	MRC CODE
Interior Communication System 430	Tank Level Indicating Systems 4372	4372 SU-1
SYSTEM	**EQUIPMENT**	**RATES / M/H**
Indicating, Order and Metering Systems 437	Tank Level Indicating Systems 4372NX	ICFN 0.1 IC3 0.4 EM1 0.2 (See Note) TOTAL M/H 1.2 ELAPSED TIME 0.4

MAINTENANCE REQUIREMENT DESCRIPTION

1. Remove protective cover from indicators and panels.

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.

TOOLS, PARTS, MATERIALS TEST EQUIPMENT

None

PROCEDURE

NOTE. Due to space limitations in RATES M/H block, additional rates and man-hours required are:

EM3	0.1
IC2	0.1
EMFN	0.1
FN	0.2

1. Remove Protective Cover from Indicators and Panels.
   a. Remove tape and fire-resistant paper from indicator and panel meter faces.
   b. Remove safety tag and energize system.
   c. Return equipment to readiness condition.

PAGE 1 OF 1

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6FRV

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LOCATION	DATE
	July 1981

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 (REV. 2-82)

FIGURE 28. IEM procedure MRC (Form OPNAV 4790/82).

PROCEDURE (Contd)

STEP	EQUIPMENT	PROCEDURE	RESPONSE
		1. Perform Air Target Tracking and Sector Blanking Test.	
		A. Controlled Aircraft Target	
1	NTDS	Using normal operating procedures, enter target INTO NTDS complex and establish a track.	Set
2	Air Controller	Vector aircraft to start of flight pattern (Point A on figure 1.)	Set
3	NTDS	Initiate request for digital communications with GFCC.	Set
4	COC	Press REQUEST/ENABLE switch to light ENABLE lamp.	Enable
5	COC	Press SPG-60 ENABLE/RADIATE switch to light ENABLE lamp.	Enable
6	COC	Rotate DESIGNATOR SELECT switch to NTDS.	NTDS
7	COC	Rotate GCC-2 ASSIGN switch to AA.	AA
8	FCSC	As target arrives at point B on flight pattern, figure 1, assign to GFCS.	Assigned
9	GCC-2	Report when TRACK lamp comes on.	(Status)
10	GCC-2	Record Range at which TRACK occurred.	(Reading)
11	FCSC	Release assignment to GFCS.	Released
12	Air Controller	Vector aircraft back to point A on flight pattern. figure 1.	Wait/ Set
NOTE 2: Repeat steps 1.8 through 1.12 four times and then steps 1.8 through 1.10 once. After sixth acquisition, vector aircraft inbound toward point D, figure 1.			
13	COC	Press SPG-60 OPERATE switch	Operate
14	GCC-2	Observe COAST lamp.	(Status)

PAGE 3 OF 6

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MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/83 (REV. 2-82)

FIGURE 29. MRC columnar format (Form OPNAV 4790/83).

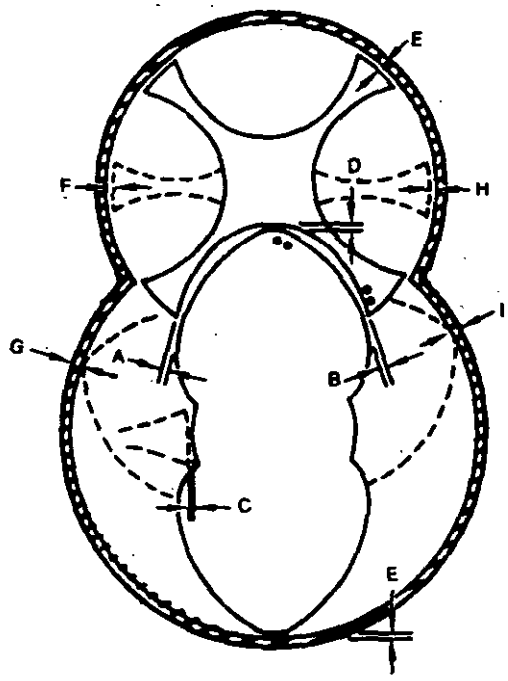

Figure 1. Location of Blower Clearance Check Points

k. Install dial indicator base attachment to top flange of cylinder block.
l. Install dial indicator with ball point in contact with blower driving timing gear teeth at right angles to ensure accurate dial reading.
m. Move blower driving timing gear until teeth of gear are tight against driven gear teeth.
n. Set indicator dial to zero.
o. Move driving timing gear in opposite direction until teeth are stopped by driven gear teeth; read indicator. Proper timing gear backlash is minimum 0.002", maximum 0.008".
p. Jack engine and repeat steps l.e. through l.o in three additional locations 90° apart.
q. Remove dial indicator and base.
r. Remove outer cover from blower and clamp drive gear backlash tool (figure 2) to lower rotor shaft end plate.

PAGE 4 OF 7

4DMP

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MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/83 (REV. 2-62)

FIGURE 30. Sample profile art (Form OPNAV 4790/83).

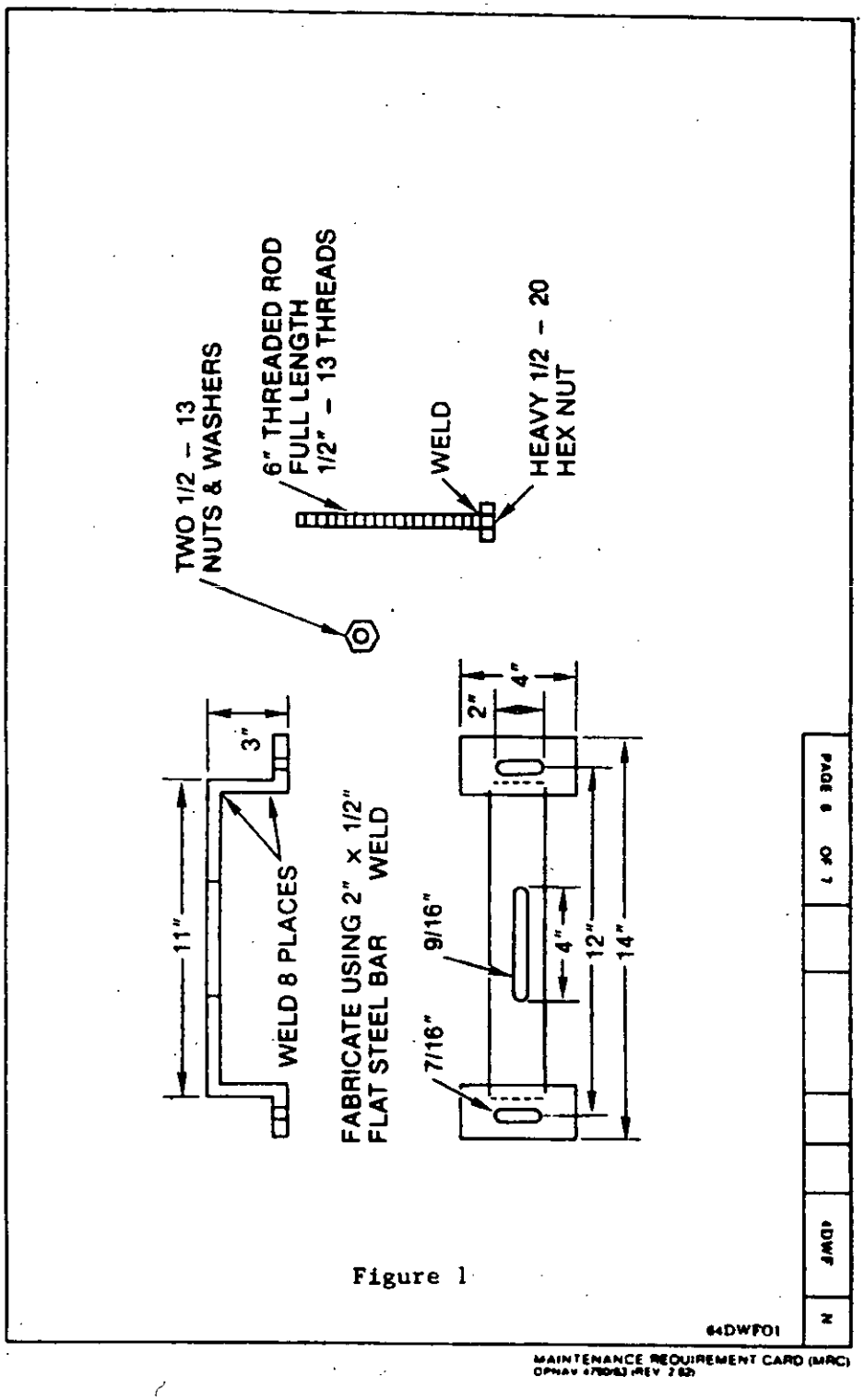

FIGURE 31. Sample landscape art (Form OPNAV 4790/83).

