NONRESIDENT TRAINING COURSE

April 1997

Fire Controlman

Volume 4—Fire-Control Maintenance Concepts

NAVEDTRA 14101

Although the words "he," "him," and "his" are used sparingly in this course to enhance communication, they are not intended to be gender driven or to affront or discriminate against anyone.

PREFACE

By enrolling in this self-study course, you have demonstrated a desire to improve yourself and the Navy. Remember, however, this self-study course is only one part of the total Navy training program. Practical experience, schools, selected reading, and your desire to succeed are also necessary to successfully round out a fully meaningful training program.

COURSE OVERVIEW: In completing this nonresident training course, you will demonstrate a knowledge of the subject matter by correctly answering questions on the following subjects:

- Planned Maintenance System,
- fault isolation,
- liquid-cooling systems,
- combat systems alignment (gun/battery), and
- collimation.

THE COURSE: This self-study course is organized into subject matter areas, each containing learning objectives to help you determine what you should learn along with text and illustrations to help you understand the information. The subject matter reflects day-to-day requirements and experiences of personnel in the rating or skill area. It also reflects guidance provided by Enlisted Community Managers (ECMs) and other senior personnel, technical references, instructions, etc., and either the occupational or naval standards, which are listed in the *Manual of Navy Enlisted Manpower Personnel Classifications and Occupational Standards*, NAVPERS 18068.

THE QUESTIONS: The questions that appear in this course are designed to help you understand the material in the text.

VALUE: In completing this course, you will improve your military and professional knowledge. Importantly, it can also help you study for the Navy-wide advancement in rate examination. If you are studying and discover a reference in the text to another publication for further information, look it up.

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Sailor's Creed

"I am a United States Sailor.

I will support and defend the Constitution of the United States of America and I will obey the orders of those appointed over me.

I represent the fighting spirit of the Navy and those who have gone before me to defend freedom and democracy around the world.

I proudly serve my country's Navy combat team with honor, courage and commitment.

I am committed to excellence and the fair treatment of all."

TABLE OF CONTENTS

INSTRUCTIONS FOR TAKING THE COURSE

ASSIGNMENTS

The text pages that you are to study are listed at the beginning of each assignment. Study these pages carefully before attempting to answer the questions. Pay close attention to tables and illustrations and read the learning objectives. The learning objectives state what you should be able to do after studying the material. Answering the questions correctly helps you accomplish the objectives.

SELECTING YOUR ANSWERS

Read each question carefully, then select the BEST answer. You may refer freely to the text. The answers must be the result of your own work and decisions. You are prohibited from referring to or copying the answers of others and from giving answers to anyone else taking the course.

SUBMITTING YOUR ASSIGNMENTS

To have your assignments graded, you must be enrolled in the course with the Nonresident Training Course Administration Branch at the Naval Education and Training Professional Development and Technology Center (NETPDTC). Following enrollment, there are two ways of having your assignments graded: (1) use the Internet to submit your assignments as you complete them, or (2) send all the assignments at one time by mail to NETPDTC.

Grading on the Internet: Advantages to Internet grading are:

- you may submit your answers as soon as you complete an assignment, and
- you get your results faster; usually by the next working day (approximately 24 hours).

In addition to receiving grade results for each assignment, you will receive course completion confirmation once you have completed all the assignments. To submit your assignment answers via the Internet, go to:

http://courses.cnet.navy.mil

Grading by Mail: When you submit answer sheets by mail, send all of your assignments at one time. Do NOT submit individual answer sheets for grading. Mail all of your assignments in an envelope, which you either provide yourself or obtain from your nearest Educational Services Officer (ESO). Submit answer sheets to:

COMMANDING OFFICER
NETPDTC N331
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32559-5000

Answer Sheets: All courses include one "scannable" answer sheet for each assignment. These answer sheets are preprinted with your SSN, name, assignment number, and course number. Explanations for completing the answer sheets are on the answer sheet.

Do not use answer sheet reproductions: Use only the original answer sheets that we provide—reproductions will not work with our scanning equipment and cannot be processed.

Follow the instructions for marking your answers on the answer sheet. Be sure that blocks 1, 2, and 3 are filled in correctly. This information is necessary for your course to be properly processed and for you to receive credit for your work.

COMPLETION TIME

Courses must be completed within 12 months from the date of enrollment. This includes time required to resubmit failed assignments.

PASS/FAIL ASSIGNMENT PROCEDURES

If your overall course score is 3.2 or higher, you will pass the course and will not be required to resubmit assignments. Once your assignments have been graded you will receive course completion confirmation.

If you receive less than a 3.2 on any assignment and your overall course score is below 3.2, you will be given the opportunity to resubmit failed assignments. **You may resubmit failed assignments only once.** Internet students will receive notification when they have failed an assignment--they may then resubmit failed assignments on the web site. Internet students may view and print results for failed assignments from the web site. Students who submit by mail will receive a failing result letter and a new answer sheet for resubmission of each failed assignment.

COMPLETION CONFIRMATION

After successfully completing this course, you will receive a letter of completion.

