



**NONRESIDENT
TRAINING
COURSE**



August 1997

Aviation Maintenance Ratings

NAVEDTRA 14022

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.

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.”

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Nonresident Training Course follows Index

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

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<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: n315.products@cnet.navy.mil
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DSN: 922-1001, Ext. 1713
FAX: (850) 452-1370
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For enrollment, shipping, grading, or completion letter questions:

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Phone: Toll Free: 877-264-8583
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FAX: (850) 452-1370
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NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you will receive retirement points if you are authorized to receive them under current directives governing retirement of Naval Reserve personnel. For Naval Reserve retirement, this course is evaluated at 11 points. (Refer to *Administrative Procedures for Naval Reservists on Inactive Duty*, BUPERSINST 1001.39, for more information about retirement points.)

COURSE OBJECTIVES

In completing this nonresident training course, you will demonstrate a knowledge of the subject matter by correctly answering questions on the following: maintenance administration, publications, aviation supply, corrosion prevention and control, line operations and special programs, work center management and quality assurance, and maintenance and production control. You will also see how these subjects

apply to the occupational standards of the following nine aviation ratings: AD, AE, AME, AMH, AMS, AO, AS, AT, and PR.

Student Comments

Course Title: Aviation Maintenance Ratings

NAVEDTRA: 14022 **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.

CHAPTER 1

MAINTENANCE ADMINISTRATION

As a nonrated person striking for an aviation rating or a new PO3, you will probably be assigned to the aircraft maintenance department of a squadron, ship, or shore station. Most of your duties will be productive maintenance, such as working on aircraft, engines, components, and support equipment. At times, you may be assigned to a support function, such as maintenance, production control, or supply. Regardless of the assignment, you should have a working knowledge of the *Naval Aviation Maintenance Program* (NAMP), OPNAVINST 4790.2, and the organizational structure of aircraft maintenance departments.

NAVAL AVIATION MAINTENANCE PROGRAM

LEARNING OBJECTIVE: Define the objectives of the Naval Aviation Maintenance Program (NAMP).

An important objective of the NAMP is to achieve and maintain maximum material readiness, safety, and conservation of material. Command attention is required at all levels to meet this objective. Aviation activities base their policies, plans, programs, and procedures on the NAMP.

For specific and detailed information on the programs and processes covered in this manual, you should refer to the *Naval Aviation Maintenance Program* (NAMP), OPNAVINST 4790.2.

Q1. What are the objectives of the NAMP?

AIRCRAFT MAINTENANCE DEPARTMENT ORGANIZATION

LEARNING OBJECTIVES: Define the purpose of the Aircraft Maintenance Department within an organization. Identify the two major types of aircraft maintenance, the three levels of aircraft maintenance, and specific responsibilities of the Chief of Naval Operations (CNO) and Naval Supply Systems Command (NAVSUP) concerning the Naval Aviation Maintenance Program (NAMP).

The aircraft maintenance department is usually the largest department in most operating units or activities. The primary effort of this department is to support the unit's mission. The operations department carries out the unit's mission of flight operations by naval aircraft. In support of the unit's mission, the maintenance department must maintain assigned aircraft in a state of full mission capability (FMC). An aircraft in this category can safely perform all of its intended missions and return to its base of operations.

All aircraft maintenance departments have the same basic organization; that is, they have a standard organization throughout the Navy. You can see the advantages of a standard organization if you consider what happens when you transfer from one aircraft maintenance activity to another. Because there is a standard organization, you find that the work centers in both the old and new activity have the same code numbers and names, and that the officers occupy similar billets. So, if you come from another aviation maintenance activity, you can perform in the new unit in a short time. You do not need a long indoctrination or break-in period.

The standard organization of the maintenance department is not limited to the operating activity (squadron) level. Broad avenues of responsibility and certain guidelines are prescribed by the Department of Defense (DOD). They are based upon years of aircraft maintenance experience in the Navy, Army, and Air Force.

Q2. What is the purpose of the Aircraft Maintenance Department within an organization?

MAINTENANCE TYPES, LEVELS, AND RESPONSIBILITIES

The aircraft intermediate maintenance department (AIMD) is a centralized local maintenance organization. AIMDs perform aviation maintenance functions that are beyond the capability of the operating squadron or unit. Capability refers to the scope of the work assigned to an activity by the NAMP. In addition to performing maintenance work on aircraft and equipment, the AIMD maintains equipment pools and issues items of support

equipment (SE) to the squadrons. Squadron maintenance personnel are usually assigned to the squadron maintenance department. However, some personnel may be assigned temporarily to the station's or ship's AIMD.

Maintenance Types

The term *aircraft maintenance* has a very general meaning. It could mean the maintenance performed in minutes at the squadron level to months of overhaul in an industrial-type facility. More than the words *maintenance* or *aircraft maintenance* are needed to indicate a specific meaning. There are two major types of maintenance—rework and upkeep. Categories within the major types of maintenance are standard rework and upkeep and special rework and upkeep. The following paragraphs discuss these types and categories of maintenance.

REWORK MAINTENANCE.—Rework maintenance is the restorative or additive work performed on aircraft, aircraft equipment, and aircraft SE. Naval aviation depots, contractor plants, and other industrial establishments do this type of maintenance. Standard rework and special rework come under the general heading of rework maintenance.

Standard Rework.—Standard rework is a comprehensive depot-level inspection of selected aircraft structures and materials, correction of critical defects, incorporation of certain technical directives, and limited removal and rework of scheduled removal components (SRCs). It also includes equipment history record (EHR), assembly service record (ASR), and module service record (MSR) items. Standard rework is commonly known as standard depot-level maintenance (SDLM).

Special Rework.—Special rework is work done to aircraft, aircraft equipment, and aircraft SE to improve or change their capability to perform specific functions. This is done by replacing or repairing parts or equipment of the aircraft. Normally, special rework is depot-level work.

UPKEEP MAINTENANCE.—Upkeep maintenance is the preventive, restorative, or additive work performed on aircraft, equipment, and SE by operating units and aircraft SE activities. It includes servicing, periodic inspection, functional and bench tests, replacement, preservation, modification, and repair. Upkeep is divided into two categories, standard and special. Military and contractor personnel perform

upkeep. The aircraft controlling custodians (ACCs) manage the process.

Standard Upkeep.—Standard upkeep maintenance is the periodic or scheduled work performed on aircraft, equipment, and SE **after** (and as a result of) completion of a prescribed number of flying hours or calendar days. Such work is performed in compliance with prescribed inspection or replacement requirements, and is also known as scheduled maintenance.

Special Upkeep.—Special upkeep is the work done to aircraft, equipment, and SE to improve, change, or restore their capability to perform specific mission functions. Special upkeep maintenance includes replacement, removal, addition, alteration, or repair of parts, equipment, or aircraft without regard to flying hours or operating times, and is also known as unscheduled maintenance.

- Q3. *What are the major types of aircraft maintenance?*
- Q4. *The restorative or additive work performed on aircraft, equipment, or support equipment is what type of maintenance?*
- Q5. *Standard rework is also known as what type of maintenance?*
- Q6. *What is special rework?*
- Q7. *Upkeep maintenance is performed by what activities?*
- Q8. *Standard upkeep is also known as what type of maintenance?*
- Q9. *Maintenance performed on aircraft without regard to operating hours or calendar is known as what type of maintenance?*

Maintenance Levels

All aircraft maintenance functions are divided into three distinct levels—organizational, intermediate, and depot. To determine the extent to which a repair task can be undertaken, the maintenance activity refers to the maintenance instruction manuals (MIMs), the operating and service instruction manuals, or the technical directives (TDs) that pertain to each weapon system or component. The levels of maintenance are discussed in the following paragraphs.

Organizational-level maintenance is work performed by an operating unit on a day-to-day basis in support of its own operations. Maintenance

performed at this level includes line operations, such as servicing, preflight inspections, and minor adjustments in preparation for flight; periodic inspections of aircraft and equipment and the associated tests, repairs, and adjustments that do not require shop facilities; and component removal and installation. This work is done in facilities assigned to the operating units. These facilities may be used exclusively by a single large squadron or they may be shared by one or more smaller units.

In an operating activity, permanently assigned personnel perform O-level maintenance. O-level maintenance at a naval air station (on aircraft assigned to the station) is a function of the operations maintenance division (OMD). When directed by higher authority, the OMD also provides O-level maintenance and other assistance to transient aircraft.

Intermediate-level maintenance is work performed in centrally located facilities for the support of operating activities within a designated geographical area. I-level maintenance work is performed at a particular base or station, or aboard aircraft carriers (CVs/CVNs), and amphibious assault ships (LHDs/LHAs/LPDs). This level of maintenance consists of calibration, off-equipment repair, or replacement of damaged or unserviceable components or assemblies. It also consists of the manufacture of nonavailable parts, periodic inspections, and technical assistance on aircraft components and equipment from supported units.

NOTE: The aircraft I-level maintenance department is commonly referred to as the SUPPORTING activity, and the O-level maintenance activity (squadron) is referred to as the SUPPORTED activity.

I-level maintenance activities are manned by a small number of permanently assigned personnel and sea operational detachment (SEAOPDET) personnel, a sea duty component assigned to the shore AIMD, used to augment the aircraft carrier AIMD in support of carrier air wing embarkations. Personnel assigned TAD to intermediate maintenance activities (IMAs) from non-CV deploying squadrons or shore IMA SEAOPDETs should be assigned for the complete deployment cycle. Shore-based Navy squadrons who have I-level billets authorized should assign personnel to the supporting IMA for a minimum of 12 months.

Depot maintenance is work that must be done in industrial-type facilities. Navy depot maintenance activities are manned primarily by civilians, and are

known as naval aviation depots (NAVAVNDEPOTs or NADEPs). The Commander, Naval Air Systems Command (COMNAVAIRSYSCOM or NAVAIR) manages NADEPs. This level of maintenance (standard depot-level maintenance or SDLM) includes overhaul and major repair or modification of aircraft, components, and equipment. It also includes the manufacture of specified aeronautical parts to be stocked as spares, the manufacture of kits for authorized aircraft and the modification of equipment. Installation of these spare parts and incorporation of modification kits may be done at this level or at a lower level of maintenance. Depot-maintenance activities also perform special rework. Some military personnel are usually assigned to the NADEPs for training or to help in performing the I- and O-level maintenance connected to the depot facility.

You can see by the above descriptions that the three levels of aircraft maintenance provide an orderly separation of the various maintenance tasks. These three separate levels of maintenance are needed because of task and equipment complexity, space requirements, the skill level of the assigned personnel, and the scope of support responsibility.

- Q10. Aircraft maintenance functions are divided into how many distinct levels?*
- Q11. What are the distinct levels of aircraft maintenance?*
- Q12. Describe organizational-level maintenance.*
- Q13. What level of maintenance includes the manufacture of non-available parts?*
- Q14. Depot-level maintenance is performed in what type of facility?*

Responsibilities

The Chief of Naval Operations (CNO) sponsors and directs the NAMP. Program administration is through the operational chain of command. The Naval Supply Systems Command (NAVSUP) provides material in support of the operation and maintenance of aeronautical equipment. NAVAIR is responsible for research, design, development, testing, acquisition, and logistic support of all naval aviation procurement relating to aircraft missile targets and associated material and equipment. Some activities may be assigned the intermediate maintenance responsibility for an entire logistic area if requested by the cognizant controlling custodian. Specific activities designated to perform intermediate maintenance are authorized to

perform higher levels of maintenance on systems and equipment unique to the assigned mission. Certain organizational maintenance activities are authorized to perform selective functions in partial intermediate support of their own operations.

Navy shore activities that are assigned I-level maintenance responsibilities have an AIMD to perform assigned maintenance. Those shore activities with assigned aircraft have an OMD within the operations department. This division performs O-level maintenance on assigned aircraft and provides flight line services for transient aircraft.

Naval Air Reserve Units (NARUs) perform both I-level and O-level maintenance on their assigned aircraft; however, the supporting activities provide logistic support. Naval air reserve squadrons perform O-level maintenance on their assigned aircraft while on active duty or assigned to fleet units. During regular scheduled drill periods, they perform maintenance according to the training requirements.

Afloat and shore-based AIMDs are manned in a similar manner. They have a small number of permanently assigned personnel and temporarily assigned maintenance personnel from the embarked squadrons and SEAOPDETS. These temporarily assigned personnel accompany their squadron upon disembarkation. SEAOPDET personnel return to the shore-based AIMD upon completion of the ships deployment.

The CV(N)/CV/LPH/LHA type of ships perform O-level and I-level maintenance on assigned aircraft. They also provide organizational and intermediate material, facilities, and SE needed by the embarked air wing, squadron, and unit.

Squadrons and units perform O-level maintenance on assigned aircraft. While shore based, designated squadron maintenance personnel are temporarily assigned to the AIMD of the supporting station for training and augmentation of the support effort. When afloat, designated squadron maintenance personnel are assigned, as required, to the AIMD of the supporting ship.

Specific squadrons and units, regardless of location, may be required to perform I-level maintenance functions on systems and equipments unique to their assigned aeronautical equipment and activity mission. Supporting ships or stations provide material, facilities, and SE. They also provide selected quantities of readily transportable material and SE as organizational property to the squadron or unit.

Q15. *The Chief of Naval Operations (CNO) has what responsibilities to the Naval Aviation Maintenance Program?*

Q16. *Who is responsible for providing material in support of the operation and maintenance of aeronautical equipment?*

AIRCRAFT MAINTENANCE DEPARTMENT FUNCTIONS

LEARNING OBJECTIVES: Identify the structure of the aircraft maintenance department. Describe the divisions of the intermediate and organizational levels of maintenance within the department.

The aircraft maintenance department supports naval operations by the upkeep of aircraft and associated SE to the assigned level of maintenance. This support is accomplished by complying with the *Naval Aviation Maintenance Program (NAMP)*, OPNAVINST 4790.2. Since all maintenance activities have similarities in mission, operation, and administration, these areas have standardized organization and administration. A maintenance department aids in improving the following areas:

- Performance and training of maintenance personnel
- Aircraft, equipment, and system readiness
- Maintenance integrity and effectiveness for all material
- Safety
- Usage of maintenance manpower and materials
- Planning and scheduling of maintenance work
- Management and evaluation of work performance
- Quality of the end product
- Attainment and retention of combat readiness
- Continuity when aircraft or personnel are transferred between commands

All personnel engaged in maintenance tasks work toward a common goal of assuring achievement in the above areas. They work under the management control process used in the aircraft maintenance department organization.

Some of the functions of an aircraft maintenance department are as follows:

- Periodic maintenance and routine inspection and servicing of aircraft, associated SE, and aeronautical material and components. Maintenance and inspection include the necessary disassembly, cleaning, examination, repair, modification, test, inspection, assembly, and preservation.
- Special work (when required) to comply with TDs or local instructions.
- Correction of aircraft and equipment discrepancies.
- Assurance of high quality in all work.
- Maintenance of required records and technical publications.
- Maintenance and custody of tools and other equipment provided the activity for its own use.
- Training of assigned personnel.
- Conducting maintenance and ground-handling safety programs.
- Submission of reports for statistical, analytical, and historical purposes.

The depth and complexity of specific functions vary with the number and type of aircraft involved and the assigned maintenance level. This chapter covers the aircraft maintenance organizations for the 0- and I-level maintenance activities. You will probably be assigned to an activity that performs only 0- or I-level maintenance.

Organizational Structure Relationships

The organizational structure of aircraft maintenance activities uses the principles and concepts of modern management. This structure incorporates the basic aspects of organizing-pinpointing responsibilities, span of control, alignment of functions, division of work, uniformity of assignments, and delegation of authority commensurate with the assignment of responsibility.

A line relationship (normally shown by a solid vertical line on an organizational chart) is a relationship that exists between a superior and subordinate within both staff and line segments of the organization. This relationship involves the direct supervisory functions of assigning work to subordinates and appraisal of performance.

On the other hand, a staff relationship (normally shown by a solid horizontal line feeding into the main arteries of the organizational chart) exists between an advisory staff supervisor and a production line supervisor. The sole concern of staff personnel is to service and support the production effort.

Management

Management exercises the authority and takes the responsibility for the performance of the mission, tasks, and work of the maintenance department. The organizational structure lets the aircraft maintenance officer (AMO) (with the aid of subordinate officers) manage the maintenance department. The AMO is responsible to the commanding officer for the accomplishment of the department's mission. The AMO directs the maintenance department according to directives from higher authority.

The functional management responsibilities assigned to the AMO are planning, control, and production. Also, the AMO estimates and programs facilities, equipment, manpower, and training requirements. With subordinate maintenance department officers, the AMO provides direction and guidance to subordinate divisions. The subordinate divisions implement and comply with all local- and higher-authority maintenance policies and technical directives. Normally, the following subordinate officers assist the AMO in the management of the maintenance department:

- Assistant aircraft maintenance officer. This officer ensures that the staff divisions conform to established policies involving quality assurance and supervises maintenance administration and department training.
- Maintenance material control officer. This officer is directly responsible to the AMO for the overall productive effort and material support of the department,
- Aircraft maintenance division and branch officers. These officers organize and manage their respective divisions and branches.

Specific responsibilities of these officers are outlined in OPNAVINST 4790.2. The organization of the maintenance department provides firm lines of authority from the AMO to the personnel who do the work for which the department is responsible. Major segments, called divisions, of the department report directly to the department head. Several branches

report to each division and at the lowest organizational level, sections report to each branch.