SHIP SYSTEM	SUBSYSTEM	MRC CODE
		5BAC000 LU-1
SYSTEM	EQUIPMENT	RATES / M/H
	Radar Set AN/SPQ-55B TERRIER M	TOTAL M/H ELAPSED TIME

MAINTENANCE REQUIREMENT DESCRIPTION

1. Perform lay-up maintenance.

SAFETY PRECAUTIONS

1. Observe standard safety precautions in accordance with Safety Summary in NAVSEA OP 4059, 4256, 4563 Volume 1.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

None

PROCEDURE

NOTE 1: This is a scheduling card. Schedule and perform listed MRCs for lay-up maintenance.

1. Perform Lay-Up Maintenance.
   a. Lubricate louver actuating mechanism.
      S-7
   b. Inspect and check liquid coolant loop.
      W-10
   c. Check heat exchanger and purification unit.
      M-6

NOTE 2: Power not required to perform MRCs listed in step 1.d.

   d. Inspect and lubricate Radar/Director Mod 6 components.

Q-8	S-16	A-12	Q-13
Q-11	S-11	S-2	S-5
	R-6	A-2	

NOTE 3: In step 1.d. use the following cards for Mod 8:

S-16	A-12	Q-13	Q-8	S-11
S-2	S-5	Q-11	R-6	A-2

   e. Inactivate radar set.
      LU-2

PAGE 1 OF 1

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CHEM

LOCATION

DATE July 1981

N

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 (REV. 3-80)

FIGURE 32. IEM scheduling MRC (Form OPNAV 4790/82).

SHIP SYSTEM, SYSTEM, SUBSYSTEM, OR EQUIPMENT	REFERENCE PUBLICATIONS	DATE
AN/URT-7, 7C, 7D Radio Transmitting Set	NAVSHIPS 0967-LP-971-5010 0967-LP-071-0010	January 1982

CONFIGURATION

AN/URT-7 FC 1 through 5, and 7
AN/URT-7C FC 1, 3
AN/URT-7D FC 1

TYPE	TYPE	SYSCOM MRC CONTROL NO	MAINTENANCE REQUIREMENT DESCRIPTION	PERIODICITY CODE	RATES	MAN HOURS	RELATED MAINTENANCE
			A scheduling aid: Review Maintenance Requirement M-1/Q-2. Omit MRC if it does not apply; no feedback report required. # Mandatory scheduling required.				
		12 BDT8 N	1. Clean air filter. NOTE: Perform quarterly if equipment is installed in environmental cabinet in a space with closed-loop air conditioning. All other installations perform monthly.	M-1/ Q-2	2RMSN	0.4	None
4		11 BK53 N	1. Test operate radio transmitting set.	M-2	ET3 RMSN	0.5 0.1	None
		12 BZS0 N	1. Clean and inspect radio transmitting set. NOTE: Perform semiannually if equipment is installed in environmental cabinet in a space with closed-loop air conditioning. All other installations perform quarterly.	Q-1/ S-1	RMSN RMSN	0.8 0.2	M-1/ Q-2# M-2#
			INACTIVE EQUIPMENT MAINTENANCE				
			The following requirements will be scheduled when the equipment is inactivated for prolonged periods. Lay-Up Maintenance				
		A9 CKL4 N	1. Install protective covering. NOTE: Accomplish if industrial work is to be performed in vicinity of equipment.	LU-1	RMSN	0.2	None
			Periodic Maintenance None				
			Start-Up Maintenance				
		A9 CKL5 N	1. Remove protective covering. NOTE: Use MRC M-1/Q-2. 1. Clean and inspect radio transmitting set. NOTE: Use MRC Q-1/S-1.	SU-1	RMSN	0.5	None

MAINTENANCE INDEX PAGE (MIP) PAGE 1 OF 1 SYSCOM MIP CONTROL NUMBER C-16/1-12

FIGURE 33. MIP including inactive equipment maintenance (IEM) (Form OPNAV 4790/82).

SHIP SYSTEM, SYSTEM, SUBSYSTEM, OR EQUIPMENT	REFERENCE PUBLICATIONS	DATE
Tube, Torpedo, SV Mk 32 Mod 14 7501 (DD-963 CLASS)	OP 4 OP 3347 OP 3355 OP 3389 OD 42433 OD 42987 SW395-AE-MMO-010/ Mk 32 Mod 14	July 1981

CONFIGURATION

This MIP reflects ORDALT 9226; however, it should be implemented before ORDALT installation.

ORDALTS: 8606, 8737, 9138, 9226

TYPE	QTY	SYSCOM MRC CONTROL NO	MAINTENANCE REQUIREMENT DESCRIPTION	PERIODICITY CODE	RATES	MAN HOURS	RELATED MAINTENANCE
			Scheduling aids: 1. Use OP 3355 and contractor prepared data for SVTT Mk 32 Mod 14, until release of publication SW395-AE-MMO-010/Mk 32 Mod 14. 2. Annual tender calibration of breech mechanism HP air gage should be performed just before performing MRC A-1. 3. Review Maintenance Requirements. Omit MRC(s) which do not apply; no feedback report required. 4. Schedule performance of MRC M-1 transmission check in FC MIP J-T116/0.				
		71 DTBA N	TORPEDO TUBE MK 32 1. Inspect torpedo tube and tube loaded torpedoes.	W-1	TMSN	1.0	None
	3	71 DTBB Y	TORPEDO TUBE MK 32 1. Test breech mechanisms for leaks. 2. Test securing mechanism. 3. Test firing solenoid valve for leaks. 4. Test manual firing operation.	M-1	TM3 TMSN	3.0 3.0	WS-62: M-2
	4	71 DTBD N	BULKHEAD MOUNTED CONTROL BOX 1. Inspect and test bulkhead mounted control box connections, switches, and indicators.	M-2	TMSN	0.5	None
	4	71 DTBC N	BREECH MECHANISM MK 1 1. Perform 24 hour pressure drop test.	Q-1	TM3 TMSN	2.5 2.5	M-1
		71 DTBE N	TORPEDO TUBE MK 32 1. Inspect, clean, and lubricate barrels, securing mechanism, and mount. 2. Lubricate emergency squib fire switch plunger.	Q-2	TM3 TMSN	3.0 3.0	W-1 M-1
		71 DTBF N	TORPEDO TUBE JUNCTION BOXES 1. Inspect electrical system. 2. Inspect mount barrel junction box connections and seals.	S-1	TM3 TMSN	1.5 1.5	M-1 Q-2
	4	71 DTBG N	BREECH MECHANISM MK 1 1. Lubricate firing valve assembly O-rings. 2. Perform hydrostatic test of breech mechanism air flasks.	A-1	TM3 TMSN	1.2 1.2	Q-1
		71 DTBH N	TORPEDO TUBE MK 32 1. Clean, inspect, and lubricate breech locking rings. 2. Clean, inspect, and lubricate safe-ready cylinder assembly.	A-2	TM3 TMSN	3.5 3.5	Q-2 S-2

MAINTENANCE INDEX PAGE (MIP) (OPNAV 4790/84 REV 7-76) PAGE 1 OF 2 SYSCOM MIP CONTROL NUMBER 7501/14-71

FIGURE 34. MIP listing requirements under specific system/equipment headings (Form OPNAV 4790/84).