ERRATA

Errata are used to correct minor errors or delete obsolete information in a course. Errata may also be used to provide instructions to the student. If a course has an errata, it will be included as the first page(s) after the front cover. Errata for all courses can be accessed and viewed/downloaded at:

http://www.advancement.cnet.navy.mil

STUDENT FEEDBACK QUESTIONS

We value your suggestions, questions, and criticisms on our courses. If you would like to communicate with us regarding this course, we encourage you, if possible, to use e-mail. If you write or fax, please use a copy of the Student Comment form that follows this page.

For subject matter questions:

E-mail: n311.products@cnet.navy.mil
Phone: Comm: (850) 452-1503
DSN: 922-1503
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC N311
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32509-5237

For enrollment, shipping, grading, or completion letter questions

E-mail: fleetservices@cnet.navy.mil
Phone: Toll Free: 877-264-8583
Comm: (850) 452-1511/1181/1859
DSN: 922-1511/1181/1859
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC N331
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32559-5000

NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you may earn retirement points for successfully completing this course, if authorized under current directives governing retirement of Naval Reserve personnel. For Naval Reserve retirement, this course is evaluated at 3 points. (Refer to *Administrative Procedures for Naval Reservists on Inactive Duty,* BUPERSINST 1001.39, for more information about retirement points.)

Student Comments

Course Title: *Fire Controlman, Volume 4—Fire-Control Maintenance Concepts*

NAVEDTRA: 14101 **Date**: _____

We need some information about you:

Rate/Rank and Name: _____ SSN: _____ Command/Unit _____

Street Address: _____ City: _____ State/FPO: _____ Zip _____

Your comments, suggestions, etc.:

Privacy Act Statement: Under authority of Title 5, USC 301, information regarding your military status is requested in processing your comments and in preparing a reply. This information will not be divulged without written authorization to anyone other than those within DOD for official use in determining performance.

NETPDTC 1550/41 (Rev 4-00

CHAPTER 1

PLANNED MAINTENANCE SYSTEM AND FAULT ISOLATION

LEARNING OBJECTIVES

Upon completing this chapter, you should be able to do the following:

1. Describe the purpose of maintenance systems.

2. Describe the methods used in identifying system faults.

INTRODUCTION

The increasing complexity of our equipments requires a viable maintenance program to ensure that the systems perform in a manner that will ensure maximum operational readiness. To overcome this problem, the Navy has developed an excellent preventive maintenance system—the Ships' Maintenance and Material Management (3-M) System. This system provides a standard means for planning, scheduling, controlling, and performing planned maintenance on all equipment.

It is not uncommon for a Fire Controlman Second Class to be in the position of a work-center supervisor. As such, you will need a broader knowledge of a variety of subjects to perform your duties in a professional manner. One area you cannot take lightly is maintenance. Your fire-control system is kept at its maximum level of readiness through maintenance. To help you in this area, this chapter briefly discusses the Planned Maintenance System (PMS) and fault-isolation procedures.

The information provided in this chapter is not intended to cover all aspects of the 3-M System. For more in-depth information on this system, refer to the *Ships' Maintenance and Material Management (3-M) Manual,* OPNAVINST 4790.4.

PLANNED MAINTENANCE SYSTEM

The Planned Maintenance System (PMS) provides a standard means for planning, scheduling, controlling, and performing planned maintenance to complex mechanical, electrical, and electronic equipments. PMS maintenance actions are the minimum required to maintain equipment in a fully operable condition and within specifications. The PMS includes a Maintenance Data System (MDS), which is used to record important scheduled and corrective maintenance information, and electronic data-processing capabilities, which are used to retrieve this information for maintenance analysis. The *3-M Manual* establishes the PMS and assigns PMS management responsibilities.

The PMS provides regularly scheduled tests to detect degraded performance and to aid in preventing failures during tactical operations. When failures do occur, the PMS provides formal corrective maintenance in step-by-step fault-isolation and repair procedures. Complete technical documentation (including

combat systems, subsystems, and individual equipment manuals) is an integral part of the PMS. These manuals provide the necessary information for understanding, operating, and maintaining combat systems.

Shipboard maintenance falls into three categories: (1) maintenance within the capability of ship personnel (organizational level); (2) maintenance requiring assistance from outside the ship (intermediate level), such as tender or fleet technical support centers; and (3) maintenance requiring port facilities (depot level), such as shipyard maintenance. Since the objective of the PMS is to perform maintenance at the organizational or intermediate level, it does not reflect depot-level maintenance. Combat systems readiness requires efficient maintenance. The key to this capability is an organized system of planned maintenance that is designed to ensure the maximum operational readiness of the combat systems.

This section describes the PMS objective, the maintenance scheduling and data system, and the integrated maintenance.

PMS OBJECTIVE

The PMS objective is to maximize operational efficiency of all equipment and to reduce downtime, maintenance man-hours, and maintenance costs. Although the PMS provides methods and resources to accomplish each objective, it is not self-sufficient and does not replace the initiative of maintenance supervisors nor does it reduce the necessity for technically competent personnel. Recording and providing feedback of maintenance and personnel data allow continuing management analysis for the improvement of maintenance methods and personnel management. Full use of the planning methods, along with the acceptance and cooperation of technicians, supervisors, and management personnel, produces a maintenance system with the inherent confidence, reliability, and capability to help achieve maximum combat systems readiness.