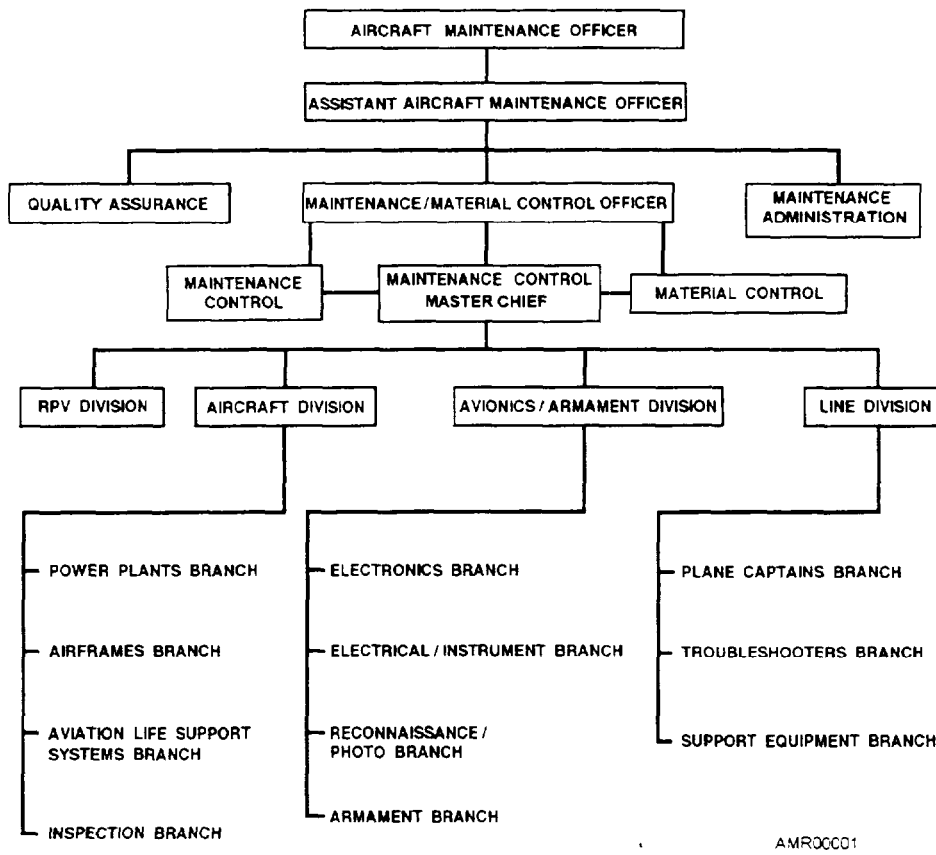
- Q17. What is a "line" relationship?
- Q18. A relationship that exists between an advisory staff supervisor and a production line supervisor is known as what type of relationship?
- Q19. Who is responsible to the commanding officer for the accomplishment of the maintenance department's mission?
- Q20. What are the functional management responsibilities of the aircraft maintenance officer?
- Q21. What subordinate officers assist the aircraft maintenance officer in the management of the maintenance department?
- Q22. What officer is responsible for ensuring that staff divisions conform to established policies?
- Q23. In addition to material support, what is the maintenance material control officer's direct responsibility?

Organizational Level (O-Level)

Organizational maintenance activities (OMAs) are the main users and operators of naval aircraft. Therefore, most of their maintenance tasks are the day-to-day support for their own operations. OMAs have maintenance managers who manage the activity, staff divisions that perform support-type functions for the production elements, and production divisions that actually perform the various maintenance tasks.

Figure 1-1 shows the organization chart of the different work centers in an O-level maintenance department. Typical work centers are maintenance control, the power plants branch of the aircraft division, and the electronics branch of the avionics/armament division.

STAFF DIVISIONS.—At OMAs, staff divisions provide services and support to the production divisions. Maintenance administration and quality assurance (QA) divisions link the progress of the production divisions. Together, they provide the AMO with a view of the current status of the maintenance



AMR0001

Figure 1-1.—O-level maintenance department organization.

department. In this section, you will be introduced to the staff divisions and their duties and responsibilities.

Maintenance Administration.—The maintenance administration provides administrative services for the maintenance department. It prepares maintenance-related correspondence that requires special attention by the AMO or higher authority; maintains files of maintenance-related correspondence and nontechnical publications and instructions; and ensures distribution of incoming messages, correspondence, and other data, including official and personal mail. It also coordinates department administrative security responsibilities with other departments and divisions; and maintains personnel assignment records for the department.

Quality Assurance.—The idea of QA is to prevent defects from occurring from the start of a maintenance operation to its finish. QA is the responsibility of all personnel. Its achievement depends upon prevention, knowledge, and special skills.

- **Prevention** is making sure that there are no maintenance failures. It extends to the safety of personnel, to the maintenance equipment, and to all aspects of the total maintenance effort. Prevention allows you to regulate events rather than have them regulate you.

- **Knowledge** is factual information. It includes data collection and analysis for acquiring knowledge to prevent defects.

- **Special skills** are required of a staff of trained personnel for the analysis of data and supervision of QA.

The objective of QA is to readily pinpoint problem areas so that management can accomplish the following:

- Improve the quality, uniformity, and reliability of the total maintenance effort

- Improve the work environment, tools, and equipment used in the maintenance effort

- Eliminate unnecessary man-hour and dollar expenditures

- Improve training, work habits, and procedures of maintenance personnel

- Increase the excellence and value of reports and correspondence originated by maintenance personnel

- Effectively disseminate technical information

- Establish realistic material and equipment requirements in support of the maintenance effort

- Effectively support the Naval Aviation Maintenance Discrepancy Reporting Program (NAMDRP)

- Support the Foreign Object Damage (FOD) Prevention and Reporting Program

Normally, QA work spaces are near the production divisions and the AMO.

System Administrator/Analyst.—The system administrator/analyst (SA/A) provides analytical information for the AMO's review of management practices within the organization. An SA/A will be established in O-level activities to monitor, control, and apply the MDS within that activity. The SA/A serves as a point of contact between work centers and the data services facility (DSF), and is responsible for all aspects of the maintenance data system (MDS), including Naval Aviation Logistics Command Management Information System (NALCOMIS) reports and inquiries. If an activity is operating with VIDS, the analyst will be assigned to QA/A.

The requirements for analysis stem from many sources and apply to a wide range of maintenance subjects. At times, analysis is initiated to provide an answer to a specific problem. At other times, analysis of selected areas of maintenance may be initiated by a monitoring action. Some of the more important responsibilities of the SA/A are as follows:

- Coordinate and monitor the MDS/NALCOMIS for the department.

- Review maintenance data reports (MDRs) to identify trends.

- Use the MDWNALCOMIS to assist in identifying possible deficiencies in technical training or documentation procedures.

- Monitor the assignment of the third position of work center codes.

- Collect, maintain, and distribute in narrative, tabular, or chart or graph form the data required to monitor, plan, schedule, and control the maintenance effort.

- Develop charts, graphs, and displays for command presentation.

- Assist the AMO and other supervisory personnel in determining the specific goals for new types of data reports required for managing the maintenance effort.

- Identify and apply analytical techniques to areas of material deficiencies, high man-hour consumption, or other pertinent trends.
- Provide assistance to production control or maintenance/material control in determining material consumption and usage based on MDS or NALCOMIS reports and inquiries.
- Coordinate all MDR matters with the DSF.

MAINTENANCE MATERIAL CONTROL.—The maintenance material control officer (MMCO) exercises authority in a line position between the AMO and the production divisions. The MMCO is directly responsible to the AMO for the overall productive effort and material support of the department. Maintenance material control normally has two work areas—one for maintenance control and one for material control.

Maintenance Control Work Center.—The maintenance control work center is usually referred to as *maintenance control* or the *maintenance control* office. Maintenance personnel use these terms interchangeably. Maintenance control is the nerve center of the maintenance department. The MMCO is its head. This officer, assisted by the maintenance control chief, directs the production divisions. He or she makes sure there is prompt movement of aircraft, parts, and materials. The MMCO also maintains liaison with the supporting activity to ensure that the department's workload requirements and productive capability are compatible. Under his or her direction maintenance control personnel plan, schedule, and provide positive control of all maintenance performed on or in support of assigned aircraft.

Material Control Center.—Material control center personnel provide material and supply support to the department. An effective aircraft maintenance department program depends upon a cooperative working relationship between production and supply. In the organizational maintenance department, the material control center acts as a liaison between the maintenance department and the local supply activity.

Personnel in the material control center make sure that the proper parts, tools, and equipment are available to the production divisions in the required quantity and at the proper time. Material control center personnel compile and analyze maintenance usage data. They furnish technical advice and information to the local supply activity on the identity and quantity of supplies, spare parts, and materials necessary for the assigned workload.

PRODUCTION DIVISIONS.—Aviation mechanics and technicians maintain naval aircraft and staff the production divisions. The production element of an O-level maintenance activity consists of the four divisions shown in figure 1-1. They may be subdivided into branches and sections to perform the required maintenance tasks more effectively. A discussion of the more important production divisions is presented in the following paragraphs.

Remotely Piloted Vehicle (RPV) Division.—An RPV division (previously Target Division) is optional, and may be established when responsibilities concerning the operation and maintenance of aerial or surface targets are extensive. The RPV division coordinates and completes periodic maintenance, inspections, decontaminations, and rehabilitation of assigned RPVs.

Aircraft Division.—The aircraft division has several branches. The *power plants branch* is manned by Aviation Machinist's Mates (ADS), who maintain aircraft power plants and their related systems and components. The *airframes branch* is manned by Aviation Structural Mechanics (AMHs-Hydraulics and AMSs-Structures), who maintain the structural systems of the aircraft, landing gear, fuselage, etc. The *aviation life support systems branch* is manned by Aircrew Survival Equipmentmen (PRs) and Aviation Structural Mechanics (AMES-Safety Equipment). PRs maintain parachutes, life rafts, emergency equipment kits, and flight clothing. AMES maintain oxygen, pressurization, air-conditioning systems, and other emergency equipment. The *inspection branch* is headed by an inspection supervisor who performs all maintenance control functions (except cannibalization) of aircraft undergoing a phase inspection.

NOTE: Many commands have a permanent inspection work center that has one person of each rating assigned, as necessary, for the inspection process. In some activities, a temporary crew may be established.

NOTE: All work centers have a responsibility for corrosion. Additionally, most activities may have a permanent corrosion work center staffed by personnel from several ratings.

Avionics/Armament Division.—The avionics/armament division has several branches. The *electronics branch* is normally manned by Aviation Electronics Technicians (AT[O]s) who perform organizational-level preventive and corrective

maintenance on aviation electronics systems, including communication, radar, navigation, antisubmarine warfare sensors, electronic warfare, data link, fire control, tactical displays, and associated equipment. The *electrical and instrument branch*, staffed by Aviation Electrician's Mates (AEs), maintains the batteries and aircraft electrical and instrument systems. The *armament branch* is manned by Aviation Ordnancemen (AOs) who maintain armament and ordnance-related equipment.

- Q24. *What is the concept of quality assurance?*
- Q25. *The achievement of quality assurance depends on what factors?*
- Q26. *What is the purpose of the system administrator/analyst at the organizational maintenance level?*
- Q27. *Who has the responsibility, as well as many other responsibilities, to identify material deficiencies and high man-hour consumption trends?*
- Q28. *What work center plans, schedules, and provides positive control of all maintenance performed on or in support of the activities assigned aircraft?*
- Q29. *What branches or work centers make up the aircraft division?*
- Q30. *The avionics/armament division consists of what work centers?*

Line Division.—Personnel from many different aviation ratings normally man the line division.

Personnel who are assigned to the line division might be aviation machinist's mates, structural mechanics, electricians mates, or even personnel who are striking for the Aviation Storekeeper (AK) and Aviation Maintenance Administrationman (AZ) clerical ratings. This is the division to which you will probably be assigned first. Here, you will be introduced to the types of aircraft that are flown in your squadron. Chapter 5 of this TRAMAN covers the line division in detail.

Intermediate Maintenance (I-Level)

The primary mission of I-level maintenance is to enhance and sustain the combat readiness and mission capability of supported activities. I-level maintenance does this by providing quality and timely material support at the nearest location with the lowest practical resource expenditure. I-level maintenance is usually performed in a centrally located area in support of operating aircraft on shore stations, aboard ships, or within designated areas.

Intermediate maintenance activities (IMAs) are not assigned aircraft for operational purposes. They concentrate their efforts on repairing and testing aircraft components.

The organizational structure of the IMA is similar to the organizational structure of the OMA. But, because the IMA is larger than the OMA, it has more divisions. The I-level maintenance organization is made up of maintenance managers, staff divisions, and production divisions, which are shown in figure 1-2.

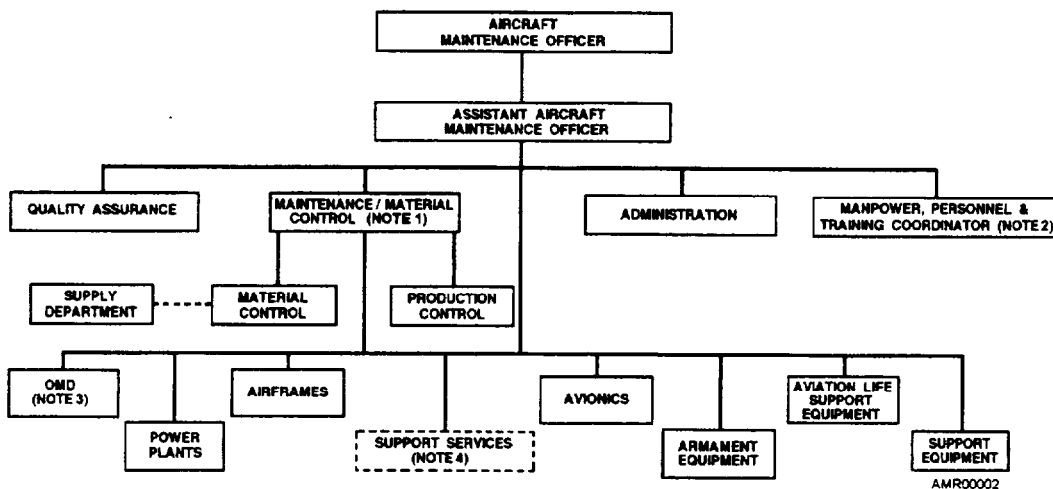


Figure 1-2.—Intermediate-level maintenance department organization (ashore).

STAFF DIVISIONS.—The staff divisions of the I-level maintenance department provide services and support to the production elements. They serve in much the same way as the QA division and maintenance administration division of an O-level activity.

The administration division functions as the coordinator for all records and reports, directives, correspondence, and personnel matters for the department. Personnel in the I-level administration division perform the following duties:

- Conduct liaison with the administrative department regarding department personnel
- Safeguard and distribute personal mail to department personnel, when appropriate
- Control the classified matter required by the department
- Distribute approved locally issued reports and studies
- Coordinate transportation and communication requirements for their department
- Establish and coordinate the department training requirements. and obtain any school quotas needed to support these requirements
- Assign spaces to the various divisions, and establish the responsibility for security and cleanliness of such spaces
- Assume the responsibility for the cleanliness and security of vacant or unassigned maintenance spaces
- Arrange department participation in joint inspections of facilities assigned to tenant activities, especially incident to the arrival or departure of a tenant activity

The QA division of I-level maintenance activities has the same primary functions as those of organizational activities—to prevent the occurrence of defects. Personnel in this division use statistical analysis to compare the results obtained with the results desired. Through research, they find methods of improving effectiveness of the overall maintenance effort. The objectives of the QA division in I-level maintenance are identical to the objectives of QA in O-level maintenance activities.

MAINTENANCE MATERIAL CONTROL.—In an intermediate activity, maintenance material control is organized much like the maintenance material control of the organizational activity. It has

two work centers—production control and material control.

Production control is the central point of the entire maintenance effort. IMAs exist to support operating activities. Personnel working in the production control work center plan and schedule the workload. The workload consists of repairing, testing, and processing aircraft parts, components, and related equipment.

Intermediate activities tend to be large. Because of this tendency, the location of various work centers, and the number of components handled daily, it is not practical to control each component inducted from a central production control area. Production control delegates some of its functions to certain selected production divisions. These divisions are responsible to production control for the production efforts of their assigned work centers, scheduling components into work centers, and assigning priorities as directed by production control.

The maintenance data base administrator/analyst (MDBA/A) provides qualitative and quantitative analytical information to the AMO via the MMCO for continuous review of management practices within the department or activity. The MDBA/A is established at the I-level to monitor, control, and apply the MDS. The MDBA/A also serves as a contact point between work centers and the DSF, and is responsible for the management of all aspects of the MDS including NALCOMIS reports and inquiries at the I-level. Specific responsibilities of the MDBA/A are parallel to that of the SA/A at the O-level. If an activity is operating with VIDS, the analyst will be assigned to QA/A.

Production control cooperates with staffmembers. It uses staff findings and recommendations to improve the overall maintenance effort. Together with the administration division, the QA division and the MDBA/A, maintenance material control provides the intermediate aircraft maintenance officer with a complete picture of the maintenance situation for any given time, and also makes recommendations for improvement.

The material control center coordinates and controls the supply functions of the department. It acts as a liaison between the department and the local supply activity. It processes all supply and material transactions for the other divisions of the department. Other functions of the material control center are as follows:

- Requisitions material

- Maintains the material control register
- Maintains inventories of materials on hand
- Maintains subcustody records for accountable items held by the department
- Maintains records of all material transactions and accounts for the expenditures of funds by the department
- Furnishes technical advice and information to the local supply activity concerning material requirements for the assigned workload

In IMAs, the material control center has an aeronautical material screening unit (AMSU). This unit coordinates the screening of received materials and parts to determine the status and repair responsibility and capability.