1 space 1 space 3 space

SHIP SYSTEM	SUBSYSTEM	MRC CODE
	Guided Missile Launching System Mk 10 All Mods	5ZBAAHT D-1

SYSTEM	EQUIPMENT	RATES	M/H
	GMLS Components	GMM2	0.5
		3GMM3	1.5
		GMMSN	0.5
		TOTAL M/H	2.5
		ELAPSED TIME	0.5

Centrally located

MAINTENANCE REQUIREMENT DESCRIPTION

1. Perform daily readiness test.

SAFETY PRECAUTIONS

1. Observe standard safety precautions in accordance with Safety Summary in technical manual SW394-AC-MMA-010/LS10 INDEX.
2. Sound train warning bell and loading horn before starting motors.
3. Verify that personnel are in a safe area before moving equipment.
4. Verify that launcher training area is clear before opening blast doors or moving launcher.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MISCELLANEOUS

1. [0637] Headset-chestset, sound powered

NOTE: Numbers in brackets can be referenced to Standard PMS Materials Identification Guide (SPMIG) for stock number identification.

PROCEDURE

Preliminary

NOTE 1: Only POS qualified personnel, or trainee under supervision of qualified operator, may operate equipment.

a. Establish phone communication with EP2, EP3, EP4, EP5 operators and launcher safety observer.
b. At EP1, position all circuit breakers to ON, except CBZ2.

1. Perform Daily Readiness Test

WARNING: Sound train warning bell and loading horn before starting motors.

a. At EP2, start motors.

(Warnings, Cautions, and Notes)

PAGE 1 OF 3

71

C2RF

N

LOCATION	DATE
	July 1981

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 (REV. 2-82)

FIGURE 35. MRC with spacing standards (Form OPNAV 4790/82).

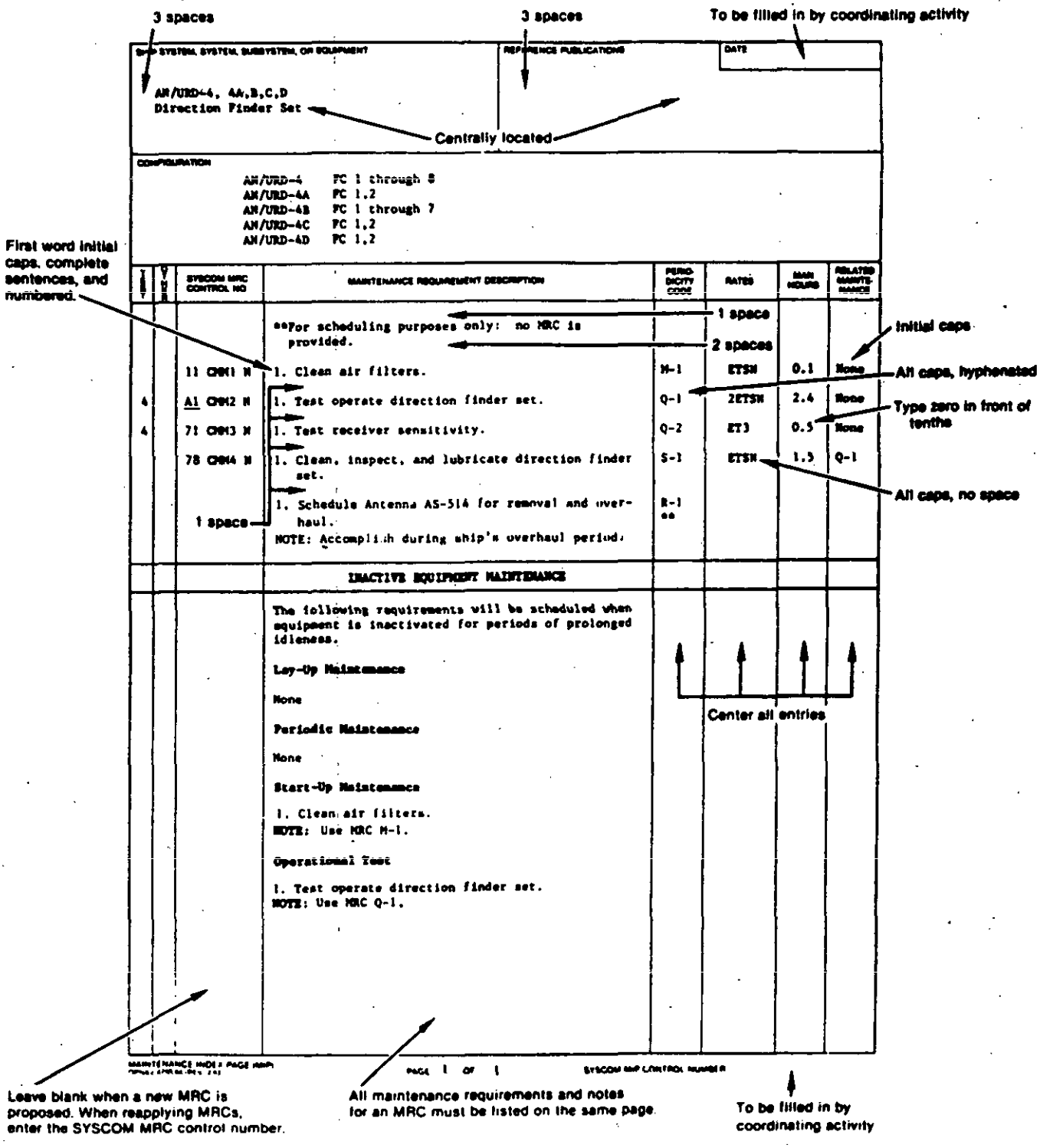

FIGURE 36. MIP with spacing standards (Form OPNAV 4790/84).

SHIP SYSTEM	SUBSYSTEM	MRC CODE
		A-84 ~~A-5R~~ S-1R

SYSTEM	EQUIPMENT	RATES	MH
	HP Air Dehydrator	MM2	3.5

TOTAL MH 3.5
ELAPSED TIME 3.5

MAINTENANCE REQUIREMENT DESCRIPTION
1. Clean and inspect lower manifold check valves (CV2 through CV5).
2. Clean and inspect prefilter check valve (CV1).
3. Inspect dehydrator for leaks.

SAFETY PRECAUTIONS
1. ~~Foreign effluent comply with Navy Safety Precautions for Foreign Effluent, OPNAVINST 5100 series.~~ SM01
2. Check valves are subject to high temperatures ~~(300° - 600°F)~~ 800°-600°F. Ensure that prior to performing maintenance, components are cool enough to permit handling and touching without danger of skin burns.
3. Do not use flammable or toxic solvent for cleaning.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MATERIALS
1. Approved safety cleaning solvent
2. Leak Test compound
3. Grease, Halocarbon 25-55
4. Rag, wiping
5. Tag, safety

PARTS
1. O-ring, Mfr Part No. PRP568-114
2. O-ring, Mfr Part No. PRP568-222
3. Backup ring Mfr Part No. MS28774-222

TOOLS
1. Key set, socket head screw
2. Wrench, spanner
3. Wrench set, combination, box and open end
4. Socket, 1-1/2" Hex
5. Socket, 1-3/4" Hex
6. Wrench, torque 0-100 ft-lb

PROCEDURE
NOTE 1: Accomplish ~~annually~~ Semiannually and when equipment malfunctions traceable to check valves.

Preliminary
a. Obtain permission of cognizant officer(s) to perform this MR.
b. De-energize electrical circuit and tag out of service.
c. Shut applicable isolation valves and tag "Do Not Open".
d. Vent dehydrator to atmospheric pressure.

PAGE 1 OF 3

LOCATION

DATE ~~August 1981~~ December 1984

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790/82 REV 5/82

2407
0754
1615
1102
1144

~~PARTS~~ 3
1. O-ring, Mfr Part No. PRP568-114, FSCM 95310
2. O-ring, Mfr Part No. PRP568-222, FSCM 54341
3. Backup ring, Mfr. Part No. MS28774-222, FSCM 34571

2410
1544
1445
1754
1289
1752

FIGURE 37. Corrected MRC for computer input (Form OPNAV 4790/82).