A sampling of data gathered from the fleet shows conclusively that those ships that adhere to their PMS schedules maintain a significantly higher state of material readiness with no greater maintenance manpower usage than those ships that do not adhere to their PMS schedules.

The primary ingredients of the PMS program are

1. comprehensive procedures for planned maintenance of the combat systems, subsystems, and equipment;
2. system fault-isolation procedures;
3. maintenance task performance scheduling and control; and
4. methods, materials, tools descriptions, and personnel required for maintenance.

Adherence to the PMS program will produce

1. improved confidence in system maintenance,
2. reduced testing time,
3. elimination of redundant testing resulting from uncoordinated testing, and
4. detection of most malfunctions during scheduled maintenance events.

MAINTENANCE SCHEDULING

The normal flow of events that maintenance managers use in developing an integrated maintenance schedule is shown in figure 1-1. This figure shows maintenance management responsibilities and the sequence of events that flow from the department master and work-center PMS record books through the scheduling aids to test execution, unscheduled maintenance, and reporting.

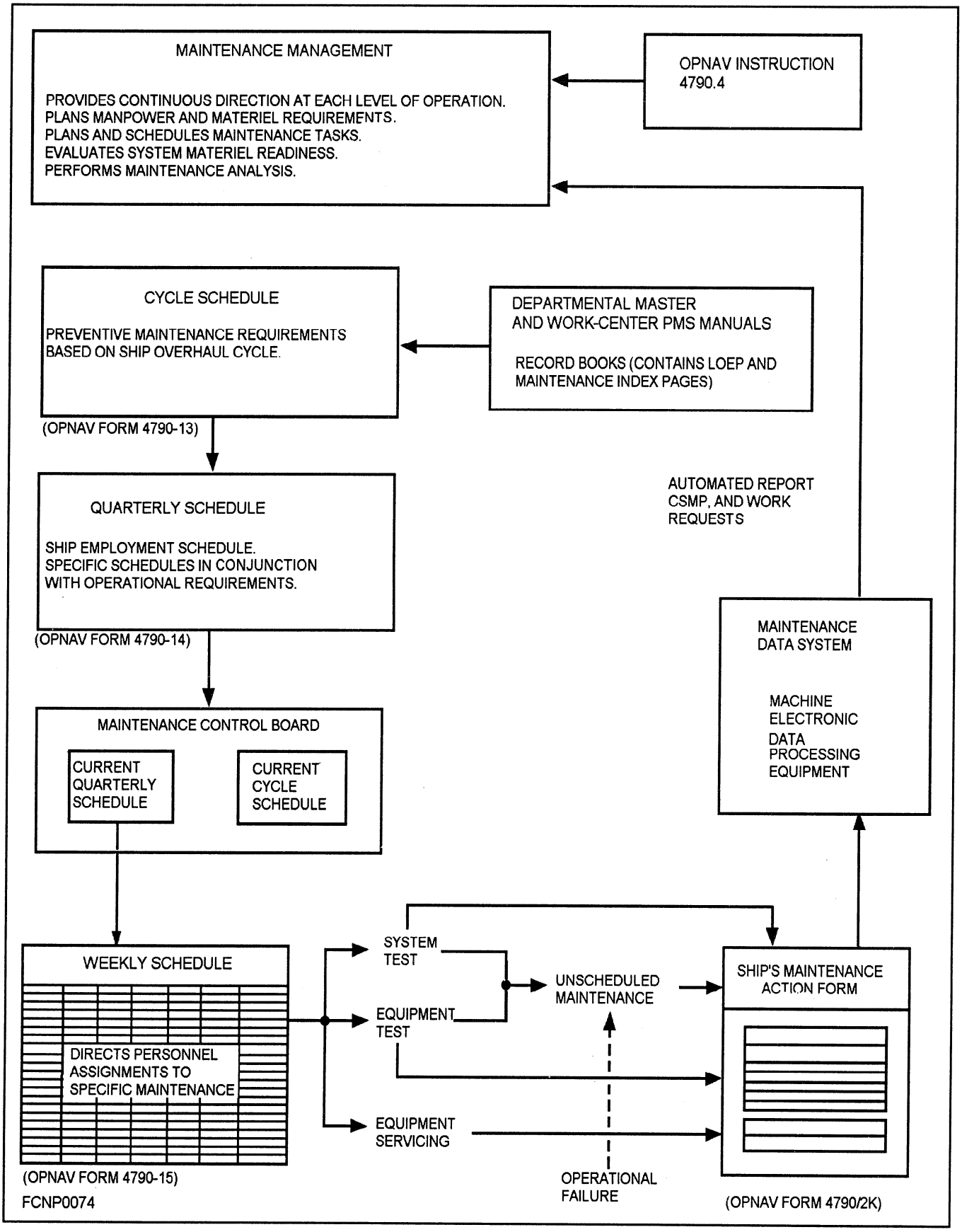

Figure 1-1.—Block diagram of the Planned Maintenance System.