PRODUCTION DIVISIONS.—Normally, the I-level maintenance organization consists of six production divisions, as shown in figure 1-2. The six production divisions are power plants, airframes, avionics, armament equipment, aviation life support equipment, and support equipment. In this chart you can see that if the OMD and IMA are combined, an organizational maintenance division is established. Additionally, a support services division may also be established if so desired. However, this discussion deals with the six normal production divisions and their responsibilities, minus organizational maintenance and support services divisions.

The type of work that you will perform is the same regardless of the maintenance level at which you are working. If you are an AD, you will work on engines. If you are an AE, you will work on instruments and electrical equipment. If you are an AT, you will work on avionics equipment. However, the work that you will perform is at a level beyond the capability of the supported activity. In this section, the more important responsibilities and functions of these divisions are presented.

Power Plants. ADS staff the power plants division. They perform maintenance on power plants, power plant components, and associated systems.

Airframes. AMs are assigned to work centers in the airframes division. The airframes division is responsible for the specified level of maintenance for the airframe and structural components; moveable structures and surfaces, including their hydraulic and pneumatic control and actuating systems and mechanisms; air-conditioning, pressurization, visual

improvement, oxygen, and other utility systems; and seat and canopy ejection systems and components.

Avionics. The avionics division is staffed with the appropriate combination of ratings to provide maintenance of avionics equipment for the supported activities: AEs maintain aircraft electrical and instrument systems. AT(I)s perform intermediate-level preventive and corrective maintenance on aviation electronic components supported by conventional and automatic test equipment, including repair of weapons replaceable assemblies (WRA) and shop replaceable assemblies (SRA). The AT also performs microminiature (2M) component repair, and performs test equipment qualification and associated test bench preventive and corrective maintenance.

Armament Equipment. AOs are assigned to the armament division. They maintain aircraft armament equipment and aviation ordnance equipment.

Aviation Life Support Equipment. PRs are assigned to the aviation life support equipment division. This division is responsible for intermediate maintenance in connection with parachutes, life rafts, pressure suits, oxygen masks, emergency equipment kits, flight clothing, oxygen regulators, automatic parachute actuators, and aviators' protective helmets, etc. AME personnel also may be assigned to this division for upkeep and support of the oxygen system, pressurization and air-conditioning systems, and other emergency equipment as assigned within the scope of that rating.

Support Equipment (SE). The Aviation Support Equipment Technician (AS) performs the necessary maintenance on the SE assigned to the maintenance department and supported activities. SE includes such items as test stands, workstands, mobile electric power plants, and pneumatic and hydraulic servicing equipment.

- Q31. *What is the purpose of the production control work center?*
- Q32. *At the intermediate maintenance activity, who provides qualitative and quantitative analytical information to the AMO?*
- Q33. *At the I-level, power plants, airframes, avionics, armament equipment, support equipment, and aviators' life support equipment are known as what type of divisions?*

**NAVAL AVIATION LOGISTICS
COMMAND MANAGEMENT
INFORMATION SYSTEM
(NALCOMIS)**

LEARNING OBJECTIVE: Define the purpose of the Naval Aviation Logistics Command Management Information System (NALCOMIS)

NALCOMIS provides OMA, IMA, and aviation supply department (ASD) activities with a modern, real time, responsive, computer-based management information system. This automation helps us do our jobs better and more efficiently by reducing paperwork. NALCOMIS is not available at all aviation commands. If your command has not yet implemented NALCOMIS, then VIDS/MAFs will still be the means of performing and tracking maintenance. There are three basic objectives of NALCOMIS.

- To increase aircraft readiness by providing focal maintenance and supply managers with timely and accurate information required in their day-to-day management and decision-making process
- To reduce the administrative burden of the fleet
- To improve the quality of up-line reported data

Figure 1-3 shows a NALCOMIS generated repair document. The information offered and data fields are the same as a VIDS/MAF; however, Conversation codes are used to input information. OPNAVINST 4790.2, Vol III, offers more detailed information on the NALCOMIS system.

NOTE: NALCOMIS specific documentation procedures, input formats, and output formats are contained in the *NALCOMIS End User Manuals* for OMA, *System Administrator (SA) Manual* for OMA, *Security Feature User's Guide* for OMA, *NALCOMIS IMA Desk Top Reference Guides*, and the *NALCOMIS IMA User's Manual*.

- Q33. *What is the purpose of NALCOMIS?*
- Q35. *What are the three basic objectives of NALCOMIS?*
- Q36. *If an I- or O-level activity does not yet operate under NALCOMIS, under what system do they document their maintenance?*

**VISUAL INFORMATION DISPLAY
SYSTEM (VIDS) BOARD**

LEARNING OBJECTIVES: Define the purpose of the Visual Information Display System board in aircraft maintenance. Identify the flow of a Visual Information Display System/Maintenance Action Form (VIDS/MAF) at the organizational and intermediate levels of maintenance.

All maintenance managers have the responsibility to manage their resources efficiently. To do this, they must maintain control of the different elements within their area of responsibility. Effective control depends upon the availability of status information on these elements. The VIDS provides this information. Communication between maintenance control, work centers, and material control is important to make sure the VIDS operation is successful. To record this communication, we use VIDS boards and VIDS forms, which are discussed in the following paragraphs.

O-LEVEL VIDS BOARD

In the work center, the VIDS board is set up like the VIDS board shown in figure 1-4. This is a 25-pocket board. Most work centers can show all the necessary information on a board of this size. However, the number of aircraft and systems determines the number and size of boards that a work center needs. If work is shown by personnel assignment, the number of people assigned determines the size and number of VIDS boards used in the work center. The work centers should verify their VIDS boards with the maintenance control VIDS board at least once a day.

- Q37. *What element is important to ensure successful operation of the Visual Information Display System (VIDS)?*
- Q38. *With regard to the VIDS board, what action should take place with maintenance control on a daily basis?*

Information Displayed

Some of the types of information that can be shown on the VIDS board include personal history and information cards, personnel training inserts, and SE required by the work center. The personal history and information cards are placed in the far left-hand side of the board, if the work center is using the bureau/side

N2R22502
 SWP4826
 VIDS/MAF OPNAV 4790/60 (REV 2-82)

. ENTRIES REQUIRED SIGNATURE
 . NONE LOGS REC
 . X AJSTYLES

=====

ACCUMULATED WORK HOURS			MAN	ACCUMULATED AWM HOURS
NAME/SHIFT	TOOLBOX/INT	DATE	HOURS	DATE TIME REASON HOURS
JHTRACY	1 D9891A7	JBS	94020 1.5	

LOCAL USE

REFERENCE

=====

FAILED/REQUIRED MATERIAL

INDEX	F/P	AWP	A/T	MAL	REFSYMBOL	QTY	PROJ	PRI	DATE	ORD	REQ NO	DATE REC
-------	-----	-----	-----	-----	-----------	-----	------	-----	------	-----	--------	----------

FSCM	PART NUMBER
FSCM	PART NUMBER
FSCM	PART NUMBER

WORK ACT					MAL					. TECHNICAL DIRECTIVE ID					
UNIT	CD	ORG	TRANS	M/L	A/T	CODE	I/P	HOURS	EMT	INT	CODE	BASIC	NO RV	AM	PART KIT
48KA1E0	D98	11	1	C	105	01	1.5	1.5							
TYPE	BU/SER														
EQUIP	NUMBER		W/D	T/M	POSIT	FID	SFTY/EI	METER		SE	FSCM	INV	CD	PERM	CD
GBGB	460640		D	B				S0691							

.....REPAIR CYCLE.....

RECD	DATE	TIME	EOC	FSCM	REMOVED/OLD ITEM	FSCM	SERIAL NUMBER	INSTALLED/NEW ITEM	FSCM	SERIAL NUMBER
IN WORK	94020	1500								
COMP	94020	1630								
AWAITING MAINTENANCE HRS				PART NUMBER	DATE	REMOVED	PART NUMBER			
MAINTENANCE/SUPPLY REC				TIME/CYCLES				TIME/CYCLES		
STATUS	DATE	TIME	EOC	TIME/CYCLES				TIME/CYCLES		
M3	94020	1500								
IW	94020	1500		DISCREPANCY	TERMOCOUPLE LEADS ARE	PILOT/INITIATOR				
JC	94020	1630		LOOSE		AN STEELE				

.CORRECTIVE ACTION TIGHTENED LOOSE LEADS

=====

CORRECTED BY	INSPECTED BY	SUPERVISOR	MAINT CONTROL	CF	QA
JHTRACY	IMWILSON	JBSMITH	IBMERCER	REQ	REQ
				RFI	BCM

JOB CONTROL NUMBER	WORK CENTER	STATUS	INSPT	PRI	TURN-IN	DDSN	SYSTEM/REASON	MCN
ORG DAY SER SUF	91A	UP	JCN	3			AIR START	SWP4826
D98020099								

AMR00003

Figure 1-3.—NALCOMIS Repair Document.

WORK CENTER 210			
SIDE NO.	IN WORK	AWM	AWP
101			
102			
103			
104			
105			
106			
107			

AMR00005

Figure 1-5.—Organizational VIDS board (bureau/side number method).

WORK CENTER 220													
RATE	NAME	IN WORK	QUALIFICATIONS										
AEC	A.B. SEAMAN												
AE1	J.A. DOE												
AE2	J.R. FROST												
AE3	M.N. CHRISTMAS												
AE3	W.T. DOOR												
AEAN	P.T. BOAT												
AN	J.T. BOATE												
AN	V.C. PISTOL												
SIDE NO.	AWM	AWP											
401													
402													
403													
404													
405													

AMR00006

Figure 1-6.—Organizational VIDS board (personnel assignment number method).

- Orange. SE partially down.
- Green. Personnel shortage. A green signal tab indicates that the personnel required to maintain a particular system are not available because they are on leave or have temporary duty requirements.

VIDS Operating Procedures

In this section, you will see how maintenance control uses the VIDS board. While reading this section, you should refer to figure 1-7. Maintenance

control receives discrepancies from sources such as pilots, aircrews, and maintenance personnel; or maintenance control might initiate a directed discrepancy (such as cannibalization). After maintenance control completes their required blocks of the VIDS/MAF, they forward copies 1 and 5 to the Work center for discrepancies found on the aircraft or SE.

The work center places copies 1 and 5 on the VIDS board under the applicable column (AWM or In Work), as directed by maintenance control. Any time the status of a discrepancy changes (for example, has been In Work and goes to AWP status or back to AWM status), maintenance control must be notified immediately. *Maintenance control must be in control of all maintenance at all times.* The VIDS/MAF should always be kept in the appropriate column, both in the work center and maintenance control.

Often a replacement part is required. To show Work stoppage for parts, mark the VIDS/MAF with the correct information in the H-Z Failed/Required material section. Then, obtain a supply priority and

project code from maintenance control and advise material control of the parts requirement. Finally, move the VIDS/MAF to the AWP column of the VIDS board. When the replacement part is received, the In Work or AWM status is entered, as appropriate, on the VIDS/MAF in addition to the date received in Block B53. If maintenance control authorizes the work to be started, the VIDS/MAF is moved to the In Work column of the VIDS board.

NOTE: A discrepancy may go through the AWM, In-Work, and AWP process many times before it is corrected. If so, follow the above steps each time the status of a discrepancy changes.

VIDS/MAF Flow

Figure 1-7 shows the VIDS/MAF flow throughout the maintenance effort. Maintenance control is notified when all corrective actions have been completed. QA must be notified if any QA inspections or check flight requirements are needed as a result of the maintenance actions.

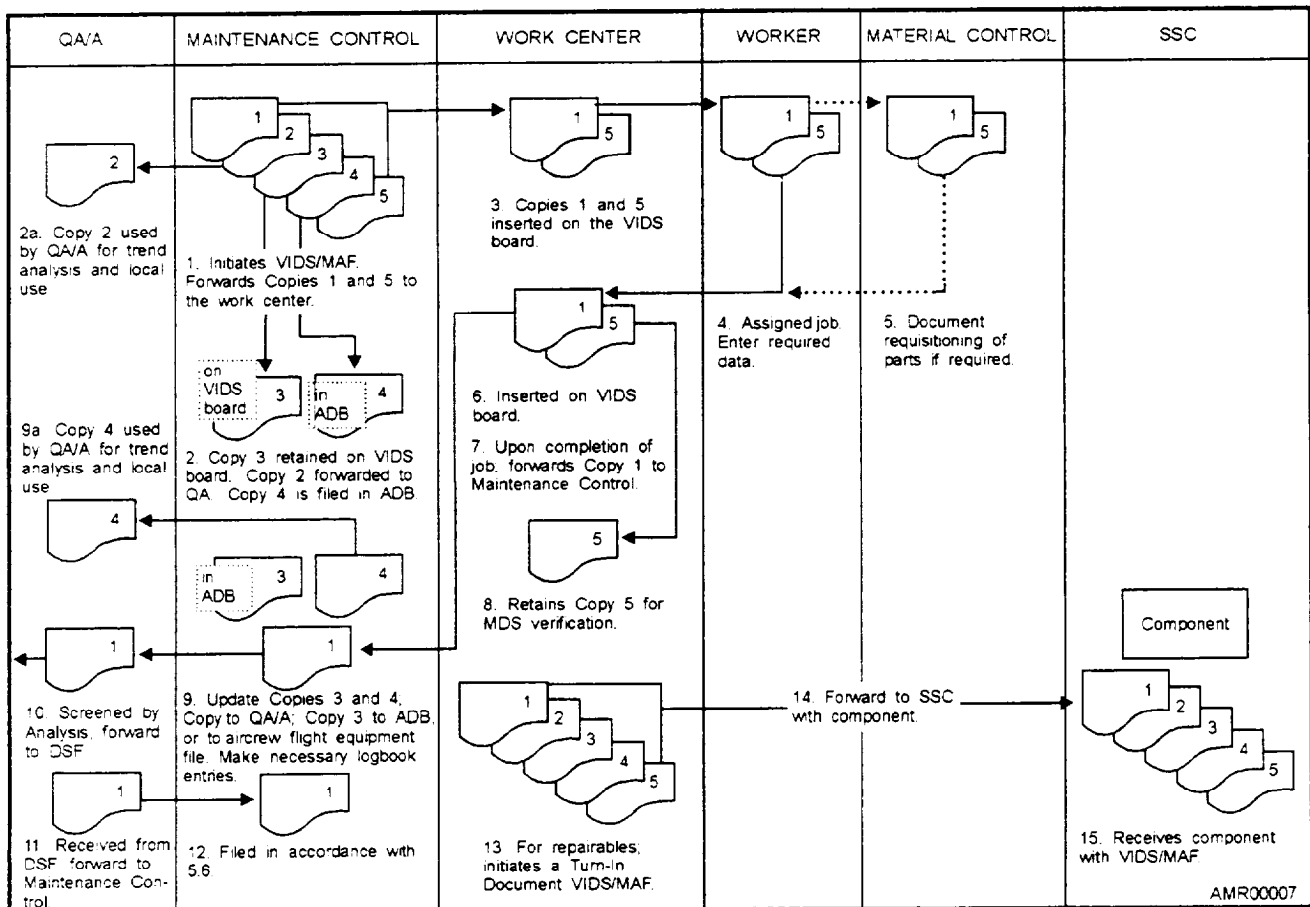


Figure 1-7.—Organizational maintenance (O-level) VIDS/MAF document flow chart.

At this time, all necessary actions should have been made on the VIDS/MAF. The completed copy 5 is filed in a temporary file in the work center.

When the supervisor signs the VIDS/MAF, it means that the maintenance action is complete, that tool control inventories have been conducted at the proper intervals, that QA measures have been met, and that the documentation is complete and correct.

Copy 1 of the completed VIDS/MAF is forwarded to maintenance control. After verification of the work center's copy 5 with the VIDS/MAF copy 1 Daily Audit Report, copy 5 is maintained or destroyed, as required by local command policy.

Q39. Upon initiation of a VIDS/MAF at the organizational level, which copies are forwarded to the work center?

Q40. What must be done if a maintenance action results in the requirement of a check flight?

Q41. Upon the completion of a maintenance action and when the VIDS/MAF is completed, which copy is forwarded to maintenance control?

I-LEVEL VIDS BOARD

A visual display of all current weapons systems or repairable component status is as necessary at the I-level of maintenance as it was at the O-level of maintenance. The VIDS/MAF flow for the I-level is shown in figure 1-8. The same forms are used at this level—VIDS/MAF and signal tabs.