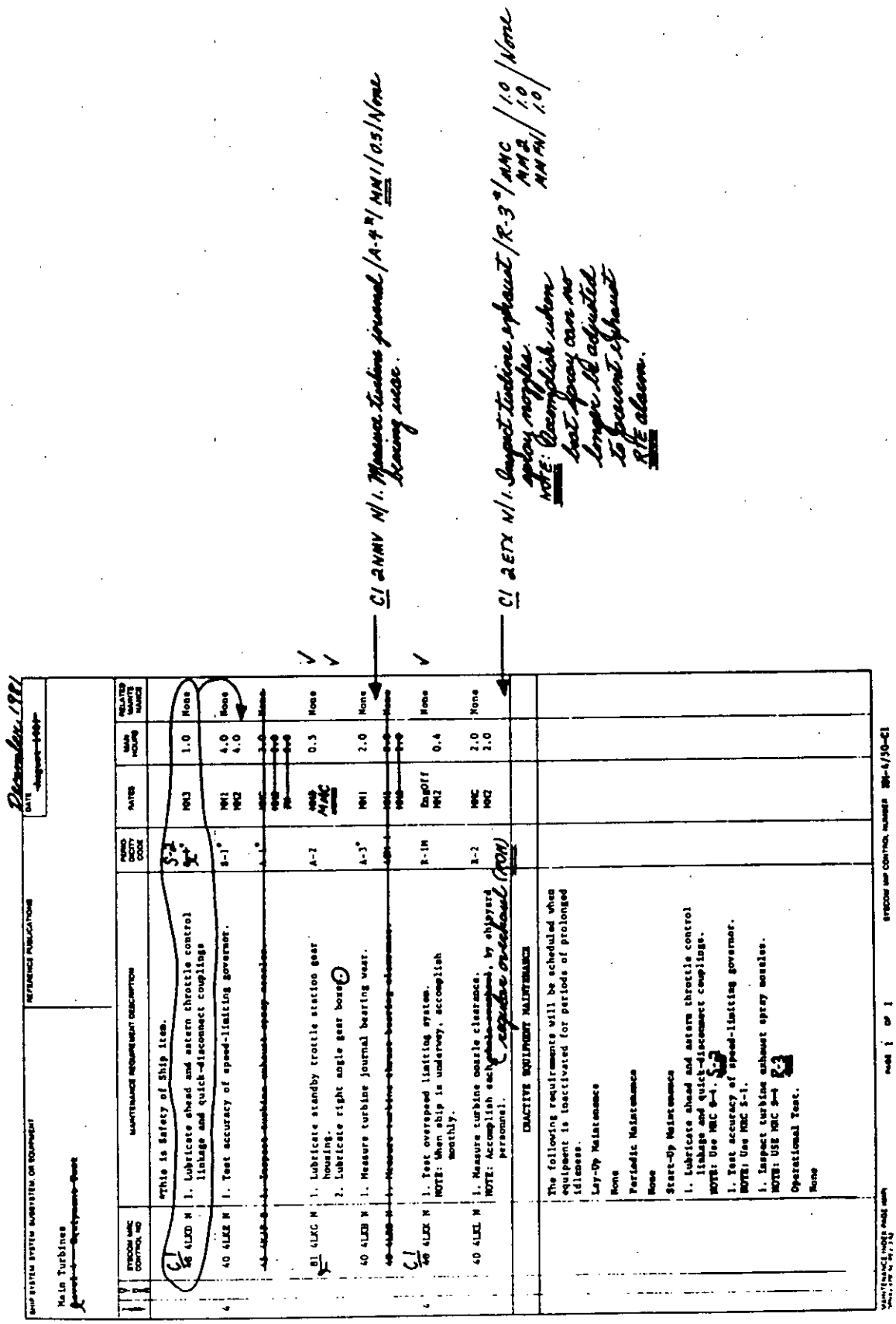

FIGURE 38. MIP marked up for revision (Form OPNAV 4790/84).

APPENDIX A

WORD USAGE

10. SCOPE

10.1 Scope. This appendix provides word usage guidelines included in the Government Printing Office Style Manual (see 2.1.2) which shall be used unless modified herein. The appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

10.2 Use of articles in technical writing.

(a) System or equipment titles. An article is not used when system or equipment titles contain nomenclatures AN, Mk, Mod, or unit numbers; for example, Power is supplied to Sonar Set AN/BQR-2.

(b) Deletion of articles. Deletion adds to brevity and impact and is desirable whenever it does not lead to confusion.

(1) Some modifiers also have verb forms. The meaning of such expressions depends upon the use of the articles, unless the rest of the sentence clarifies. The technical writer must be careful; however, to keep the meaning clear.

This.....	could mean this.....	or this.
Open door	Open the door.	The open door
Lead wires	Lead the wires.	the lead wires
Wire gages	Wire the gages.	the wire gages
Slack line	Slack the line.	the slack line
Correct alignment	Correct the alignment.	the correct alignment
Test oscilloscope	Test the oscilloscope.	the test oscilloscope

(2) In most cases, the article "the" should be eliminated from the MRC.

Example a: Remove the paper from the typing unit.
Preferred: Remove paper from typing unit.

Example b: Remove the typing unit from the base.
Preferred: Remove typing unit from base.

10.3 Personal pronouns. The personal pronouns commonly used on MRCs are "it and their." These can usually be omitted without changing the meaning of the sentence. When possible, they should be omitted.

10.4 Use of "that". It is not necessary to unite "ensure that" on MRCs. "Ensure" alone is sufficient.

(a) This rule does not apply to other words, such as verify, observe, inform, advise, and so forth.

(1) If these words are followed by a clause, the word "that" should introduce the clause. For example:

Verify that the motor operates smoothly.
Ensure that the lamp is lit.

(2) If these words are followed by a noun (and modifiers), the word "that" may be omitted. For example:

Verify readings.
Observe standard safety precautions.

10.5 Choice of words. The following list contains words and expressions that are preferred either because they are simple and short, or because they convey a precise meaning. The choice of the most appropriate word for an individual situation is left to the writer.

NOT THIS:	THIS:
all	This word may usually be omitted.
as to	about, for, in, or
audible	heard
be sure	ensure
card, MRC card	MRC, MR card
carry out	perform or accomplish
check	This word should be used only when no more specific word is appropriate (test, verify, measure).
clean off	clean
clean with wire brush	wire-brush
cleaning solvent	solvent
commence	begin, start
connect together	connect
construct	build, make
consumption (N)	use (N)
confident	sure
create	make
depress	press
detect	find
diametrical	diametral
Engineering Officer	Engineer Officer
for a period of	for
flush out	flush
freeze up	freeze
give evidence of	show
is illuminated	is lit, lights
illustrate	show
in a clockwise (counterclockwise) direction	clockwise, counterclockwise
in case of	if
initiate	start, begin
inspect that	inspect for

NOT THIS:	THIS:
is capable of	can
manually operate	operate
observe for	inspect for
outside of	outside
physically inspect	inspect
prepare a mixture of	mix
prior to	before
provided that	if
put together	assemble, reassemble
recheck	inspect
revolve	turn
run	operate
scale information	scale
should this condition exist	if this condition exists
such that	so that
take out	remove, withdraw
take apart	disassemble, dismantle
turn on (motor)	start, restart (motor), energize
usage (N)	use (N)
utilize (V)	use (V)
visually inspect	inspect
warm up	warm
wipe off	remove

(a) The word "secure" has more than 30 definitions. A more definite verb should be used if at all possible; for example, de-energize, fasten, stop, stow, tighten.

(b) The word "type" is a useful but often an unnecessary word. For example, ball valve is preferred to ball-type valve. If the word "type" must be used, the word "of" should always follow it.

(c) Preferred words and expressions.

NOT THIS:	THIS:
(1) Operate the switch to OFF.	(1) Set (position) switch to OFF.
(2) Restore equipment to normal condition.	(2) Return equipment to readiness condition.
(3) Reinstall cover using new gasket.	(3) Install new gasket and reinstall cover.
(4) spots of rust	(4) rust spots
(5) The oil is free from foreign matter.	(5) Oil is free of foreign matter.

10.6 Flaws and conventions. Because of similar spelling or meaning, certain words are often misused. This causes confusing statements and loss of clarity. The most commonly misused words, with definitions, are listed:

ABOUT	in the general area of
APPROXIMATELY	very close to "Approximately" is the word that should be used with numbers.
ABOVE, BELOW	indicate high or low. For example, units on a bulkhead are above or below each other, not over and under.
ACCEPT	to get or receive.
EXCEPT	to leave out, exclude.
AFFECT	always a verb, means to act on; to impress; or to produce a change in.
EFFECT	as a noun, means result or consequence. As a verb, it means to bring about, to accomplish.
AMONG	implies more than two objects.
BETWEEN	implies only two objects.
AMOUNT	refers to things measured in bulk, weight, or sums.
NUMBER	refers to things that can be counted.
CITE	to use as an example, to quote (verb).
SITE	location (noun), area.
CLOSE	Electrical contacts are closed.
SHUT	Valves are shut.
COMPARE, COMPARE TO	used to point out likenesses.
COMPARE WITH	used to find likenesses or differences.
CONTRAST	always means to find differences.
CONTINUAL	frequently or closely repeated, with little or no time in between.
CONTINUOUS	without interruption, unbroken.
ASSURE	to promise, give assurance.
ENSURE	to make certain.
INSURE	to obtain indemnity against.
EQUIPMENT	the implements (as machinery or tools) used in an operation or activity. This meaning usually applies to everything needed, except personnel, for efficient operation or service. A collective noun meaning one or more pieces of equipment.
FARTHER	expresses physical distance
FURTHER	expresses the sense of an idea
FEWER	refers only to numbers and things that are counted.
LESS	refers only to amount or quantity of things measured.
GREATER	refers to quantity
LARGER	refers to size.

IDENTICAL	exactly the same.
SIMILAR	related in appearance or nature; alike, though not identical.
IF	used for conditions.
WHETHER	used in expressions of doubt.
IN	generally shows location.
INTO	generally shows direction.
INSTALL	something new.
REINSTALL	the same thing that was previously removed.
RENEW	to restore to freshness, fullness, or sufficiency. For example, renew oil.
REPLACE	to serve as a substitute for or a successor of. It implies supplying a substitute or equivalent for something. Replace is used with wear-out materials that require replacement such as batteries, seals, and gaskets. For example, replace gaskets.
INSTALLED, LOCATED, MOUNTED	When describing merely the location of something, these words can usually be omitted without changing the meaning of the sentence.
MINIMIZE	should be used only when something has been reduced to an absolute minimum.
REDUCE	to lessen to some degree.
NORMALLY	under usual conditions.
PRACTICAL	useful, helpful.
PRACTICABLE	possible to perform, feasible.
OBSERVE	to perceive, notice, or see something. Observe implies no judgement on the part of the observer; it merely tells the reader to notice something. For example, Observe unit 6 active search display on lower CRT and passive search on upper CRT.
VERIFY	to prove the truth of by the presentation of evidence, to substantiate, to determine the accuracy of. Verify implies that the result, outcome, or condition can only be correct. For example, Verify that all status lights on 6A1 panel are lit.
SIT	to occupy a place.
SET	to put in place.

THAT, WHICH — both relative pronouns. That (see 10.4) is always restrictive; which can be either restrictive or nonrestrictive. That refers to persons and things; which usually only to things. A good rule of thumb to remember is if the clause can be omitted without changing the meaning of the sentence, introduce the clause with which. If not, use that.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

APPENDIX B

USE OF NUMERALS

10. SCOPE

10.1 Scope. This appendix provides guidelines for the use of numerals. Guidelines for the use of numerals included in the Government Printing Office Style Manual shall be used unless modified herein. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

10.2 Written or figures. The rule for use of numerals in technical writing is based on the general principle that the reader comprehends numerals expressed as figures more readily than the written expression of the number.

(a) When writing the procedural portion of the MRC, numbers shall be expressed in arabic figures when stating time, measurement, or quantity of material.

(b) Numeric expressions are written:

(1) At the beginning of a sentence.

(2) When two numbers are used in close proximity (one number is spelled out).

(3) When zero is used without associated figures.

10.3 Decimals. Use a zero before the decimal point when another figure does not precede the decimal even if there is a zero after the decimal point.

10.4 Commas. The comma is used in a number containing four or more digits. Exceptions occur in serial numbers, common and decimal fractions, military time, and kilocycles and meters of not more than four figures pertaining to radio; for example, 2300 hours, 1450 kilohertz, 1100 meters.

10.5 Aligning figures in columns.

(a) When double rows of figures appear within a column, connected by a dash, plus, or minus sign, the word to or a similar connecting word; the dashes, signs, or words are aligned. Plus and minus signs at the left of figures are placed close to the figures regardless of alignment. For example:

40 to 600	+40.4
150 to 300	+98.1
4 to 10	-2.9

(b) Decimal points are aligned except in columns containing numbers that refer to mixed units (inches and yards, grams and kilograms, pounds and ounces), in which case the column is aligned on the left. When a number in a column is a decimal, a zero is placed at the left of the decimal point. A zero alone in a decimal column is placed in the unit row and is not followed by a period.

In columns with mixed units and decimals of two or more places, no zero is added on the right. When a column has mixed units with single decimals only, a zero is supplied on the right. For example:

39.37 inches	0.7	0.7	1,000,000	0.7
2.6 yards	1.7	1.6	100,000	1.0
	3.6	3.5	1,000	3.5
28.35 grams	1.56	0	100	6.0
0.4356 kilogram	2.45	2.45	1	12.4
	1.4	0	0.1	132.0
2,204.6 pounds	12.8	8.6	0.001	18.0
32,478 ounces	3.9	12.22	0.0001	24.6

10.6 Fraction measurement.

(a) If a fraction is used alone with a unit of measurement, a hyphen should connect them. For example: Oil is stored in 1/2-gallon cans.

(b) If a compound number is used with a unit of measurement, the number itself must be hyphenated. Therefore, no hyphen can be used between the fraction and the unit of measurement. For example: Oil is stored in 1-1/2 gallon cans.

10.7 Numbers in parentheses. Do not write a figure in parentheses after writing out a number. This is proper only in legal or commercial writing.

10.8 Page identification.

(a) When there is more than one page of an MRC, it shall be numbered in the vertical blocks on the right-hand side of the MRC. For example: Page 1 of 3. A single page MRC is numbered, Page "1 of 1".

(b) On the MIP, Page 1 of 2 at the bottom of the first page and Page 2 of 2 at the bottom of the second page would identify a two-page MIP. A single page MIP is numbered, Page 1 of 1.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

APPENDIX C

CAPITALIZATION

10. SCOPE

10.1 Scope. This appendix provides guidelines for capitalization. Capitalization guidelines included in the Government Printing Office Style Manual shall be used along with the guidelines enumerated in this appendix. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

10.2 Titles.

(a) Capitalize the first letter of every word, except articles, short prepositions, and short conjunctions.

(1) Articles: a, an, the
(2) Short prepositions: at, by, if, in, of, for...
(3) Short conjunctions: and, but, or...

(b) The words in the ship system, system, subsystem, and equipment blocks are titles. The maintenance requirement description sentences in the procedure block are titles.

(c) Capitalize both parts of hyphenated words in titles; for example, High-Pressure Air System.

10.3 Itemized lists.

(a) These occur in the tools, parts, materials, test equipment block of the MRC (see figure 31) and sometimes as substeps in the procedure.

(1) Capitalize all letters of category headings (see 10.2(a)).
(2) Capitalize the first letter of the first word in each item. For example:

TEST EQUIPMENT
1. [1422] Voltmeter 0 dB
IMW/600 Ohm (SCAT 4206)

MATERIALS
1. [1144] Tag, safety
2. [1364] Tarpaulin, cotton duck

10.4 Quoted expressions on tags. Capitalize the first letter of each word, except articles, short preposition, and short conjunctions; for example:

(a) "Do Not Open."
(b) "Out of Service."