Information Displayed

VIDS/MAFs are used at the I-level of maintenance in the same way that they are used at the O-level of maintenance. The VIDS/MAF is used to report maintenance repair actions. The signal tabs are used in much the same way at I- and O-level maintenance, but with the following differences:

- Orange. Bench/equipment inoperable
- Yellow. Bench/equipment partially capable
- Green. Local Repair Cycle Asset (LRCA) at low level
- Blue. LRCA at zero level (critical)
- Red. Expeditious repair

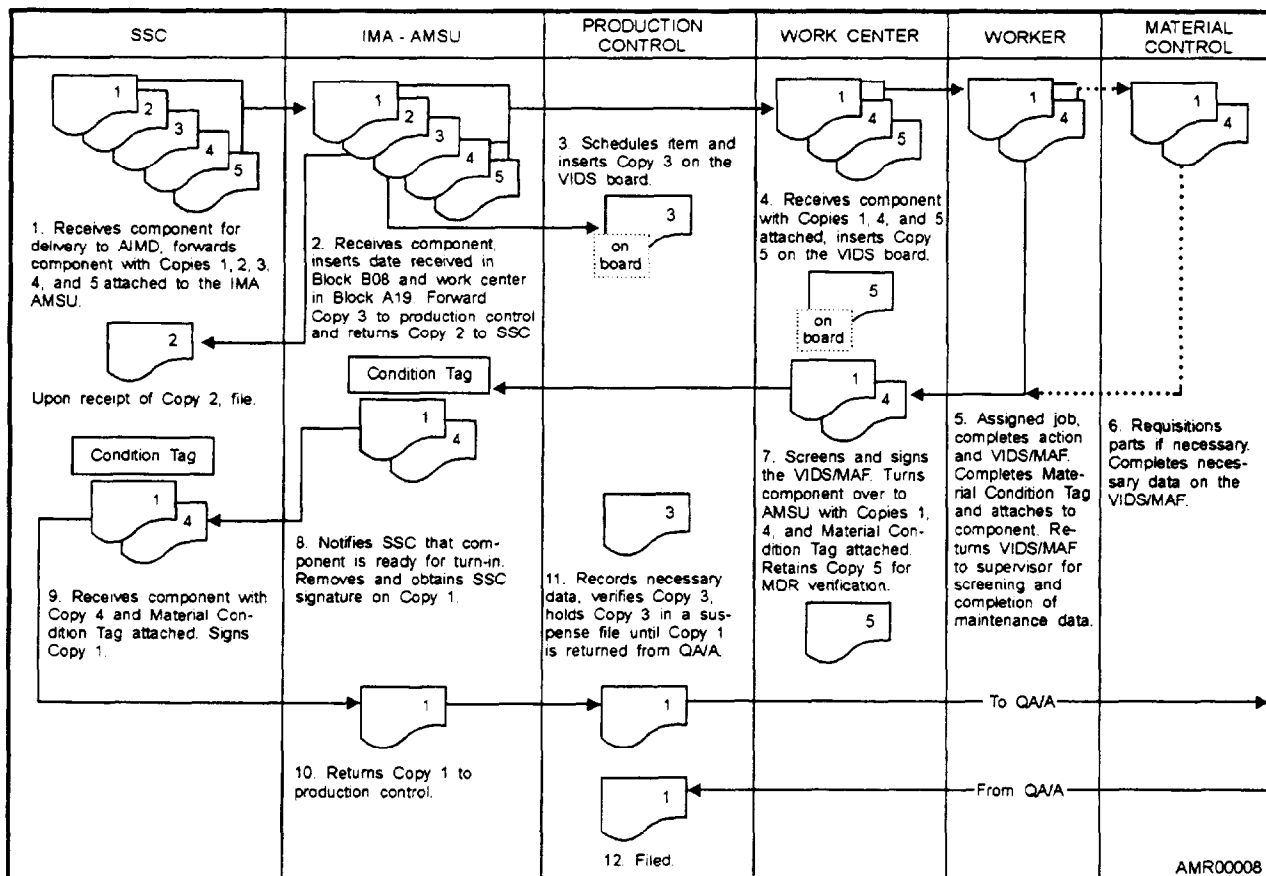


Figure 1-8.—I-level maintenance VIDS/MAF document flow chart.

VIDS Operating Procedures

The work center receives copies 1, 4, and 5 of the VIDS/MAF with the nonready-for-issue (non-RFI) component. The work center supervisor puts copy 5 on the work center VIDS board in the pocket next to the applicable work unit code (WUC)/LRCA number/part number/name under the In-Work column. Copies 1 and 4 are kept with the inducted equipment throughout the maintenance cycle. If the job is not assigned by production control, copy 5 is placed under the AWM column. Any status changes, such as from In Work to AWP or In Work to AWM, must be reported to production control. Copy 5 is then placed under the correct column of the work center VIDS board.

When a component goes to an AWP status and after appropriate entries have been made on the VIDS/MAF, that component should be packaged and preserved. Then, it is sent to the AWP unit or its equivalent. Copies 1 and 4 of the VIDS/MAF stay with the component. Copy 5 of the VIDSMAF is moved to the AWP column of the work center VIDS board.

When the component is in a ready for issue (RFI) or beyond capability of maintenance (BCM) condition, the necessary entries are made on all copies of the VIDSMAF (including date). Copy 5 is placed in a temporary file until it is verified against the daily audit report (DAR). Components that are BCM have the Type Equipment code and job control number (JCN) entered in the Remarks block of the attached Material Condition Tag (DD Form 1577-2/1577-3).

The supervisor's signature on the VIDS/MAF means that the following actions have been taken:

- Maintenance actions have been completed.
- Too! control inventories have been held at the appropriate times.
- The component has been adequately preserved and secured for routing to the AMSU.
- Documentation is correct.
- QA measures have been met.

The work center supervisor is also responsible for maintaining the work center's VIDS board. As shown in figures 1-9 and 1-10, this board provides the status for In-Work, AWM, and AWP components by WUC, pool index number, or part number within the work center.

NOTE: It is not mandatory that the VIDS boards be set up exactly as they are shown in this chapter. However, In-Work, AWM, and AWP must be visually shown by WUC, pool index, or part number at the I-level of maintenance.

The production control supervisor should establish a schedule to make sure that all work centers verify the production control VIDS board at least daily.

Q42. *What does a red signal tab on an I-level VIDS board or VIDS/MAF indicate?*

Q33. *Upon induction of a non-RFI component to an I-level activity, where are copies 1, 4, and 5 of the VIDS/MIF routed?*

WORK CENTER 610					
WUC	P/N	LRCA#	AWM	IN WORK	AWP
71430					
71431	1091295	110			
71432	54400428	145			
71480					
71481	522-2537-00	65			
71482	5253667-00	170			
72360					
72361	1268-2904	160			
72362	3161522	205			
73510					
73511	6707420002	125			
73512	6709017003	270			

AMR00009

Figure 1-9.—Work center 610 VIDS board.

WORK CENTER 630												
RATE	NAME	IN WORK					QUALIFICATIONS					
ATC	Q.R. JONES											
AT1	S.T. GRAY											
AT2	U.V. BROWN											
AT3	W.X. SMITH											
AT3	Y.Z. GREE											
ATAN	A.B. WHITE											
ATAN	C.D. JONES											
WUC	P/N	LRCA#	AWM				AWP					
74240												
74241	616R424001	155										
74242	615R584001	85										
74243	614R379G01	180										
77110												
77111	474100-1	360										
77112	474200-3	315										
77113	474150-3	130										

AMR00010

Figure 1-10.—Work center 630 VIDS board.

Q33. At the I-level, what happens to a repairable component for which parts have been ordered?

ADMINISTRATIVE FORMS AND DOCUMENTS

LEARNING OBJECTIVE: Identify the forms and documents used in the maintenance administration section, their purpose, and use.

The Aviation 3-M Maintenance Data System (MDS) provides a mechanized collection and processing of statistical data. This is essential to the management of resources. The maintenance worker records most of this data on prescribed forms. As a mechanic or technician, you will be required to initiate or complete various forms. A brief description of some of these forms and related data is given in the following text. For more detailed instructions on filling out these forms, refer to OPNAVINST 4790.2. Personnel having responsibilities under NALCOMIS should refer to the *NALCOMIS User's Manual*.

DATA ACCURACY

Accurate documentation is necessary. Each MDS document that is not correct causes a loss of effectiveness of the data and of the system in general. The data must be accurate and complete because it has Navy-wide application.

VIDS/MAINTENANCE ACTION FORM (MAF)

O- and I-level maintenance activities use the VIDS/MAF, OPNAV 4790/60 (fig. 1-11), or NALCOMIS to report on equipment maintenance actions. They also use one of the two methods to document the removal and processing of a repairable component or item to AIMD. For the VIDS/MAF, copies 1, 3, 4, and 5 of the form contain the same information. Copy 2 is a tear-out that contains the necessary data for material reporting. Copy 3 is perforated along the fold line to make it easier to fold the form for insertion in the VIDS board or to permit removal of the top part of the form. Carbons separate all of the copies so that the coded information carries through to each copy of the form.

At the O-level of maintenance, copies of the VIDS/MAF are used and distributed as follows:

- Copy 1—work center register, control, and processing copy
- Copy 2—QA suspense file copy
- Copy 3—maintenance control register
- Copy 4—aircraft discrepancy book (right side) copy
- Copy 5—work center MDR verification copy

At the I-level of maintenance, copies of the VIDSMAF are used and distributed as follows:

No. **SWP 4826**

COPY 1

WORK CENTER REGISTER, CONTROL AND PROCESSING COPY
VIDS/MAF OPNAV 4790/60 (REV 5-88) S/N 0107-LF-002-5900

5 PART FORM
 USE BALL-POINT PEN PRESS HARD

ENTRIES REQUIRED SIGNATURE
 NONE LOGS REC
 AZ1 Seamen

LOCAL USE	ACCUMULATED WORK HOURS					ACCUMULATED AWM HOURS			
	NAME/SHIFT	TOOL BOX	DATE	MAN HOURS	ELAPSED M/T	DATE	TIME	REASON	HOURS
	Boat	3lcb	4133	0 5	0 5				
	Boat	3lcb	4133	0 5	0 5				
REFERENCE									

(H-Z) FAILED/REQUIRED MATERIAL												
79 INDEX	08 F/P	09 AWP	10 A/T	11 MAL	14 MFR	19 PART NUMBER	34 REF SYMBOL	41 QTY	43 PROJ	45 DATE QRD	49 REQ NO	53 DATE REC
<input type="checkbox"/>	<input type="checkbox"/>				82598	1268		1	AK7	03	4133	G562 4133
<input type="checkbox"/>	<input type="checkbox"/>											
<input type="checkbox"/>	<input type="checkbox"/>											
<input type="checkbox"/>	<input type="checkbox"/>											
<input type="checkbox"/>	<input type="checkbox"/>											
<input type="checkbox"/>	<input type="checkbox"/>											

SAMPLE

FOLD

TECHNICAL DIRECTIVE IDENTIFICATION

A1 WORK UNIT CODE	A2 ACTION ORG	A3 TRANS	A4 MANTAL	A5 ACT TAKEN	A6 MAL CODE	A7 ITEMS/P	A8 MAN HOURS	A9 ELAPSED M/T	A10 ITEM	F01 FOR CODE	F02 BASIC NO	F03 RY	F04 AM	F05 PART	F06 NOT	
7236100	AC1	23	1	R	383	1	1 0	1 0	<input type="checkbox"/>							

A11 TYPE EQ/ID	A12 BUYSER NUMBER	A13 DISCD	A14 TAN	A15 POST	A16 FD	A17 SMT/TYPE	A18 SER	A19 METER	A20 SE MTR	A21	F07 INVENTORY	F08 PERM UNIT CODE	F09
AAEG	151687	D	B										

REPAIR CYCLE				REMOVED/OLD ITEM		INSTALLED/NEW ITEM	
RECEIVED	B08 DATE	B12 TIME	B16 EDC	E08 MFR	E13 SERIAL NUMBER	G08 MFR	G13 SERIAL NUMBER
	4133	1400	B	82598	68	82598	92
IN WORK	B19	B23	B27	E23 PART NUMBER	E38 DATE REMOVED	G23 PART NUMBER	
	4133	1400	B	1268	4133	1268	
COMPLETED	B30	B34		E42 TIMECYCLES	E47 TIMECYCLES	E52 TIMECYCLES	G38 TIMECYCLES
	4133	1615		M0425			M0167

AWAITING MAINTENANCE

MAINTENANCE/SUPPLY RECORD

JOB STATUS	DATE	TIME	EOC	DISCREPANCY
B53 S	B54 4133	B58 1430	B62 B	BY 150'
B53 M	B54 4133	B58 1545	B62 B	
C08	C09	C13	C17	MATCHED SET SEE JCN AC1-133-022
C20	C21	C25	C29	CORRECTIVE ACTION
C32	C33	C37	C41	REMOVED & REPLACED RT601/APN 141. CHECKS GOOD.
C44	C45	C49	C53	
C56	C57	C61	C65	
D08	D09	D13	D17	

CORRECTED BY	INSPECTED BY	SUPERVISOR	MAINT CONTROL
AT2 Boat	AT1 Pistol	ATC Door	AZ2 Frost
MODEX	PRI	SYSTEM-REASON	MCN

AMR00011

Figure 1-11.—Visual Information Display System/Maintenance Action Form (VIDS/MAF).

Copy 1—work center register, control, and processing copy

Copy 2—supply department VIDS copy

Copy 3—production control register

Copy 4—RFI/BCM copy

Copy 5—work center MDR verification copy

The VIDSMFAF documents the following types of maintenance actions and accumulates data for reports that establish supply and manpower requirements:

Maintenance actions:

- Repair work on the equipment that does not involve removal of defective or suspected defective repairable components.

- The portion of a special, conditional, corrosion, periodic, phase, acceptance, or transfer inspection that involves the search for defects. This portion is commonly known as the *look phase*.

- Removal of components for check, test, inspection, and service actions.

- Removal and replacement of an item for cannibalization purposes.

- Removal or installation of items/components for mission configuration changes as designated by the ACC.

- Incorporation of TD changes and associated maintenance actions.

- Removal and replacement of repairable components within end items.

- Subsystem Capability and Impact Reporting (SCIR) data.

- Fix-in-place actions discovered during inspections.

Supply/manpower reports:

- Man-hours accumulated during work stoppage for parts or maintenance.

- Accumulated man-hours during or at the end of a reporting period for a job not completed, where required by the ACC.

- Assistance from work centers in support of a basic work center.

- Support of a repairable item being processed through an IMA.

- Troubleshooting man-hours.

- Ordering and issuing of repairable components, subassemblies, and parts.

- Accumulated man-hours on jobs closed out due to an aircraft accident.

- Documentation of preservation or depreservation.

The MAF flow under NALCOMIS varies slightly from that of a VIDS/MAF. Upon origination of a discrepancy, only two copies of the MAF are printed and, as the discrepancy is repaired, it is updated electronically. The complete process for OMA and IMA are outlined in OPNAVINST 4790.2.

Q45. *What is the result of inaccurate or incomplete information documented in the Maintenance Data System (MDS)?*

Q46. *At both the I and O levels of maintenance, what is the purpose of NALCOMIS or VIDS/MAFS?*

Q47. *What is the "look phase" of an inspection?*

MACHINE REPORTS

O- and I-level maintenance supervisors regularly use the daily and monthly MDRs described in this section. OPNAVINST 4790.2 lists all of the MDRs available from the DSF and their uses.

VIDS/MAF Copy 1 Daily Audit Report

This report is for the work center supervisor. It is designed to validate the previous day's VIDS/MAF copy 1 submissions. DARs should be verified daily, corrections annotated, and returned to the analyst. The analyst will resubmit the corrected report with the following day's data. NALCOMIS users should refer to the *NALCOMIS User's Manual* for details on verification of data accuracy.

Monthly Production Report (MDR-2)

This report summarizes, by work center, all maintenance actions, TD compliance, and data entered in the Failed/Material block of the VIDS/MAF.

CODES

LEARNING OBJECTIVE: Recognize the codes used to document maintenance on NALCOMIS and the VIDS/MAF.

Aircraft maintenance uses codes for processing information. Some information, such as the aircraft bureau number, is normally expressed in numerical terms; thus, it does not need to be converted into codes. In other cases, the information must be converted into code so it can be machine processed.

Basic codes used on the VIDS/MAF are prescribed for Navy-wide use. Therefore, they cannot be changed at local option. Some of the codes are built to provide some flexibility to allow expansion to meet local needs. Some of the principal codes used by aircraft maintenance activities are described below.

NOTE: A complete list of the codes can be found in an appendix to OPNAVINST 4790.2.

Organization code. The organization code is a three-character, alphanumeric code that identifies an activity within a major command.

Permanent Unit Code (PUC). The PUC is a six-character, numeric code assigned to each aircraft reporting custodian for identification.

Work Center Code (WCC). The WCC is a three-character, numeric code that is used to identify work centers within an organization.

Type Equipment code (TEC). The TEC is a four-character, alphabetic code that identifies the end item of equipment on which work is performed, such as aircraft, engine, or SE.

Julian date. The Julian date is a four-character, numeric code used to show the date. The first character of the code is the last digit of the year, and the last three characters of the code show the day of the year. For example, Julian date 6324 is the 324th day of 1996, or November 19, 1996. When used on the VIDSMAF as part of the JCN, the first position (showing the year) is omitted. All dates used on source documents are shown in Julian dates.

Job control number (JCN). The JCN is a 9-, 10-, or 11-character, alphanumeric code used to separately identify each maintenance action. The JCN is made up of four parts: the Organization code, the three-character part of the Julian date that shows the day of the year, a sequence number, and a JCN suffix.

The sequence number is either a three-character number that runs sequentially from 001 to 999 or a three-character, alphanumeric number with an alphabetic first character and the last two numbers running sequentially, from 00 to 99. Three-character, sequence numbers are used to identify routine

day-to-day maintenance actions, such as AC4-324-216. Three-character, alphanumeric sequence numbers are used only to document major inspections other than preflight, postflight, turnaround, daily, special, conditional, corrosion, and acceptance/transfer inspections. An example of this type of JCN is AC4-324-A00.

The JCN suffix is an alphanumeric code that is used by IMAs. It identifies a subassembly, or subassembly repair action completed separately from the major component repair action. This suffix is added to the basic JCN to create the fourth part.

Work Unit Code (WUC). The WUC is a one-, three-, five-, or seven-character numeric or alphanumeric code. This code normally identifies the system, subsystem, set, component, and part of the end item being worked on. The first two characters identify the system and are standardized.

Action Taken code. The Action Taken code is a one-character, alphabetic or numeric code that describes what maintenance was performed on an item identified by a Work Unit Code.