10.5 Notes, warnings, cautions. When used as a heading, capitalize each letter in the words: NOTE, WARNING, CAUTION. Capitalize the first letter in the sentence which follows one of these.

10.6 Ships. Write the names of ships in all capital letters. Side letters belong in parentheses after the ship name; for example, USS HENDERSON (DD 785).

10.7 Abbreviations.

(a) Ordinarily, abbreviations (see 3.11.1.9) should not be capitalized. A few are capitalized, such as HP, LP, Mk, Mod, and No. Examples of those not capitalized are lb and ft.
(b) If one letter of a normally lower-case abbreviation must be capitalized as part of a heading, capitalize all letters.
(c) Capitalize each letter in NAVAIR, NAVSEA, NAVELEX, ORDALT, SHIPALT, and similarly authorized abbreviations.

10.8 Specific locations. When referring to a specific location, capitalize the first letter of each word. The use of an identifying number or letter with the name of the place makes it specific; for example:

(a) Area 1, Area 2, Area 3...
(b) Machine Shop No. 1, Panel No. 6

10.9 Names of equipment parts (switches, handles, and so forth).

(a) When the operator has to position an equipment part, the name of the part shall be exactly as imprinted on the equipment; for example:

(1) Set TURRET EMERG STOP switch to STOP.
(2) Set MAN-AUTO switch to AUTO.

(b) Do not capitalize the name of a part that is not imprinted on the equipment; for example:

(1) Mount captain's firing switch.
(2) Turret officer's emergency switch

(c) If both the item name and the nomenclature appear in a sentence, capitalize the first letter of each word; for example, Adjust Gun Sight Mk2.
(d) If the equipment is written but is not accompanied by identifying number, Mark, Mod, do not capitalize the name; for example, Adjust gun sight.

10.10 Missiles. Capitalize all letters in missile names; for example, TERRIER. Do not capitalize reference to missiles; for example, ballistic missile.

10.11 Proper nouns now standard expressions. Some expressions contain words which were originally proper nouns, but which no longer have the meaning of the proper nouns. They have new, independent meanings; the proper nouns are no longer associated with the expressions. When we say arabic numerals, we think of the numbers rather than the country of Arabia. When we say plaster of paris, we think of the material, not the city of Paris. Do not capitalize such standard expressions which have come from proper nouns, if they no longer carry the weight of the proper noun.

10.12 Noun with number. A common noun used with a date, number of letter to denote time or sequence does not form a proper name. Therefore, it is not capitalized; for example:

(a)	chart B	(d)	page 2
(b)	column 2	(e)	table 4
(c)	figure 7	(f)	step 2

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

APPENDIX D

PUNCTUATION

10. SCOPE

10.1 Scope. This appendix provides guidelines for punctuation. Punctuation guidelines included in the Government Printing Office Style Manual shall be used unless modified herein. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

10.2 Period.

(a) Sentences. Use a period at the end of a complete sentence. Do not use a period to end a group of words that is not a sentence.

(b) Titles. Do not use a period at the end of a title, unless the title is a complete sentence.

(c) Itemized lists. Do not use a period at the end of items under tools, parts, materials, and test equipment block of the MRC.

(d) Abbreviations. Do not use a period after abbreviations on MRCs, unless the abbreviation spells a word. For example, no period is required after qt, pt, gpd, vol, in-lb, and ft-lb. Periods are required after no. and fig.

(e) References to procedural steps. References to procedural steps within an MRC shall be specific and shall be acceptable only in the following formats:

(1) Referencing one step:

x.----------step 1.c.-------.

(2) Referencing two steps:

x.----------steps 1.s. and 1.t.-------.

(3) Referencing three or more steps:

x.----------step 1.a.(1) through 3.c.(9)(aa)-3- ----.

10.3 Comma.

(a) Use a comma after each member within a series of three or more words, phrases, letters, or figures used with and, or, or nor.

(1) Using three nouns: Inspect for rust, dirt, and old grease.

(2) Using three modifiers: Open inlet, outlet, and discharge valves.

(3) Using four verbs: Clean, inspect, lubricate, and test inter-compartment salvage valves.

(b) Abbreviations. When transitional expressions such as i.e. and e.g. are used as introductory elements, they are always followed by commas.

(c) Clarity. Use a comma where it is necessary to clarify and to prevent misreading of a sentence. For example: Avoid contact with, or inhalation of, cleaning solvents.

(d) Adverbial clauses or phrases.

(1) When an adverbial clause comes after the main thought, when it is quite short, and when there is no danger that it can be misread, the comma may be omitted. For example: Replace piston valves if worn.

(2) An introductory adverbial phrase is usually set off from the rest of the sentence by commas. For example: If pointer rests to left of B maker, replace batteries.

(3) To avoid confusion, sometimes it is necessary to punctuate an adverbial phrase which comes after the main thought. For example: Replace valves, if worn, and gaskets, if deteriorated.

(e) The use of the comma is often a matter judgement. Commas should be used only for easy reading and for clarity.

10.4 Colon.

(a) The colon is used to introduce explanation, examples, quotations and enumerations. A colon shall not be used after include, and are.

(b) Titles. Use a colon after a marginal title when copy follows the title. For example:

(1) NOTE: Accomplish after 672 hours of operation.

(2) CAUTION: To prevent damage to a generator or regulator, do not operate engine below rated speed without setting regulator switch to off.

(c) List. Use a colon after a word that formally introduces a list. For example:

(1) ...at Control Panel Mk 362, position switches:

Nomenclature	Position
CONVENTIONAL WIRE GUIDE POWER	ON
FIRE CONTROL INDICATOR POWER	OFF
PRESET POWER	OFF

10.5 Semicolon.

(a) Use the semicolon between two main clauses not linked by a coordinating conjunction (and, but, or, nor, for) or by the connectives so and yet. For example: Be cautious of loose barbs when handling wire; wear gloves to prevent gouging hands.

(b) A semicolon may be used to separate items in a series when the items contain internal commas. For example: Inspect equipment for pitting on outer surfaces; wear, especially on moving parts; and cracks around edges.

(c) Do not use a semicolon between parts of unequal grammatical rank, such as a clause and a phrase or a main clause and a subordinate clause. For example: Construct two wave shaping networks; as shown on figure 1.

10.6 Apostrophe.

(a) Plural abbreviations. The general rule is to use an 's to form the plural of abbreviations written in all capital letters. In technical writing, the accepted usage has allowed the apostrophe to be omitted when a lower case s is used; for example, MIPs and MRCs.

(b) Possessives. The possessive case is not used in expressions in which one noun modifies another; for example, the motor frame or motor bearing.

10.7 Quotation marks (quoted expressions). Enclose statements on tags in quotation marks. For example: De-energize circuit and tag "Out of Service."

10.8 Underline.

(a) Headings. Use a solid line to underline the headings on MRCs that are prepared in columnar format (see figure 29).

(b) Emphasis. When emphasizing words, underline each word separately. Do not underline the entire expression with a sold line. For example: Do not disturb needle valve setting.

10.9 Parentheses.

(a) Usage. Use parentheses to enclose words or expressions that are inserted for comment, explanation, translation, or reference. For example: At UBWCS SWBD (Panel 123), position ZEROING switch to ZERO.

(b) Punctuation.

(1) A reference in parentheses at the end of a sentence is placed before the period unless it is a complete sentence in itself. For examples:

Release four latches (two on each side).
Connect oscilloscope to test point TP-7 (see figure 1).

(2) If a sentence contains more than one parenthetic reference, the one at the end is placed before the period. For example: Remove hinge and O-ring (see figure 3) from mounting plate (see figure 2).

(3) Do not put a comma before a parenthesis.

(c) Double parentheses. Do not use parentheses within parentheses. Use a pair of dashes for the outside parentheses; for example, A shipcheck—made in 1972 by NSWSES (Code 4400)—revealed minor technical errors.

10.10 Hyphen (compounding rules).

(a) Use a hyphen:

(1) To join two or more words that serve as a single modifier before a noun; for example, fan-cooled area, shock-tested valves.