Commercial and Government Entity (CAGE). This is a five-position code assigned to manufacturer's and nonmanufacturer's organizational entities and contractors of items procured by agencies of the Federal Government. This code is commonly called the Manufacturer's code.

Malfunction Description code. The Malfunction Description code is a three-character, alphanumeric code used to describe the malfunction occurring on or in an end item. These codes are listed in both alphabetical and numerical sequence in all Work Unit Code manuals.

Technical Directive code. The Technical Directive (TD) code is a 12- or 13-character code used to identify a specific TD by type number, revision, amendment, part, and kit number. This code applies to the VIDS/MAF when a TD compliance is documented. The first two characters of Technical Directive codes are listed in an appendix to OPNAVINST 4790.2.

Technical Directive Status code. The Technical Directive Status code is a one-character, alphabetic or numeric code used to describe the type of work accomplished. The type of work refers to scheduled maintenance, unscheduled maintenance, and so forth.

When Discovered code. The When Discovered code is a one-character, alphabetic code that identifies when the need for maintenance was discovered.

Transaction code. The transaction code is a two-character, numeric code that shows the type of data being reported.

Time/Cycle Prefix code. The Time/Cycle block is made up of a prefix and four numerical digits. The prefix indicates the source of time (usually in hours), cycles, or counts (rounds fired, number of catapult launches, or arrested landings). All entries in the Time/Cycle block are preceded by a prefix code. Some examples of these codes are as follows:

A—indicates aircraft time and is used to report removal/installation of equipment not having an hourmeter installed or Aeronautical Equipment Service Record (AESR) or an SRC card maintained.

E—indicates engine time (logbook time since overhaul).

L—landings.

M—indicates meter time.

N—rounds fired.

All entries in these blocks must be five digits. For example, report 27 hours type-equipment time as A0027. If the time exceeds 9,999 hours, record the last four digits only. For example, 10,231 hours would be recorded as A0231.

Awaiting Maintenance Reason code (AWM). The AWM code is a one-digit, numeric code used to show the reason no maintenance is being performed.

Q48. *What components create the Job Control Number (JCN)?*

Q49. *What is indicated by a JCN suffix?*

Q50. *What is a Work Unit Code (WUC)?*

Q51. *What code describes the maintenance performed on an item identified by a WUC?*

Q52. *What is the proper name for what most technicians refer to as the Manufacturer's code?*

Q53. *What is a Malfunction code?*

Q54. *How many positions complete the Time/Cycle block on a VIDS/MAF?*

SE RECORDS, FORMS, AND DOCUMENTS

LEARNING OBJECTIVE: Identify the records, forms, and documents used for support equipment (SE) maintenance management and their purposes.

Throughout the operational life of an end item of SE, many records, forms, and documents are generated for the support and management of that particular item. The following records, forms, and documents (which effect transfer of SE) are used to obtain and maintain the history of operation, maintenance, and configuration status.

SE CUSTODY AND MAINTENANCE HISTORY RECORD, OPNAV 4790/51

This form is used to record acceptance information, custody and transfer, rework, preservation and depreservation, and TDs. It also includes a record of periodic maintenance performed by hours, starts, date completed, next PM due, activity and signature. It accompanies all items of SE that have formal periodic maintenance requirements; for example, MRCs, MIMs, handbook of service instructions, manufacturer's handbook, and applicable TDs. Exceptions are precision measuring equipment (PME), engine test cells and stands, and GB1As (these items have their own records). However, those items of PME that have formal periodic maintenance requirements, in addition to calibration requirements, will require this form; for example, versatile avionics shop test (VAST) stations. Reporting custodians retain the latest completed copy, the current copy, and transcribe accumulated data on initiation of each new record (fig. 1-12). This form accompanies weapons and support equipment (WSE) to the weapons department when subcustodied from AIMD. You can find an example of the form, along with step-by-step instructions, in OPNAVINST 4790.2.

Q55. *What form is used to document preservation of support equipment?*

Q56. *Are SE Custody and Maintenance History Records, OPNAV 4790/51, used to document rework maintenance on an engine test cell?*

Q57. *Who retains the latest completed copy of the SE Custody and Maintenance History Record, OPNAV 4790/51?*

SE CUSTODY AND MAINTENANCE HISTORY RECORD							
1. NOMENCLATURE		2. MODEL TYPE		3. SERIAL NUMBER		4. MANUFACTURER	
SECTION I - CUSTODY AND TRANSFER RECORD							
A. DATE	B. FROM	C. TO	D. AUTHORITY	E. REMARKS	F. RECEIVED		
SECTION II - RECORD OF REWORK							
A. DATE INDICATED	B. DATE COMPLETED	C. DESCRIPTION OF WORK		D. AUTHORIZATION	E. ACTIVITY	F. SIGNATURE	
SECTION III - PRESERVATION/DE-PRESERVATION							
A. DATE PRES.	B. RE-APP. DUE DATE	C. TYPE	D. DATE DE-PRESV.	E. DIRECTIVE COMPLIED WITH	F. REASON FOR INACTIVE STATUS	G. ACTIVITY	H. SIGNATURE
PAGE 1							2
							3
							4

Figure 1-12.—SE Custody and Maintenance History Record, OPNAV 4790/51.

SE PREOPERATIONAL RECORD, OPNAV FORM 1790/52

This form (fig. 1-13) is maintained on the VIDS board cardex or filing container held by the work center responsible for performing preoperational inspections. The activity that has physical custody is responsible for required entries. Entries are made to reflect all preoperational inspections performed. The reporting custodian issues a new card when the card in use has been completely filled.

THE MONTHLY MAINTENANCE PLAN

LEARNING OBJECTIVE: Identify the purpose and applicability of the Monthly Maintenance Plan (MMP).

The purpose and contents of the monthly maintenance plan (MMP) for O- and I-level maintenance activities are discussed in the following paragraphs.

O-LEVEL MONTHLY MAINTENANCE PLAN

The MMP provides scheduled control of the predictable maintenance workload. The predictable maintenance workload includes inspections, transfer and receipt of aircraft, and incorporation of TDs. By scheduling predictable maintenance, maintenance managers can determine their capability for doing unscheduled work. Additionally, maintenance managers can determine the requirements for SE, material, manpower, and any other factors affecting the maintenance operation in advance of the actual need.

A monthly maintenance meeting is held within the maintenance department to finalize the MMP. The AMO presents the proposed MMP, and maintenance personnel discuss requirements, problems, support, and other factors involved in the maintenance effort.

The AMO sets the format and the arrangement of the MMP. The MMP contains the following information:

10. DATE	11. INSPECTOR (Signature)	12. SUPERVISOR (Signature)	13. DATE	14. INSPECTOR (Signature)	15. SUPERVISOR (Signature)
SAMPLE					
1. NDM/NCA AIRFR		2. EQUIPMENT MODEL/PART NO.		3. SER # NO.	
4. DATE	5. INSPECTOR (Signature)	6. SUPERVISOR (Signature)	7. DATE	8. INSPECTOR (Signature)	9. SUPERVISOR (Signature)
SAMPLE					
<p>Entries are made on this form by the activity having physical custody of the SE. Enter date each preoperational inspection is performed, signature of inspector, and supervisor in these three columns. Back of this form is the same.</p>					
OPNAV 4790/52 (Rev. 3-83)		SN 0107-L-7703001		SE PREOPERATIONAL RECORD AWR00013	

Figure 1-13.—SE Preoperational Record, OPNAV 4790/52.

Projected known operational commitments, including the number of flights, flight hours, and aircraft use

- Date of scheduled inspections
- Schedule of preinspection meetings
- Dates of scheduled receipts or transfers of aircraft and type of work to be done on these aircraft
- PME calibration requirements
- Schedule of technical training
- Forced removal item (high time, and so forth)
- Technical directive compliance (TDC)
- Current list of QA personnel (QAR, CDQAR, CDI)
- Schedule of personnel for ejection seat safety checkout

- Date of scheduled SE inspections
- Schedule of nondestructive inspection (NDI) requirements

The MMCO prepares and publishes the MMP for the AMO's signature. The MMP is distributed by the 25th of the month prior to which it applies. For example, the MMP for April is distributed by the 25th of March. Maintenance supervisors within the activity, plus the supporting AIMD/IMA and the station/ship supply officer, know the contents of the MMP.

AIMD/IMA MONTHLY MAINTENANCE PLAN

The MMP is published by the AIMD/IMA for use by the production divisions. The AIMD/IMA officer holds a monthly meeting. Representatives of the maintenance and supply departments of all supported

activities attend this meeting. A representative of the weapons department also attends the meeting. This meeting provides the planning and coordination needed to improve the overall maintenance program.

Organizational maintenance representatives attend this meeting to discuss the quantity and type of support required. This includes a discussion about the contents of the organizational MMP. Squadron representatives discuss ail factors that affect the anticipated AIMD/IMA workload. This meeting is a tool used to plan the monthly maintenance schedule. The maintenance schedule is part of the MMP. The AIMD monthly maintenance plan is distributed by the last day, of the month prior to the month to which it applies. The following information is included in the MMP.

- A projected schedule of items to be inducted for check and test from supported squadrons and the supply activity
- Anticipated changes in the operational commitments of supported activities
 - A schedule of technical training
 - A schedule of maintenance requirements for shop-installed SE
 - Other known or anticipated factors affecting the production effort of the IMA
- All known TD incorporation requirements
- A current list of QARs, CDQARs, and CDIs
- Identification of forced removal (high-time) components
- Weapons department inputs, which include the following: A projected schedule of armament weapons support equipment (AWSE) inspections, those items requiring test and check, and anticipated receipts or transfers; all known WSE TD incorporation requirements; and identification of known or anticipated AWSE end items or components to be returned to the AIMD for maintenance beyond the capability of the weapons department or for other reasons.

Q58. What is the major provision of the Monthly Maintenance Plan?

Q59. At the O level, when is the Monthly Maintenance Plan for March required to be distributed?

Q60. Where can you find a list of current I-level collateral duty inspectors?

MAINTENANCE TRAINING IMPROVEMENT PROGRAM (MTIP)

LEARNING OBJECTIVE: Define the purpose of the Maintenance Training Improvement Program (MTIP) in aircraft maintenance.

The Maintenance Training Improvement Program (MTIP) is an unclassified training management system which, through diagnostic testing procedures, identifies training deficiencies at both the O- and I-levels of maintenance. Through individual evaluation of technical knowledge levels, a qualitative assessment is made of existing training courses, materials, and community level skills. Such assessments point out corrective actions needed to enhance technical knowledge levels and to improve existing training courses.

The Director of Air Warfare (N88) establishes policy and exercises overall control of the MTIP Program; however, the AMO or IMA maintenance officer ensures the MTIP program is conducted per ACC/TYCOM directives.

Q61. What is the purpose of the Maintenance Training Improvement Program (MTIP)?

SUMMARY

This chapter discussed a variety of areas to include NAMP objectives, familiarization of O- and I-level maintenance, their structures, responsibilities, and rating applications, as well as a brief overview of the NALCOMIS program, VIDS/MAFs, SE records and forms, how they are used in the maintenance departments, and a brief description of MTIP. This volume of information is more than any one individual could memorize or be solely responsible for; therefore, you should refer to the applicable references when you need more information. Make sure you are informed of any changes affecting you or your work center.

ANSWERS TO REVIEW QUESTIONS

- A1. *Achieve and maintain maximum material readiness, safety and conservation of material in the maintenance of aircraft.*
- A2. *To maintain assigned aircraft in a state of full mission capability (FMC).*
- A3. *Rework and upkeep.*
- A4. *Rework maintenance.*
- A5. *Standard depot-level maintenance (SDLM).*
- A6. *Work done to aircraft, equipment, or support equipment to improve or change its capability to perform special functions.*
- A7. *Operating units and SE activities.*
- A8. *Scheduled*
- A9. *Special upkeep or unscheduled maintenance.*
- A10. *Three.*
- A11. *Organizational, intermediate and depot.*
- A12. *Work performed by an operating activity on a day-to-day basis in support of its own operations.*
- A13. *Intermediate level.*
- A14. *Industrial type.*
- A15. *The CNO sponsors and directs the NAMP.*
- A16. *Naval Supply Systems Command (NAVSUP).*
- A17. *A relationship that exists between a superior and subordinate within both staff and line segments of the organization.*
- A18. *A staff relationship.*
- A19. *The aircraft maintenance officer.*
- A20. *Planning, control, and production.*
- A21. *Assistant aircraft maintenance officer (AAMO), maintenance/material control officer (MMCO), and aircraft division and branch officers.*
- A22. *Assistant aircraft maintenance officer.*
- A23. *The overall productive effort of the maintenance department.*
- A24. *To prevent defects from occurring from the onset of a maintenance operation through its completion.*
- A25. *Prevention, knowledge, and special skills.*
- A26. *Monitor, control, and apply the Maintenance Data System within the activity.*
- A27. *System administrator/analyst.*
- A28. *Maintenance control.*
- A29. *Power Plants, airframes, and aviators life support systems (some activities also have an inspection or phase branch and a corrosion branch).*

- A30. *Electronics branch, electrical and instrument branch, and the armament branch.*
- A31. *Production control, the central point of the entire maintenance effort, plans and schedules the IMA's workload.*
- A32. *The maintenance data base administrator/analyst.*
- A33. *Production divisions.*
- A34. *NALCOMIS provides OMA, IMA and ASD activities with a modern, real time, responsive, computer based management information system.*
- A35. *1. To increase aircraft readiness by providing local maintenance and supply managers with timely and accurate information required in their day-to-day management and decision making process.*
2. To reduce the administrative burden to the fleet.
3. To improve the quality of up-line reported data.
- A36. *Visual Information Display System (VIDS).*
- A37. *Communication between maintenance/production control, workcenters, and material control.*
- A38. *VIDS board verification.*
- A39. *Copies 1 and 5 are forwarded to the work center.*
- A40. *Notify quality assurance.*
- A41. *Copy 1 of the VIDS/MAF is sent to maintenance control.*
- A42. *The component inducted is expeditious repair.*
- A43. *To the work center receiving the non-RFI component for repair.*
- A44. *The component should be properly preserved, packaged and sent to the AWP unit managed by supply personnel.*
- A45. *Loss of effectiveness of the data and the MDS in general.*
- A46. *Documentation of on-equipment maintenance actions.*
- A47. *The portion of a special, conditional, corrosion, periodic, phase, acceptance or transfer inspection that involves the search for defects.*
- A48. *The organization code, the last three digits of the Julian date, and an activity assigned sequence number.*
- A49. *A subassembly or subassembly repair action completed separately from the major component repair action.*
- A50. *A one, three, five, or seven character numeric or alphanumeric code which identifies the system, subsystem, set, component or part of the end item being worked on.*
- A51. *Action Taken Code.*
- A52. *Commercial and Government Entity (CAGE).*
- A53. *A three character, alphanumeric code used to describe the malfunction occurring on or in an end item.*

- A54. *Five, a prefix and four numbers.*
- A55. *SE Custody and Maintenance History Record, OPNAV 4790/51.*
- A56. *No. Test cells have their own records.*
- A57. *Reporting custodian.*
- A58. *The MMP provides scheduled control of all predictable maintenance.*
- A59. *By the 25th of February.*
- A60. *The IMA Monthly Maintenance Plan.*
- A61. *The MTIP identifies training deficiencies, at both the O and I levels of maintenance, through diagnostic testing procedures.*

CHAPTER 2

PUBLICATIONS

In chapter 1, you were given an overview of the maintenance system, maintenance administration, Visual Information Display System/Maintenance Action Form (VIDS/MAF), and Naval Aviation Logistics Command Information System (NALCOMIS). In this chapter, you will learn about some of the publications that you will use to perform your duties.

Good technical manuals are necessary to maintain modern weapons systems. The Navy's combat readiness depends upon the quality of these publications and the knowledge and skill of maintenance personnel using them.

Technical publications provide information and direction in your own technical language. They are prepared by the manufacturer of the specific aircraft model, engine, or equipment and by NAVAIRSYSCOM or its field activities, according to specifications issued by NAVAIRSYSCOM. The information contained in these manuals include the current, authoritative directions for material upkeep, check, test, repair, and operation. This provides for optimum product performance. All personnel responsible for the operation and maintenance of aircraft, engines, and associated equipment and systems must know how to use these publications. For more information concerning the technical manual program, refer to *Naval Air Systems Command Technical Manual Program*, NAVAIR 00-25-100, and *OPNAV Application Guide and Index for Navy Standard Technical Manual Identification Numbering System*, OPNAV N0000-00-IDX-000/TMINS.

NAVAIR TECHNICAL MANUAL PROGRAM

LEARNING OBJECTIVES: Define the purpose of technical publications. Identify the manual that outlines the management of the NAVAIR Technical Manual Program. Recognize the types, styles, and formats of NAVAIR technical publications. Recognize the systems used to identify technical manuals. Describe the means of updating technical manuals.

The primary purpose of technical publications is to help you perform your assigned maintenance tasks. If you are to maintain complex weapons systems, you must be able to get the required information from technical manuals. The Department of Defense (DOD), the Department of the Navy (DON), and the Naval Air Systems Command (NAVAIRSYSCOM) work together to maintain and improve the quality of aeronautic technical publications.

The NAVAIR 00-25-100 manual describes the NAVAIR Technical Manual Program and provides guidance on maintaining technical manuals. It covers such topics as audit/inventory, deficiency reporting, storage, establishing libraries, ordering, changes, and responsibilities for use within a command. It also covers the use of Army/Air Force publications in the NAVAIR system. All personnel in the aviation maintenance ratings use this manual to maintain and manage technical manuals.