(2) In a long phrase in which several adjectives modify each other; for example, air-motor-driven pump.

(3) To hyphenate a combining verb form; for example, fan-cool area, shock-test valves.

(4) To avoid an awkward union of letters; for example, de-energize, anti-icing.

(5) When using a single letter to indicate shape, connect the letter to the word modified with a hyphen; for example, O-ring.

(6) To separate words in equipment titles on MRCs; for example, Indicator-Transmitter, not Indicator/Transmitter.

(7) Use a suspension hyphen in a series; for example, one or two-digit numbers.

(8) When dividing words at the end of a line, hyphenate words between syllables. Never divide a one-syllable word ending in "ed" such as sliced or mixed.

(b) Do not use a hyphen:

(1) When the adjectives modify the noun independently (not forming a single modifying idea); for example, a volute centrifugal pump, an emergency power source.

(2) In a long phrase in which more than two adjectives independently modify the noun. Separate such phrases with commas; for example, multistate, mixed flow, volute centrifugal pump. (A comma is not necessary between the last two adjectives.)

(3) When more than one word is modifying the same word; for example, salinity and temperature monitoring panels.
(4) When proper nouns are used as modifiers; for example, Atlantic Ocean salinity.

(c) Double compound words. When using two long compound words in sequence, form the compound words, and separate them with a slash; for example, a control rod drives a bevel-gear-segment/bevel-gear-arrangement.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

APPENDIX E

MAINTENANCE INDEX PAGE (MIP) CONTROL NUMBERS

10. SCOPE

10.1 Scope. This appendix provides guidelines for maintenance index page numbering. MIPs which result from this specification are system oriented and contain maintenance procedures previously covered by more than one MIP or MIP Group. The index of maintenance procedures for items which function together or comprise a system, will be listed on a single MIP. The number assigned to this MIP will allow cross reference to other Navy data systems and will identify the system for functional grouping of items by use of the SWAB number. The SWAB will be used as illustrated in 10.1.2 to provide the generic identification of the level of indenture included on the MIP. The SWAB assigned to the MIP will be the same as used by the SECAS to identify the level of indenture illustrated on figures E-1 and E-2. In the absence of SECAS or SWAB data, the PMS Coordinating Activity will coordinate with the SECAS program to obtain numbers. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

10.1.1 The SYSCOM MIP control numbers - segments. The SYSCOM MIP control number assigned to MIPs developed in accordance with this specification is composed of three segments.

SEGMENT

1 2 3

XXXX / XXX - XX

(a) The first segment is a four-digit identifier of the system or functional grouping of items on which the maintenance procedures provided by this MIP are to be performed. If any of the last three positions of this segment contains a 0 (zero), the configuration block of the MIP must contain the identification of those items which have been grouped together for maintenance purposes and are covered by the index of procedures listed on the MIP. The conventions to be followed for grouping items together for maintenance purposes are explained in 10.1.2. The four-digit numbers and nomenclatures which identify systems by hull will be found in SECAS reports by hull which list the items which comprise subsystems at and below the fourth indenture level. The first segment of the SYSCOM MIP Control Number will consist of this number.

(b) The second segment indicates the sequence of maintenance requirements development for this functional grouping or system. This number will not change unless the configuration changes.

(c) The third segment indicates the date of the MIP. The first position indicates the month and the second position indicates the year.

10.1.2 Segment 1 -- SWAB level indenture. The conventions for assignment of the four digits to the first segment of the SYSCOM MIP control number and for grouping items which function together for maintenance purposes must follow the top-down breakdown configuration data in the Navy. This data may be a SECAS report for active ships and a Fitting Out Management Information System (FOMIS) report or other approved data for new construction ships.

(a) The lowest level at which MIPs should be prepared is the fourth indenture level (SWAB level 4) shown on figure E-1. MIPs prepared for equipment or components (SWAB level 5) need prior approval of NAVSEA, Code 56G. MRCs will be prepared for all items or combinations of items which require maintenance in the fourth indenture level and will be listed on a MIP identified by the four-digit number for the indenture level 4 grouping.

(b) If it is desirable to combine the maintenance requirements for more than one level 4 grouping on a single MIP, a level 3 MIP will result. Such a MIP must contain the MRCs for all items at level 3, level 4, and level 5 which require maintenance and will be identified by the three-digit number for the level 3 grouping followed by a 0 (zero) to maintain a four-digit format.

(c) If it is desirable to combine the maintenance requirements for more than one level 3 grouping on a single MIP, a level 1 or 2 MIP will result. Such a MIP must contain the MRCs for all items or combinations of items to the lowest indenture level which require maintenance and will be identified by the one- or two-digit number for the level 1 or 2 grouping followed by two or three zeros to maintain a four-digit format.

(d) High level system tests which require the simultaneous operation of items in different trees of the top-down breakdown structure and have no common number among them, are to be included on MIPs containing only test procedures. These will be identified by special purpose four-digit numbers in the Weapons Systems File (WSF) such as 4401 - Integrated Communication System Test (see figure E-2). If a special purpose number has not been assigned to the combination of items which it is desired to test, notify NAVSEA, Code 56G.

(e) For instances described in 10.1.2b through 10.1.2d, the configuration block of the MIP must contain the level 4 item number(s) and nomenclature(s), both of which are covered by the MIP. The level 5 item number(s) and nomenclature(s) should be included when required for clarity.

10.2 Alternate MIP numbering. MIPs which resulted from developments before implementation of this specification may not be assigned MIP numbers in accordance with the SWAB levels. These MIPs use two different numbering systems as detailed in 10.2.1.

10.2.1 Conventional MIP numbering.

A four segment code is used as follows:

SEGMENT

1 2 3 4

XXX - XX / XXX - XX

(a) Segments 1 and 2 identify equipment groupings. Segment 1 may contain from one to three characters and is followed by a dash. Segment 2 may also contain from one to three characters, followed by a slash.

(b) Segment 1 identifies the equipment group and segment 2 identifies a specific subgroup or component within an equipment group. An example is A-137. The A has been assigned to auxiliary engineering machinery and the 137 has been assigned to the N-2 compressor.

(c) Segment 3 identifies a distinct version within the equipment subgroup and may contain from one to three characters followed by a dash. Segment 3 will include a P as the first character for a preliminary MIP as described in OPNAVINST 4790.4 Vol. 1.

(d) Segment 4 is a two character code that identifies the month and year. The first position indicates the month and the second position indicates the year. The Month codes use a numeric identifier for January through September. The letters A, B, and C are used for October, November and December; for example, AO is October 1980.

(e) In some cases a preliminary MIP may be issued without MRCs to provide fleet personnel with a listing of maintenance requirements prior to development of the MRCs. In this case the date code will be replaced with a 01 to indicate preliminary without MRCs. Revision of the 01 would be an 02. When MRCs are added, then the date code will be issued.

10.3 Surface missile system (SMS) MIP numbering. The SMS coding system utilizes a three segment code as follows:

SEGMENT

1 2 3

5XXXXXX / XXX - XX

(a) Segment 1 is a seven character alpha-numeric code that identifies equipment or system to which the MIP is applicable. The number is the Equipment Identification Code (EIC) of that equipment or system. When the equipment to which the MIP is applicable has more than one EIC, the first two characters will be 5Z.

(b) Segment 2 indicates the specific configuration of the equipment identified by segment one. This number changes when maintenance requirements are changed as a result of ORDALT installation in equipments. Segment 2 may be alphanumeric and consist of one to three characters. If the first character is a U, the MIP is for unscheduled maintenance.

(c) Segment 3 (following the dash) indicates the revison level of the MIP and may be one or two numeric characters.

10.4 Maintenance Requirement Card vertical coding. Maintenance requirement cards are assigned identification numbers by the PMS Coordinating Activity, as follows:

SEGMENT			
1	2	3	4
X	XX	XXX	X

(a) Segment 1 indicates the security classification of the MRC; for example, C for Confidential and S for Secret. Unclassified MRCs do not use Segment 1.