- Q1. As a technician, if you are to maintain complex weapons systems, where must you obtain the required information?*
- Q2. What manual provides guidance on maintaining technical manuals?*

TECHNICAL PUBLICATIONS

Technical publications prepared for the NAVAIR technical publication system are presented in specific types, styles, and formats. You should be familiar with the basic types, styles, and formats, and their intended use.

Types of Technical Manuals

Technical manuals are divided into two major types, operational and maintenance. These manuals are the basic source of information for definition of operating instructions, tactical application, and the maintenance and upkeep of hardware. They are also the main support or reference for the training program.

Operational Manuals. Operational manuals contain descriptions of weapons systems with instructions for their effective use. These manuals, such as the Naval Air Training and Operating

Procedures Standardization (NATOPS), tactical manuals, and weapons loading manuals, contain descriptions of weapons systems, systems integration, operating instructions, operational applications, and safety and emergency procedures. They also contain other pertinent data exclusive of maintenance procedures.

Maintenance Manuals. Maintenance manuals contain a description of the weapons systems from the viewpoint of upkeep and repair. These manuals include information on maintenance operation, troubleshooting and testing, assembly, disassembly, repair, and supply support. Descriptions are in the form of an illustrated parts list or breakdown.

Technical Manual Styles

Technical manuals are available in two general styles, military specifications and commercial.

Military Specification Manuals. Military specification manuals are prepared for specific requirements to support defined maintenance concepts and predetermined maintenance level coverage. They are accompanied by an illustrated parts breakdown (IPB) that reflects Navy provisioning actions for spares and spare parts.

Commercial Manuals. In selected cases, commercial manuals are bought to support commercially available off-the-shelf equipment. These manuals support commercial practice techniques or specifications. The commercial manual

procurement policy permits the purchase of such manuals, provided there is no degradation in equipment operation, reliability, or support. Normally, these manuals are purchased on a onetime basis. They are not readily updated to reflect changes. NAVAIR publication numbers are assigned to these manuals to meet indexing, filing, stocking, and distribution requirements.

Technical Manual Arrangement

Technical manuals can be found in two specific format styles—the “conventional” or topic-sectionalized manual and the newer “work package” (WP) concept manual. The WP manuals are divided by functions and tasks. They are prepared to reflect distribution and destruction statements on their cover and title pages (fig. 2-1).

Conventional Manuals. The topic-sectionalized technical manual format is still being used for NAVAIR technical publications. This basic arrangement was effective and remained constant until sophisticated avionics and support equipment systems were purchased by the Navy. Principles of operation, troubleshooting, wiring diagrams, and schematic requirements were expanded in support of new design advancements. However, general organization of the data (fig. 2-1) has remained constant.

Many of the older manuals still reflect early weapons systems maintenance practices. However, as six levels of maintenance were consolidated to the

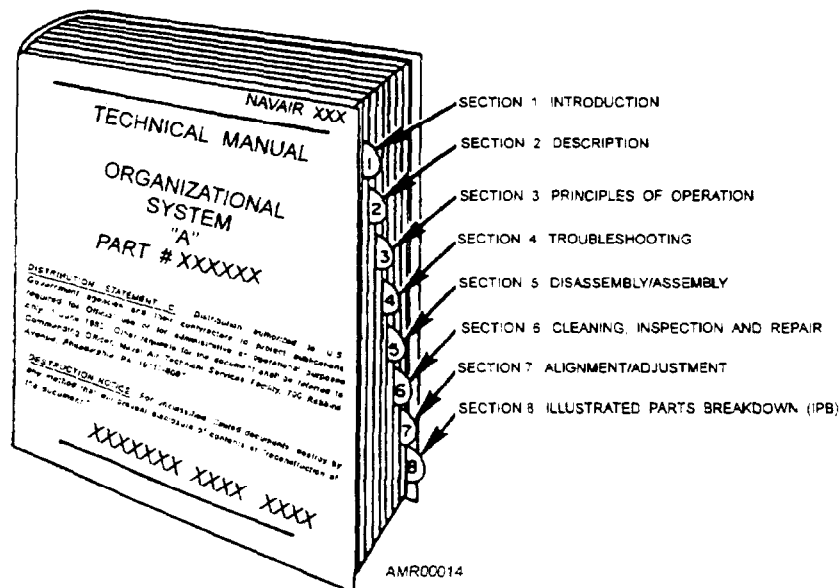


Figure 2-1.—Conventional technical manual content arrangement.

present three levels (organizational, intermediate, and depot), new maintenance techniques evolved. System testing and the use of hot benches started to disappear in favor of specialized test simulators for components and equipment. Unique fault isolation and rapid-fix techniques were developed at intermediate and depot levels. This was based on an “inspect and repair as necessary” unit concept. A reduction in maintenance costs and pipeline turnaround was the goal. Organizational flight deck/line troubleshooting remained on a system basis. The increases in installed systems and equipment complexity reduced flight-line maintenance to component-fault isolation and unit replacement. Technical manuals had to reflect these new practices to support aircraft turnaround-time limitations.

Conventional manuals have reached the limits of their expansion. This format that has served so well can no longer cope with new designs. Microminiaturization, computerization, integrated weapons systems design, and the introduction of microfilm media dictated the development and introduction of new formats and presentation methods. This resulted in the work package concept.

Work Package (WP) Technical Manual Arrangement. The complexity of weapons system design has made the technician more dependent on publications. To improve technical information, publications place emphasis on data accessibility, adequacy, accuracy, and overall documentation usability. The limited viewing range imposed by

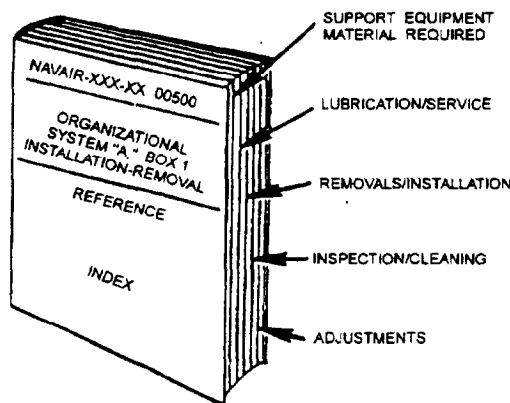
microfilmed manuals adds further demands for data presentation improvements. In addition, manuals must be compatible to both paper and film.

Investigation of publication requirements, primarily through fleet visits, confirms that usability is the key. The value of information is limited if it is difficult to use. The usability of a manual has three primary elements-visible lock-on format, logical arrangement structure, and quick understanding or comprehension.

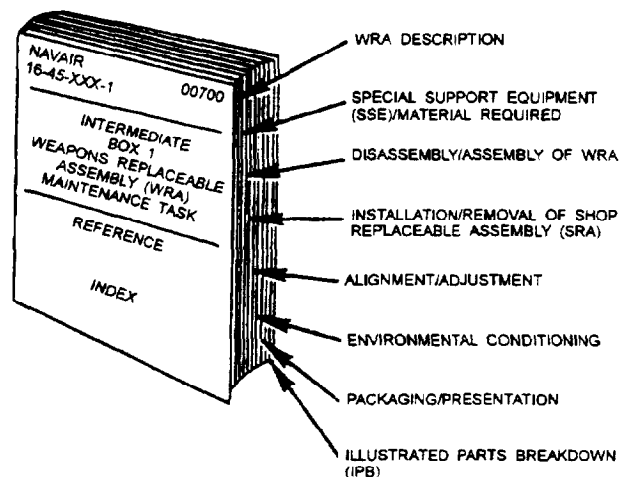
- Q3. What are the two general styles of technical manuals?
- Q4. Technical manuals are divided into how many major types and what are they?
- Q5. How are workpackage (WP) manuals divided?
- Q6. What are the three primary elements for usability in a manual?

Format Considerations. Text for microfilm emphasizes coordination between text and illustrations, line art instead of photographic art for illustration legibility, and a comprehensive index for many points of entry.

Logical Arrangement. Data is screened and consolidated to make it easier to find units of information within the manual. The units of information are arranged sequentially by functions and tasks. Each unit is also written to stand alone as an individual maintenance unit that contains all the data required for task performance. See figure 2-2.



TYPICAL ORGANIZATIONAL MAINTENANCE WORK PACKAGE



TYPICAL INTERMEDIATE MAINTENANCE WORK PACKAGE

AMR00015

Figure 2-2.—Work package (WP) arrangement data consolidation for organizational and intermediate maintenance.

Work Package Manual Arrangement. To provide quick comprehension for the user, information is broken down by major functional elements, and further subdivided by individually sequenced tasks. The division of functional elements include system/equipment description and principles of operation, testing and troubleshooting, system maintenance, wiring data/schematics and diagrams, and an IPB. Each of these elements is further broken down systematically into smaller units, depending upon the system complexity, integration, and logistic support analysis (fig. 2-3).

Work Package Technical Manual Definition. Consolidation of the criteria above results in a technical manual concept known as a "functionally assembled document." These documents are arranged in the general order of work flow and grouped into small units or work packages (WPs) covering individual tasks. The WPs are called *self-supporting units of information*, and contain all the information required for a technician to perform a specific task.

Work Package Numbering. The individual WP has a five-digit code number that appears in the upper right corner of the page. The WP number consists of two blocks of three and two digits, respectively. The first three digits identify the initial manual WPs (001

thru 999). The last two digits identify new WPs issued as changes (or revisions) that logically fit between existing WPs (fig. 2-4).

Work Package Format. Page identifiers, such as the technical manual code number, WP number,

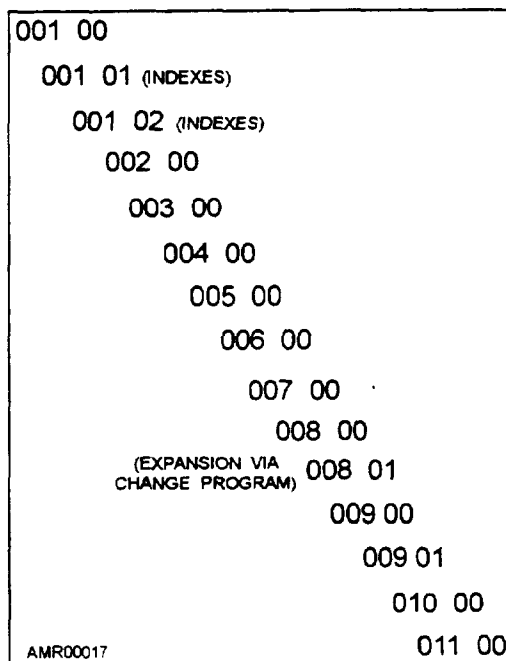


Figure 2-4.—Work package (WP) number identification.

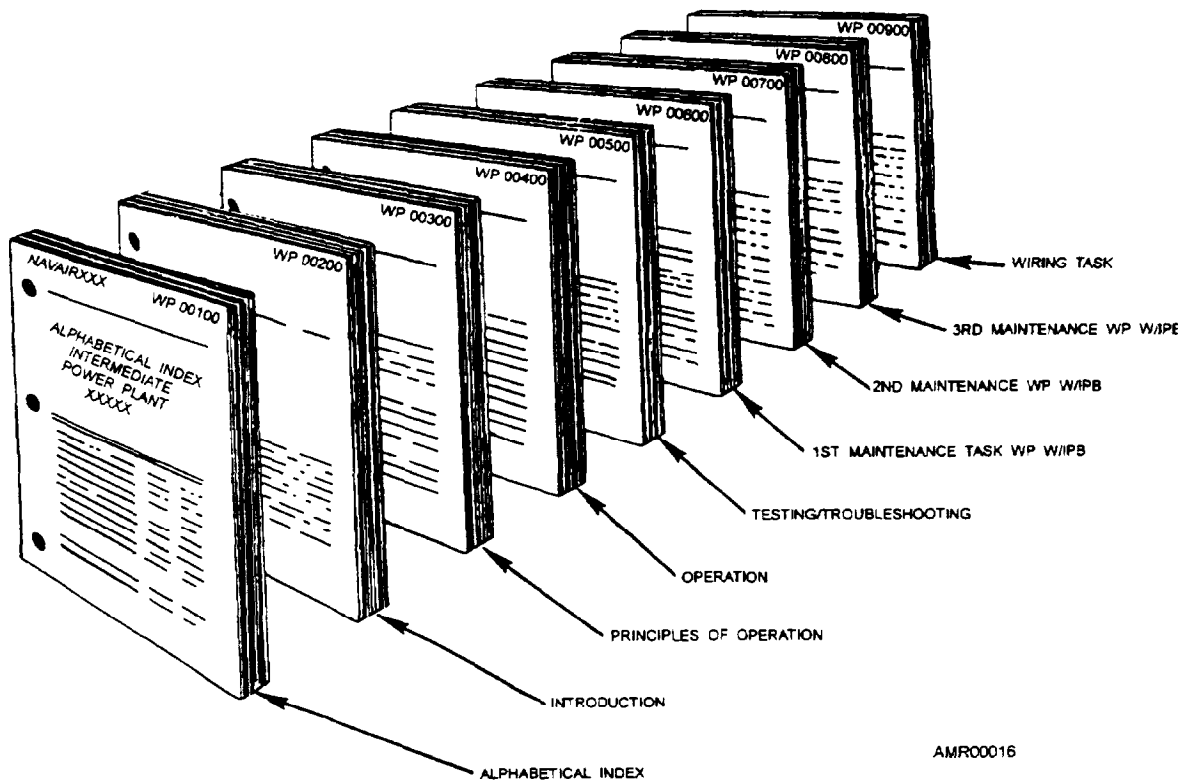


Figure 2-3.—Typical work package (WP) and manual arrangement.

change designation, and page number, are on the top left and right of the page. This is done to make the information usable and readable, particularly in the microfilm-scanning mode. Because of the ability to

print out WP units separately, each package has been developed with its own abbreviated title page (fig. 2-5). The title block identifies the function/task by title, WP number, level of maintenance, and the


<p>NAVAIR 03-75HP-5 15 December 1990</p>	<p>004 02 Page 1 of 4</p>						
<p>DISASSEMBLY DEPOT MAINTENANCE WITH ILLUSTRATED PARTS BREAKDOWN VALVE AND ACTUATOR ASSEMBLY (WESTON/BORG-WARNER) P/N 40D980 AND 40D990</p>							
<p>Alphabetical Index</p>							
<u>Subject</u>	<u>Page No.</u>						
Actuator Disassembly	2						
Motor and Gearbox Assembly Removal	4						
Potentiometer Removal	2						
Materials Required	1						
Servo Valve and Butterfly Disassembly	1						
Support Equipment Required	1						
<p>1. <u>MATERIALS REQUIRED.</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"><u>Specification or Part Number</u></td> <td style="width: 40%;"><u>Nomenclature</u></td> <td style="width: 30%;"></td> </tr> <tr> <td>MIL-A-46146</td> <td>Adhesive/Sealant</td> <td></td> </tr> </table>		<u>Specification or Part Number</u>	<u>Nomenclature</u>		MIL-A-46146	Adhesive/Sealant	
<u>Specification or Part Number</u>	<u>Nomenclature</u>						
MIL-A-46146	Adhesive/Sealant						
<p>2. <u>SUPPORT EQUIPMENT REQUIRED.</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"><u>Specification or Part Number</u></td> <td style="width: 40%;"><u>Nomenclature</u></td> <td style="width: 30%;"></td> </tr> <tr> <td>Commercial</td> <td>5/32-inch Hex Key Wrench</td> <td></td> </tr> </table>		<u>Specification or Part Number</u>	<u>Nomenclature</u>		Commercial	5/32-inch Hex Key Wrench	
<u>Specification or Part Number</u>	<u>Nomenclature</u>						
Commercial	5/32-inch Hex Key Wrench						
<p>3. <u>SERVO VALVE AND BUTTERFLY DISASSEMBLY.</u></p>							
<p>4. Refer to figure 1, WP 009 02 for items in parenthesis "()" and to figure 2, WP 009 02 for items in brackets "[]".</p>							
<p style="text-align: center;">NOTE</p> <p>Exercise care when breaking seal between mating edges of sealed joints to avoid damaging components</p>							
<p style="text-align: right;">a. Remove three screws (1) and separate actuator (2) from valve body (41)[50].</p> <div style="text-align: center; margin: 10px 0;">  </div> <p style="text-align: right;">Methyl Ethyl Ketone TT-M-261</p> <p style="text-align: right;">1</p> <p style="text-align: right;">b. Use MEK to remove epoxy on two screws (3)[8]. Remove two screws (3)[8] and remove bearing mount assembly (4 through 11)[3 through 11].</p> <p style="text-align: right;">c. Remove locking (4)[3], washers (5 and 6)[4 and 5], pinion gear (10)[11], two washers (9)[10] and washer (11)[9].</p> <p style="text-align: right;">d. Do not remove bearing (7)[6] unless required after inspection. If required, remove needle bearing (7)[6] as described by NAVAIR 01-1A-503.</p> <p style="text-align: right;">e. Remove lockring (12)[12].</p>							
AMR00018							

Figure 2-5.—Typical work package title page.

applicable aircraft or equipment serial number effected. Also, reference material that applies to the package is listed here. The title page also has a small index that outlines the WP coverage and an applicable technical directive listing. A listing of support equipment and material required to perform the task is in the front of the text. This information will give you an idea of the task before you begin the work. A typical WP title page is shown in figure 2-5.