(b) Segment 2 is a date code. The first character indicates the month. January through September are assigned 1 through 9. October, November, and December use A, B, and C. The second character indicates the year. A 21 birthdate would indicate February 1981.

(c) Segment 3 is an alpha-numeric library control number.

(d) Segment 4 is assigned the letter Y to indicate repair parts which are required for performance of the MRC. The letter N is used when the MRC does not require repair parts. The letter U is used on UMRCs.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

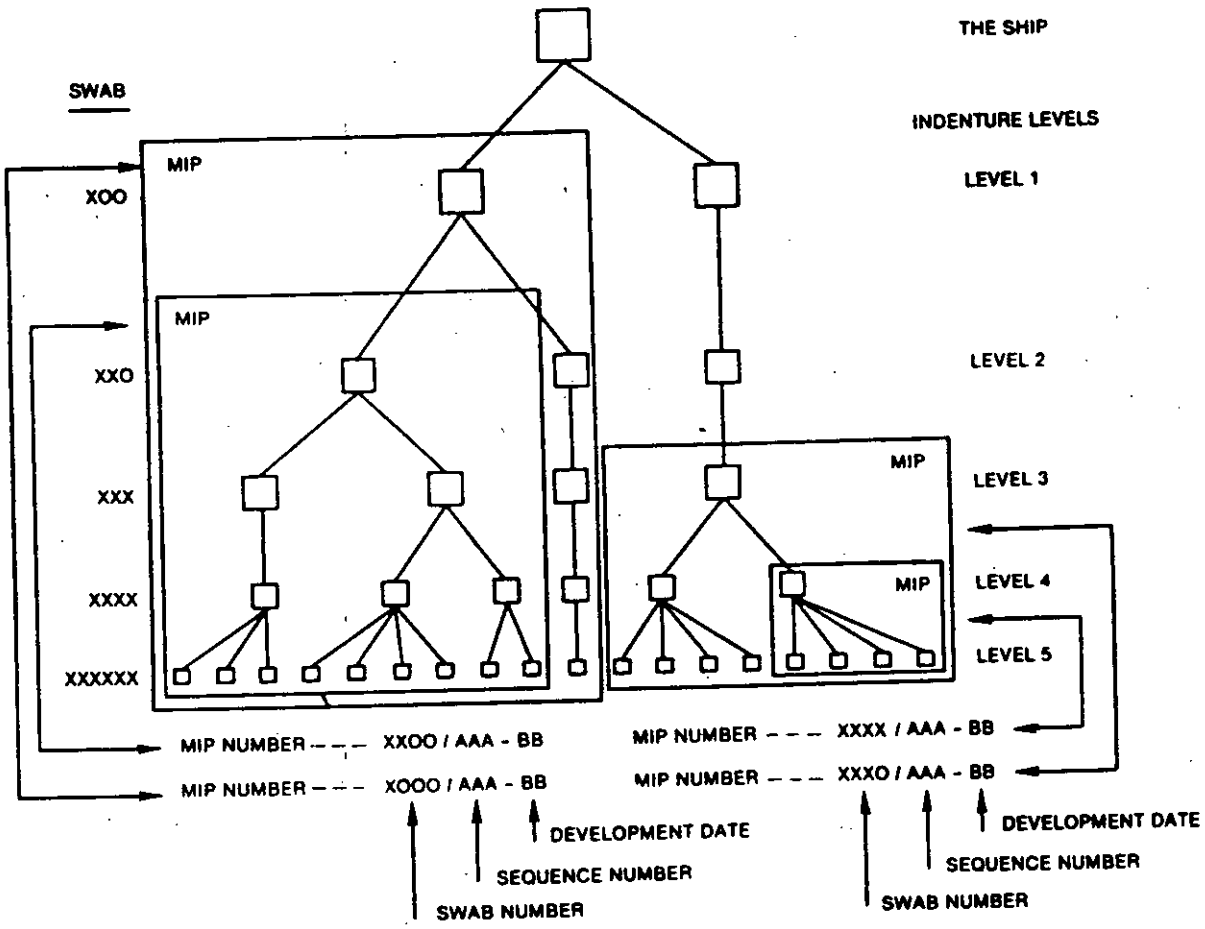

FIGURE E-1. Indenture levels.

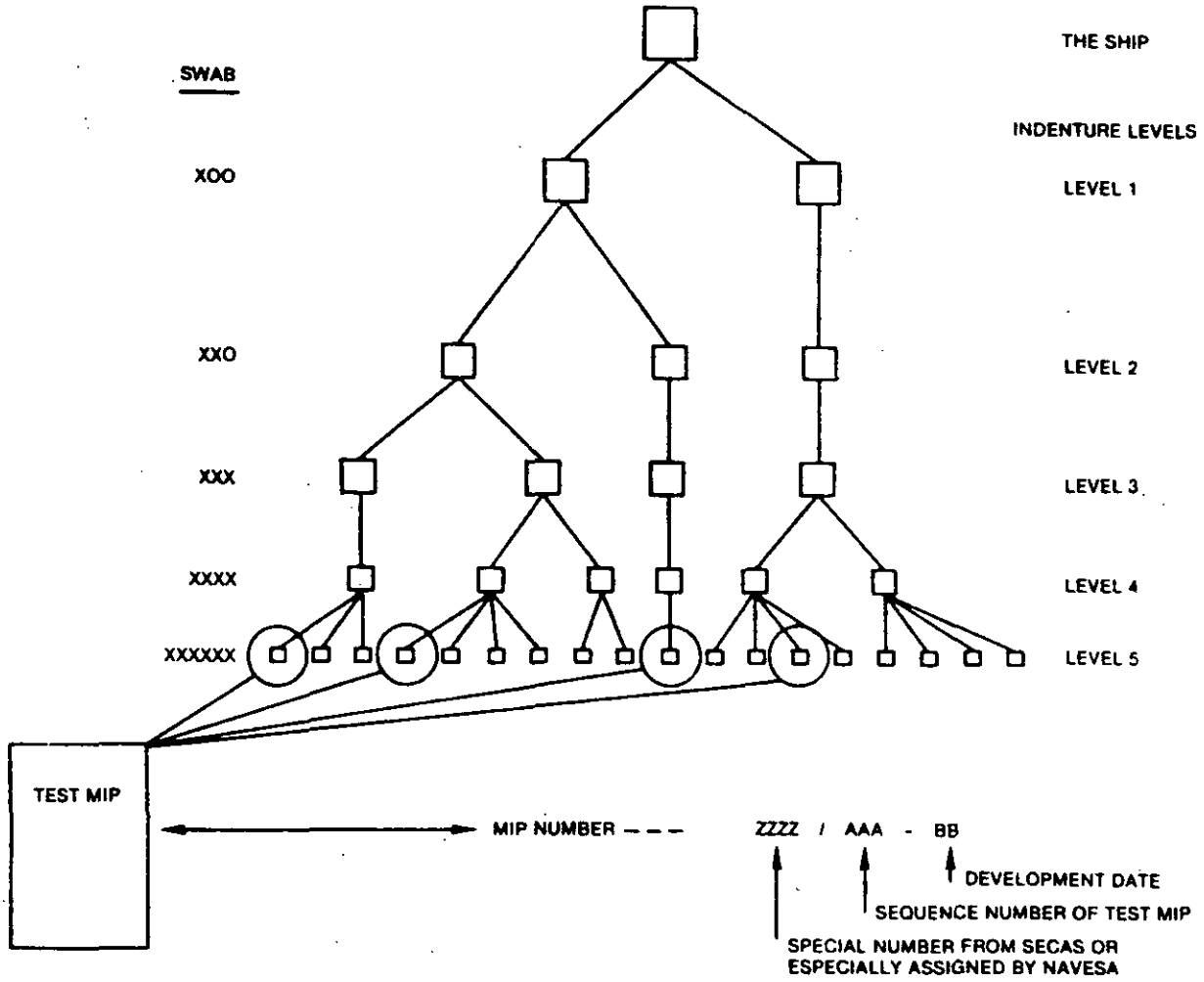

FIGURE E-2. Test indenture levels.

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