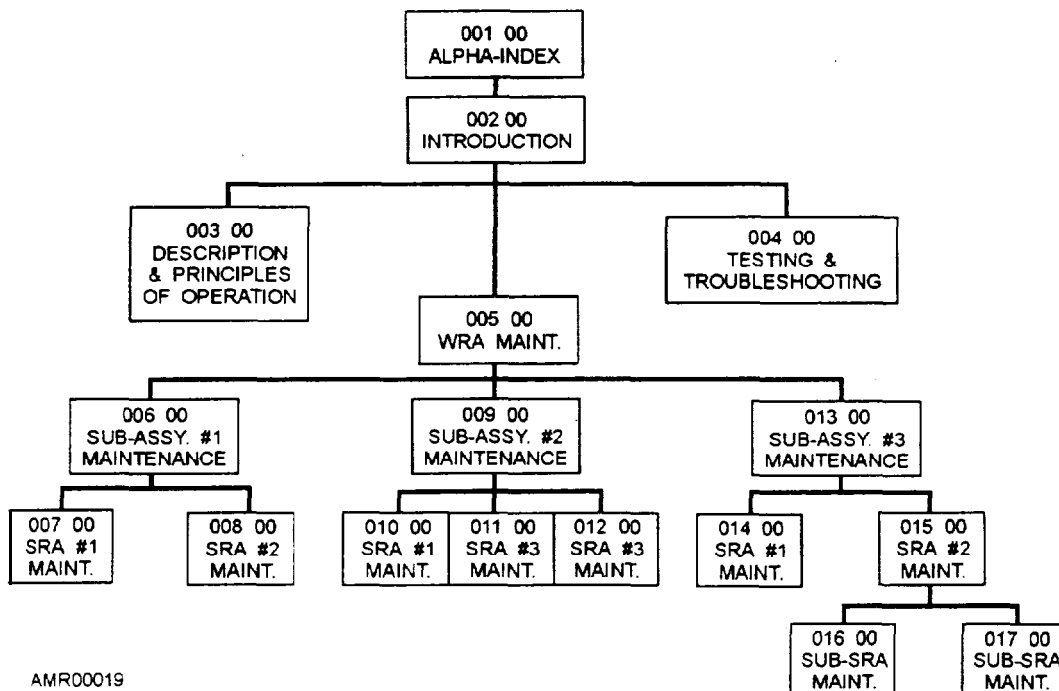
Content Format. Content format depends on the specific task to be performed, the authorized depth of information required and the sequence of performance. Work packaging provides the flexibility to arrange content to meet system or component design criteria, construction, and selected repair. Work packaging is tailored to fit the specific maintenance demands of the unit under repair.

Organizational data is system oriented. Organizational system maintenance covers installation, removal, alignment, and adjustment in task order. Descriptive information and principles of operation data are in the order of operational signal flow or mechanical operating sequence by component. Testing and troubleshooting are organized by functional block logic and by action sequence with consideration given to mode selection and failure

probability. Where possible, specific points of entry to the text are identified to preclude the necessity of running a complete end-to-end test after each corrective action. IPBs are in a format that is compatible with the other volumes by system and WP alignment.

Intermediate- and depot-level manuals are based on component rather than system breakdown. Most intermediate- and depot-level WPs are organized in a pyramid fashion based on standard top-down breakdown of the component, as shown in figure 2-6. Where the volume of data permits, end item description, principles of operation, and troubleshooting appear as a series of introductory WPs preceding the maintenance data. The first WP would then cover the removal/installation and IPB of components from/on the end item. Tasks then follow through the disassembly/assembly of the removed components. The type of information contained in each WP is shown in figure 2-7. Note that parts replacement IPB data is in the intermediate/depot WP. This data provides maximum information in support of the total package concept.

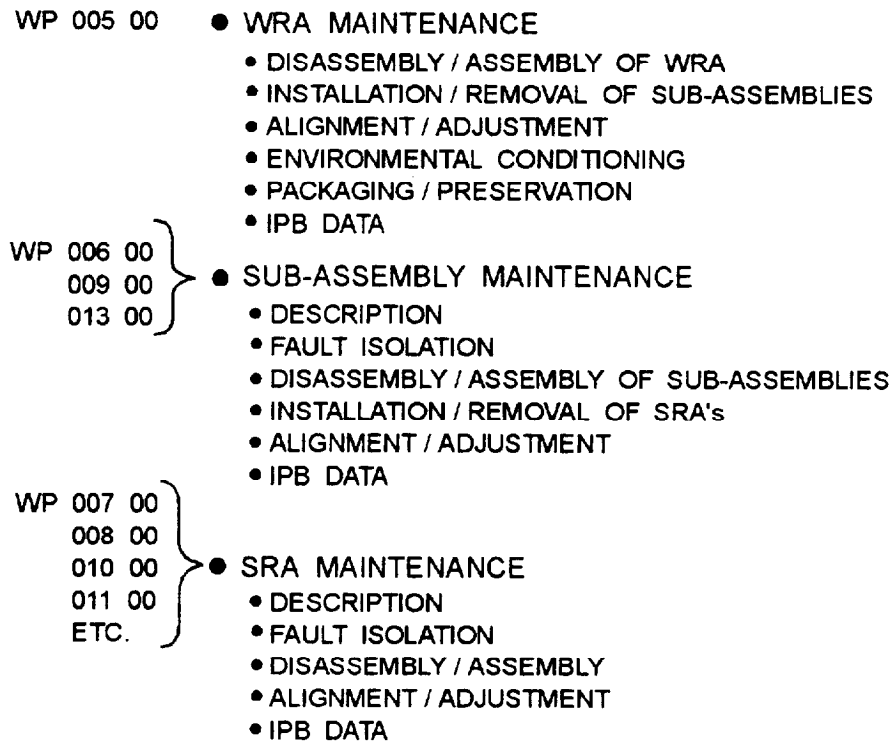
WORK PACKAGE BREAKDOWN- INTERMEDIATE / DEPOT



AMR00019

Figure 2-6.—Typical intermediate/depot technical manual assembly.

WORK PACKAGE BREAKDOWN- INTERMEDIATE / DEPOT



AMR00020

Figure 2-7.—Typical work package task information.

TECHNICAL PUBLICATION UPDATE METHODS

The usefulness of technical manuals directly relates to how effectively the information reflects the system or equipment configuration and the depth and scope of maintenance data. Changes to equipment occur to improve either mission or maintenance capabilities. Technical manuals must reflect these changes. Technical manuals are updated by two methods—changes and revisions.

A change to a technical manual is the official release of new or correction pages to a part or portion of an existing document. It consists of replacement change pages for the area of the manual affected by the change action. Upon issue, the recipient removes the superseded pages and inserts the new pages. This action is required for paper manuals only.

A revision is the complete reissue of a replacement manual the change information incorporated. A revision normally takes place when more than 60 percent of the pages are affected by a single change or

accumulated changes. A WP consisting of 10 pages or less will always be revised.

Types of Publication Changes

Changes are authorized and issued on an “as required” basis to periodically update equipment configuration, maintenance concepts, or procedural direction. Changes are also initiated to correct user-detected errors, improve verbiage, or incorporate a “better way.” These types of changes usually result from fleet input through the Technical Publication Deficiency Report (TPDR) System (explained later in this chapter). Changes are issued as either routine or rapid action changes (RACs).

A routine change is issued through normal update processes, and is released periodically.

A rapid action change is an expedited change action. It is programmed for short turnaround and release because of possible relationship to safety, equipment damage, or danger to personnel.

Changes to Conventional Manuals

The Naval Air Technical Services Facility (NAVAIRTECHSERVAC) determines when there is a requirement to change a manual and authorizes that the change be made. Information gathered is combined to correct or update pages affected by the change requirement. A change to the "A" page

(Numerical Index of Effective Pages) is prepared to identify all pages that have been changed. See figure 2-8. The "A" page helps the user insert new pages and maintain a record of current pages.

When a change is issued, existing page numbers, paragraph numbers, figure numbers, and table numbers are not changed. Supplemental numbers are assigned to new pages, paragraphs, figures, and tables.

A1-H60FB-110-400		Page A		
RAC 1 - 4 December 1992				
<u>NUMERICAL INDEX OF EFFECTIVE PAGES/FIGURES</u>				
List of Current Changes				
Original	0	6 December 1990	Change 4	6 December 1991
Change	1	31 May 1991	Change 5	31 May 1992
Change	2	1 October 1991	Change 6	1 June 1992
Change	3	4 October 1991	RAC 1	4 December 1992

Only those pages/figures assigned to the manual are listed. If the numerical sequence is broken in the list, the missing page/figure numbers have not been assigned to this manual. Insert RAC 1 pages/figures, dated 4 December 1992. Dispose of superseded pages/figures. The portion of text and tabular listings affected is indicated by a change bar or the change symbol R in the outer margin of text pages and tabular data. Total number of pages in this manual is 998 consisting of the following:

Figure Number	Page Number	Title	Change Number
	Title		RAC 1
	Page A	Numerical Index of Effective Pages/Figures	RAC 1
	Page B	Numerical Index of Effective Pages/Figures	RAC 1
	Page C	Numerical Index of Effective Pages/Figures	RAC 1
	Page D	Numerical Index of Effective Pages/Figures	RAC 1
	Page E	Numerical Index of Effective Pages/Figures	RAC 1
	Page F	Numerical Index of Effective Pages/Figures	RAC 1
	Page G	Numerical Index of Effective Pages/Figures	RAC 1
	Page H	Numerical Index of Effective Pages/Figures	RAC 1
	Page J	Numerical Index of Effective Pages/Figures	RAC 1
	Page K	Numerical Index of Effective Pages/Figures	RAC 1
	Page L	Numerical Index of Effective Pages/Figures	RAC 1
	TPDR-1	List of Technical Publications Deficiency Reports Incorporated	RAC 1
	INDEX-1	Alphabetical Index	1
	INDEX-2	Alphabetical Index	6
	INDEX-3	Alphabetical Index	0
	INDEX-4	Alphabetical Index	6
	INDEX-5	Alphabetical Index	RAC 1
	INDEX-6	Alphabetical Index	6
	INDEX-7	Alphabetical Index	RAC 1
	INDEX-8	Alphabetical Index	6
	INDEX-9	Alphabetical Index	RAC 1
	INDEX-10	Alphabetical Index	6
	INDEX-11	Alphabetical Index	0
	INDEX-12	Alphabetical Index	RAC 1
	INDEX-13	Alphabetical Index	1
	INDEX-14	Alphabetical Index	RAC 1
	INDEX-15		
	INDEX-22	Alphabetical Index	6
	INDEX-23	Alphabetical Index	RAC 1
	INTRO-1	Introduction	4
	INTRO-2		
	INTRO-3	Introduction	6

AMR00021

Figure 2-8.—Numerical Index of Effective Pages/Figures.

Therefore, except when a number is added at the end of a sequence (in which case the next consecutive number is used), paragraphs, illustrations, tables, and pages are numbered by adding an alphabetical suffix. The same method is used for added pages, except that these pages are not added between a right-hand (odd numbered) and a left-hand (even numbered) page. When new material is added to a right-hand page, any overrun is carried to the left-hand page. Any overrun from this is placed on an added page. Therefore, added pages are always assigned even numbers, such as 2A, 2B, 4A, or 4B.

Each page with changed or added material bears the word "change..." placed at the bottom of the page (fig. 2-9). For foldout pages, the change number is placed in the lower, outer corner of the page beneath

the figure title. This change number requirement applies to all added pages, including those placed at the end of a manual.

Change Symbology. Usually, text and table changes, including new material on added pages, are identified by a vertical line or change symbol in the margin. This line or symbol extends the entire length of the affected material. The line is placed on the outer margin for double-columned material, and in the margin opposite the binding edge for single-columned material (fig. 2-10). There is one exception. Pages with emergency markings (black diagonal lines around three edges) may have the vertical line or change symbols along the inner margins.

When a page is changed, previous change symbols on a page are deleted. Symbols show current changes

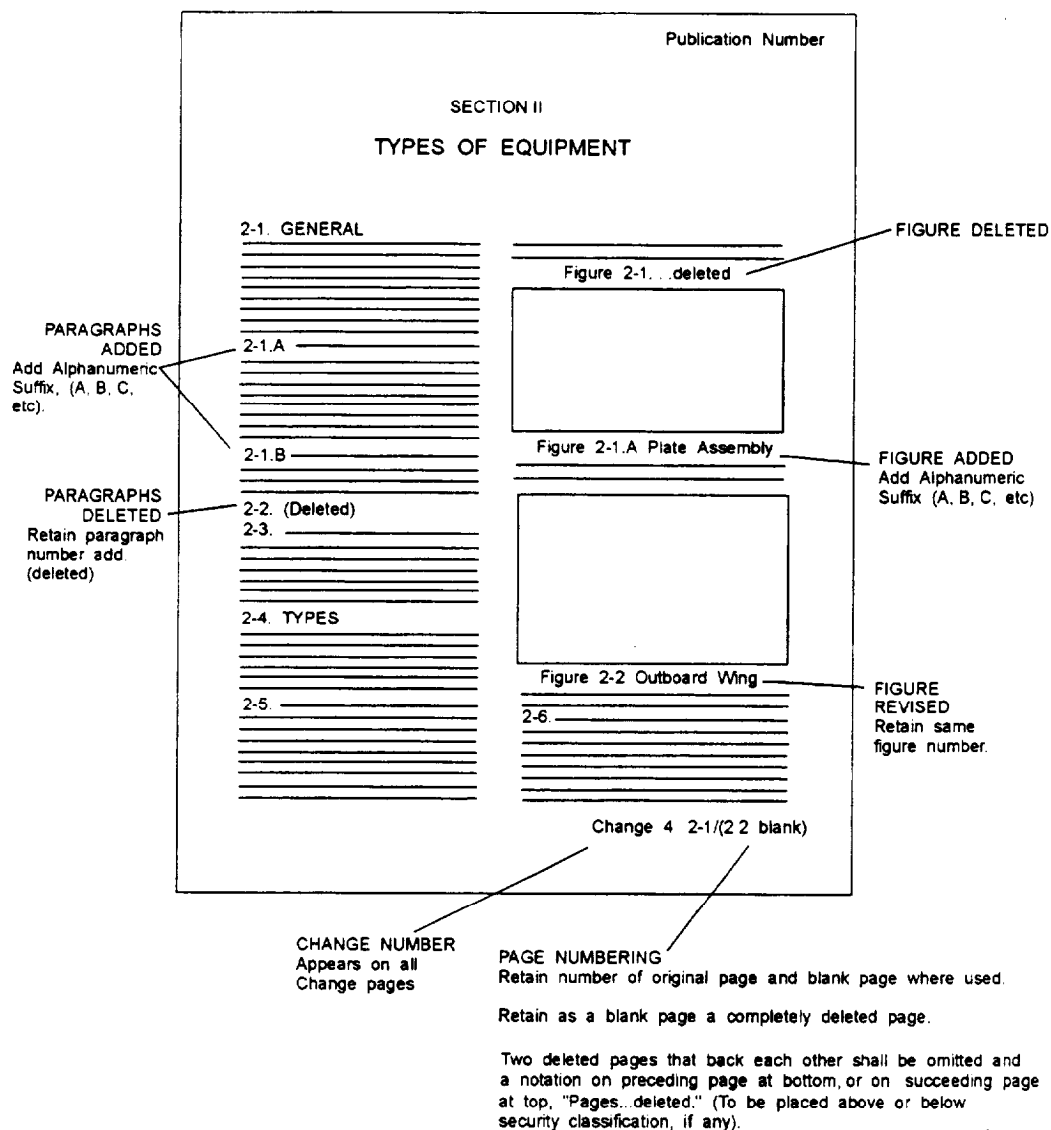


Figure 2-9.—Supplement format, conventional manual (paragraph illustration and page numbering).

only. Change symbols, such as a number sign (#), plus mark (+), black circle, black square, and the letters C, R, or X are explained in the introductory portion of the manual. Change symbols are not used for the following:

- Introductory material
- Indexes and tabular data where the change cannot be identified
- Blank space resulting from the deletion of text, an illustration, part of an illustration or a table
- Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, renumbering of paragraphs, etc., unless such correction changes the meaning of instructive information or procedures
- Replacement or addition of a complete part, chapter, or section

Changes to illustrations, line drawings, and photographs are normally identified by a miniature pointing hand. This hand points to the general area of change information, as shown in figure 2-11. Changes confined to the same general area are indicated only once on the illustration. A vertical line next to changed material may be used on a chart or graph. In the

illustrated parts breakdown of technical manuals, the illustrations have no change symbols.

Shading and screening are used for diagrams and schematics to highlight the areas containing the changed information. Shading is put in the direct area of the change. Extensively changed information may be indicated by a screen border around the affected area (fig. 2-12). For microfilm, however, no screening is used.

Difference Data Sheets. Difference data sheets (fig. 2-13) allow data to be added to or changed without making a direct impact on the existing information. These sheets reflect minor changes in the basic design. A separate sheet is prepared and issued for each additional configuration or model covered.

The format of difference data sheets is as follows:

- Sheets are identified by the title DIFFERENCE DATA SHEET centered at the top of each page.
- The first page of each sheet (for a specific model) has a heading in uppercase type, which consists of the nomenclature and the model, type, or part number of the item covered. The heading is followed by a statement to this effect: THE INSTRUCTIONS CONTAINED IN THE PRECEDING SECTIONS OF THIS

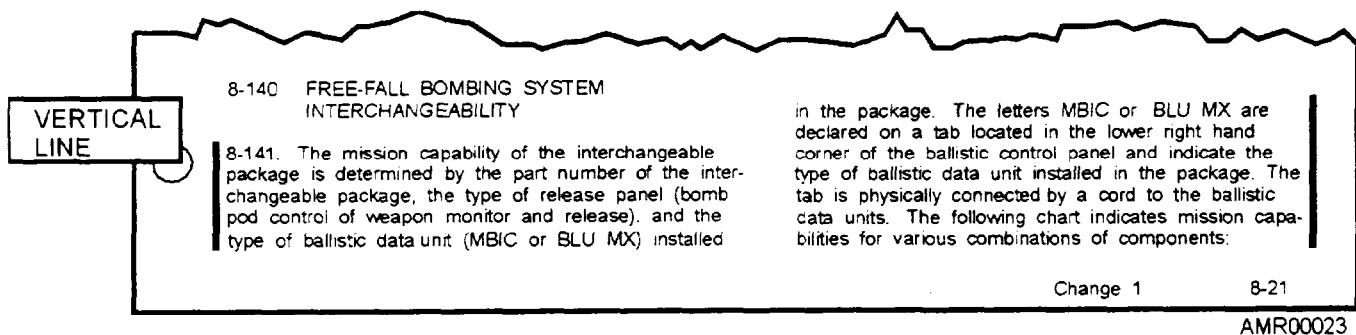


Figure 2-10.—Change symbol, vertical line.

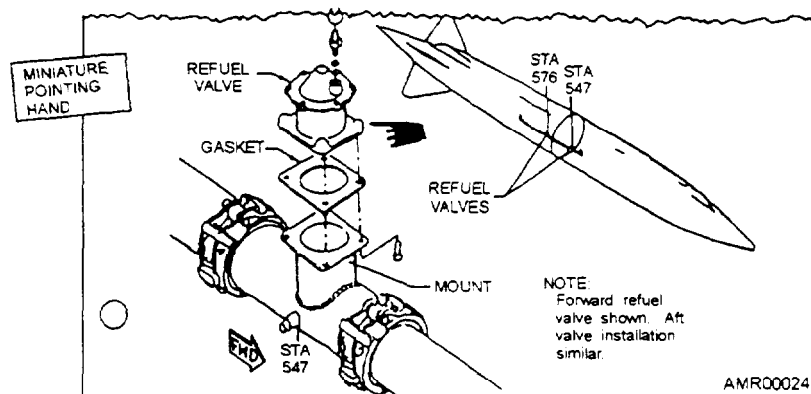


Figure 2-11.—Change symbol, miniature pointing hand.

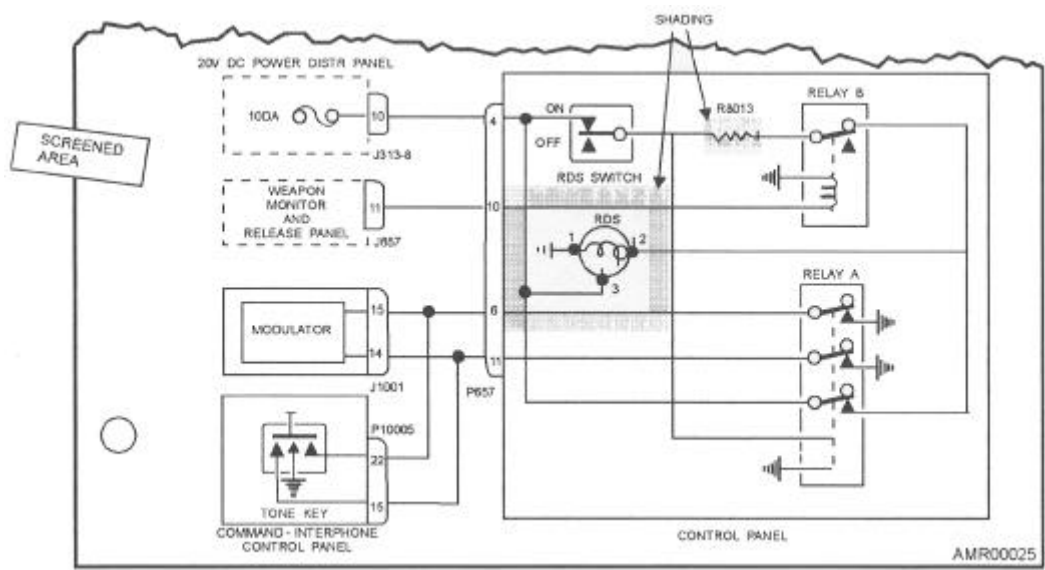


Figure 2-12.—Change symbol showing shaded area and screening.

DIFFERENCE DATA SHEET	
FUEL PUMP	MODEL 4X-2
THE INSTRUCTIONS CONTAINED IN THE PRECEDING CHAPTERS OF THIS TECHNICAL MANUAL ARE APPLICABLE TO THIS MODEL EXCEPT FOR THE DIFFERENCE CITED IN THIS DIFFERENCE DATA SHEET	
<p>1. INTRODUCTION AND GENERAL INFORMATION. Same as Model 4X-1, except the maximum output capacity is increased to 4.8 cubic feet per minute and the output pressure adjustment is increased to 22 pounds per square inch.</p> <p>2. SPECIAL TOOLS AND TEST EQUIPMENT. Same as for Model 4X-1, except seat replacing tool, Part No. 249Y is not required.</p> <p>3. PREPARATION FOR USE AND SHIPMENT. Same as Model 4X-1.</p> <p>4. OPERATION INSTRUCTIONS. Same as Model 4X-1.</p> <p>5. MAINTENANCE Model 4X-2 is equipped with a replaceable nylon seat in the by-pass valve (7, figure 5-2).</p>	<p>Inspection of the seat is the same as for Model 4X-1; however, if it is unserviceable, the nylon seat will be replaced rather than refaced. To remove the seat, use a 3/8 inch allen wrench and unscrew counter-clockwise. To install a new seat, apply a light film of lubricating oil to the threads and torque to 20 inch pounds.</p> <p>Test the same as Model 4X-1, except the output pressure shall be set at 22 pounds per square inch and the measured fuel flow must be between 4.3 and 4.8 cubic feet per minute.</p> <p>6. DIAGRAMS. Not applicable.</p> <p>7. ILLUSTRATED PARTS BREAKDOWN. Seat, Part No. 45462, is used in lieu of Part No. 28431 (9, Figure 7-1).</p>
AMR00026	

Figure 2-13.—Difference data sheet format.

TECHNICAL MANUAL ARE APPLICABLE TO THIS MODEL EXCEPT FOR THE DIFFERENCE CITED IN THIS DIFFERENCE DATA SHEET. (Refer to figure 2- 13.)

- Sheets for each model start on a right-hand page. Page numbers, figure numbers, and table numbers run consecutively throughout the section. Sheets are added as required. Paragraphs need not be numbered. If

numbering is used, single Arabic numerals beginning with "1" for each added model may be used.

Changes to Work Package (WP) Manuals

Manuals prepared in the WP format are compatible to microfilm and paper media. The selection of the approach used for a change is determined by the reproduction media (film, or paper).

A change action to an individual WP normally relates only to manuals in paper media format. A change to a WP manual could consist of both changed and revised WPs as well as the addition or deletion of WPs. The numerical index of effective WPs (fig. 2- 14) accounts for all changed, revised, added, or deleted work

packages affected by the change as well as previous changes to the manual.

Paragraphs, illustrations, tables, pages, and index numbering (on illustrations) added between existing items are assigned the preceding number plus

A1-F18AE-WPM-000						Page A	
Change 2 - 1 March 1							
NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES/PAGES							
List of Current Changes							
Original	0	1 Mar 93	Change	2	1 Mar 94		
Change	1	1 Sep 93					
<p>Only those work packages/pages assigned to the manual are listed in this index. Insert Change 2, dated 1 March 1994. Dispose of superseded work packages/pages. Superseded classified work packages/pages shall be destroyed in accordance with applicable security regulations. If changed pages are issued to a work package, insert the changed pages in the applicable work package. The portion of text affected in a change or revision is indicated by change bars or the change symbol "R" in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands, change bars, or MAJOR CHANGE symbols. Changes to diagrams may be indicated by shaded borders.</p>							
<p>Total number of pages in this manual is 714 consisting of the following"</p>							
<u>WP/Page</u>	<u>Change</u>	<u>WP/Page</u>	<u>Change</u>	<u>WP/Page</u>	<u>Change</u>	<u>WP/Page</u>	<u>Change</u>
<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Title	2	15	2	50	2	85	2
A	2	16	2	51	2	86	2
B	2	17	2	52	2	87	2
C	2	18	2	53	2	88	2
D	2	19	2	54	2	89	2
E blank	2	20	2	55	2	90	2
TPDR-1	2	21	2	56	2	91	2
TPDR-2 blank	2	22	2	57	2	92	2
001 00		23	2	58	2	93	2
1	2	24	2	59	2	94	2
2	2	25	2	60	2	95	2
3	2	26	2	61	2	96	2
4	2	27	2	62	2	001 03	
5	2	28	2	63	2	1	1
6	2	29	2	64	2	2	1
001 01		30	2	65	2	3	1
1	2	31	2	66	2	4	1
2	2	32	2	67	2	5	1
3	2	33	2	68	2	6	1
4 blank	2	34	2	69	2	7	1
001 02		35	2	70	2	8	1
1	2	36	2	71	2	9	1
2	2	37	2	72	2	10	1
3	2	38	2	73	2	11	1
4	2	39	2	74	2	12	1
5	2	40	2	75	2	13	1
6	2	41	2	76	2	14	1
7	2	42	2	77	2	15	1
8	2	43	2	78	2	16	1
9	2	44	2	79	2	17	1
10	2	45	2	80	2	18	1
11	2	46	2	81	2	18	1
12	2	47	2	82	2	19	1
13	2	48	2	83	2	20 blank	1
14	2	49	2	84	2	002 00	

AMR00027

Figure 2-14.—Numerical index of effective work packages.

consecutive capital letter suffixes; for example, 1A and 1B would be assigned to items added between 1 and 2 (fig. 2- 15).

The text and tabular data affected by the change to a WP manual is indicated by the letter *R* or a change bar in the left margin for material changed in the left column, and in the right margin for material changed in the right column. (Refer to figure 2-10.) Change symbols for illustrations are as follows:

- IPB illustrations do not require change symbols.
- On line drawings (other than diagrams), a miniature pointing hand highlights the area containing the changed information (fig. 2-11). When several changes are made at once in the same area of an illustration, a change bar may be used to indicate the general area. A vertical line next to the changed text and callouts on illustrations is used instead of a pointing hand. A change bar also may be used next to changed

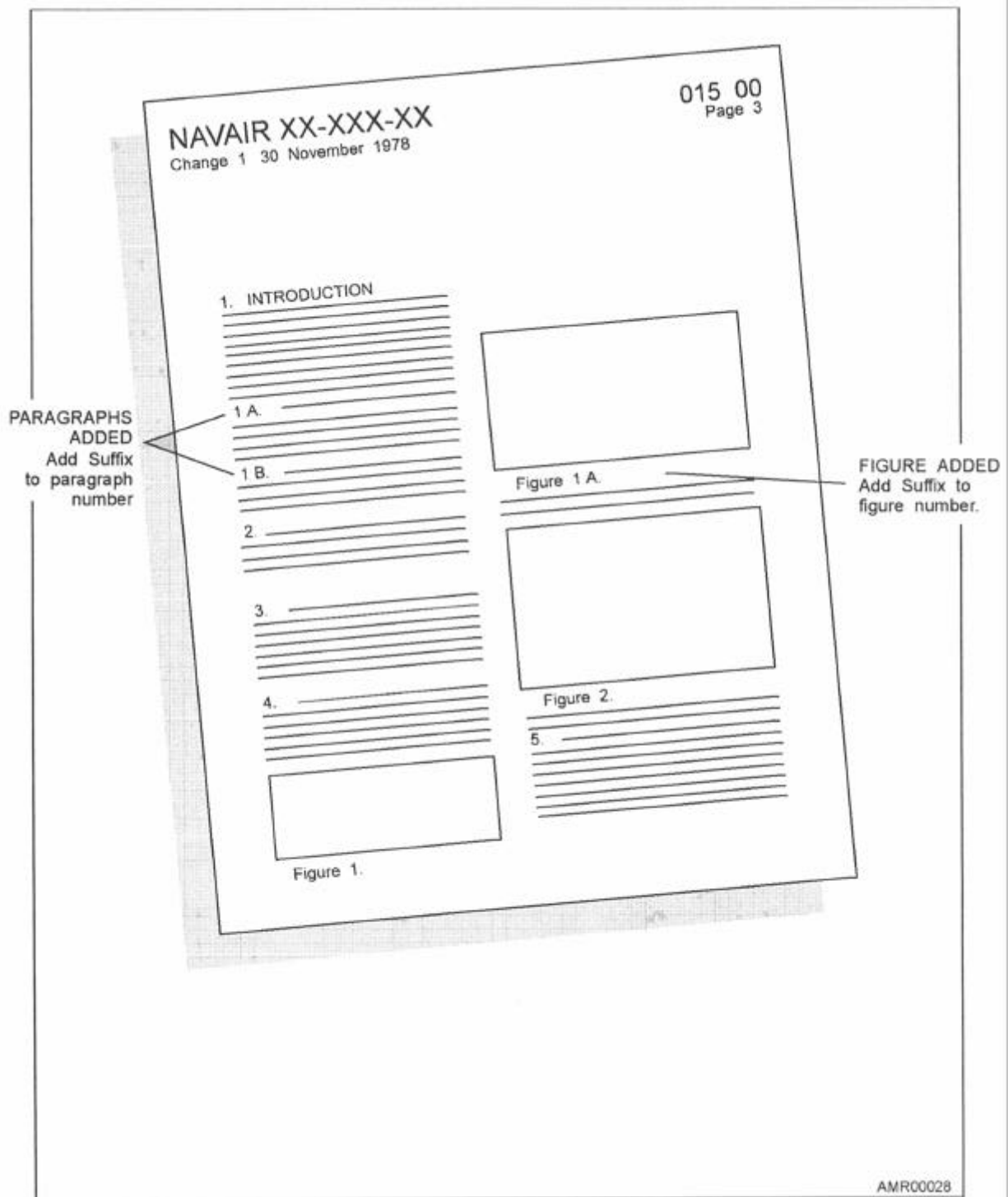


Figure 2-15.—Supplemental format, work package manual (paragraph and illustration numbering).

material on a graph. When an illustration is extensively changed, a change bar is placed across the top of the reproduction area (full page illustrations), or in the left or right margin, as applicable (partial page illustrations).

- On diagrams, bordering or pointing hands indicate the area containing the changed or added information (fig. 2-11). Extensively changed or added areas are indicated by a change bar around the affected presentation. or change bar across the top of the affected image area.

Rapid Action Changes (RACs)

The function of the RAC is to expedite the dissemination of urgent operation and maintenance change information. RACs are applicable to all In-Production and Out-of-Production NAVAIR weapons system maintenance instruction manuals, related component equipment manuals, maintenance requirements cards, illustrated parts breakdowns, support equipment, weapons handling and loading manuals, calibration manuals, and other related procedural manuals.

For more in-depth information, message format and incorporation procedures for RACs, refer to NAVAIR 00-25-100.

- Q7. *In a work package type manual, what is the information that appears in the upper right corner of each page?*
- Q8. *What is the difference between a change and a revision of a technical manual?*
- Q9. *What reporting system allows fleet input to technical manual changes?*
- Q10. *What are the two types of publication changes?*
- Q11. *What is the purpose of the "A" page in a manual?*
- Q12. *Difference data sheets are used for what purpose?*
- Q13. *In a WP manual, where can you find information for all changed revised, added or deleted work packages?*
- Q14. *How are illustrations and tables added between existing items and how are they numbered?*
- Q15. *What is the function of the Rapid Action Change (RAC)?*

TECHNICAL MANUAL NUMBERING SYSTEM

LEARNING OBJECTIVE: Identify the categories used in numbering technical manuals.

The numerical and alphabetical combination used for a NAVAIR technical manual number identifies the basic equipment category, main groups within the category, specific item of equipment, type of usage, type or model designation, and specific type of manual.

There are two numbering systems presently in use by NAVAIR: the older NAVAIR publication numbering system and the newer Technical Manual Identification Numbering System (TMINS). You must be able to use both numbering systems.

NAVAIR Publication Numbering System

The NAVAIR manual publication number consists of a prefix (NAVAIR or NA for NAVAIRSYSCOM) that designates the command responsible for developing or maintaining the manual. The manual number is divided into three parts, separated by a dash (-). Additional numbers may be added to show multiple volumes of a manual. The three parts that make up the NAVAIR manual number are discussed in the following paragraphs.

Part I of the publication number is the category. Normally it is a two-digit number (in some cases two digits and a letter). It designates the major category of the manual; for example, 00 tells you that this is a general manual; 01 is for airframes, 02 is for power plants. Refer to NAVAIR 00-25-100 for a complete breakdown of publication numbering categories.

Part II of the publication number is made up of numbers or numbers and letters. They identify either a basic aircraft model, the manufacturer, or the specific class, group, or subcategory of the manual. For example, in figure 2-16, the number F14AAA in view A identifies the aircraft model. In view D, 75PAC identifies Lockheed as the manufacturer of the P-3C airframe.

Part III of the publication number usually identifies a particular type of manual. For example, -1 identifies the NATOPS flight manual, -2 the maintenance instruction manual, -3 the structural repair manual, and -4 the illustrated parts breakdown.

Additional numbers may be added to show system grouping breakout by volume or subsystem grouping by subvolume. For example, in the number -2-2, the second -2 indicates the second volume of a maintenance manual. In the number -2-2.1, the .1 indicates a subvolume within the grouping.

Figure 2-16 shows examples of technical manual number assignments.

Technical Manual Identification Numbering System (TMINS)

The TMINS numbering system is part of the effort to standardize technical manual numbers for all ships, aircraft, and equipment. *Navy Standard Technical Manual Identification Numbering System*, NAVAIRINST 4160.1, establishes the TMINS for aeronautic publications. The TMINS provides a single

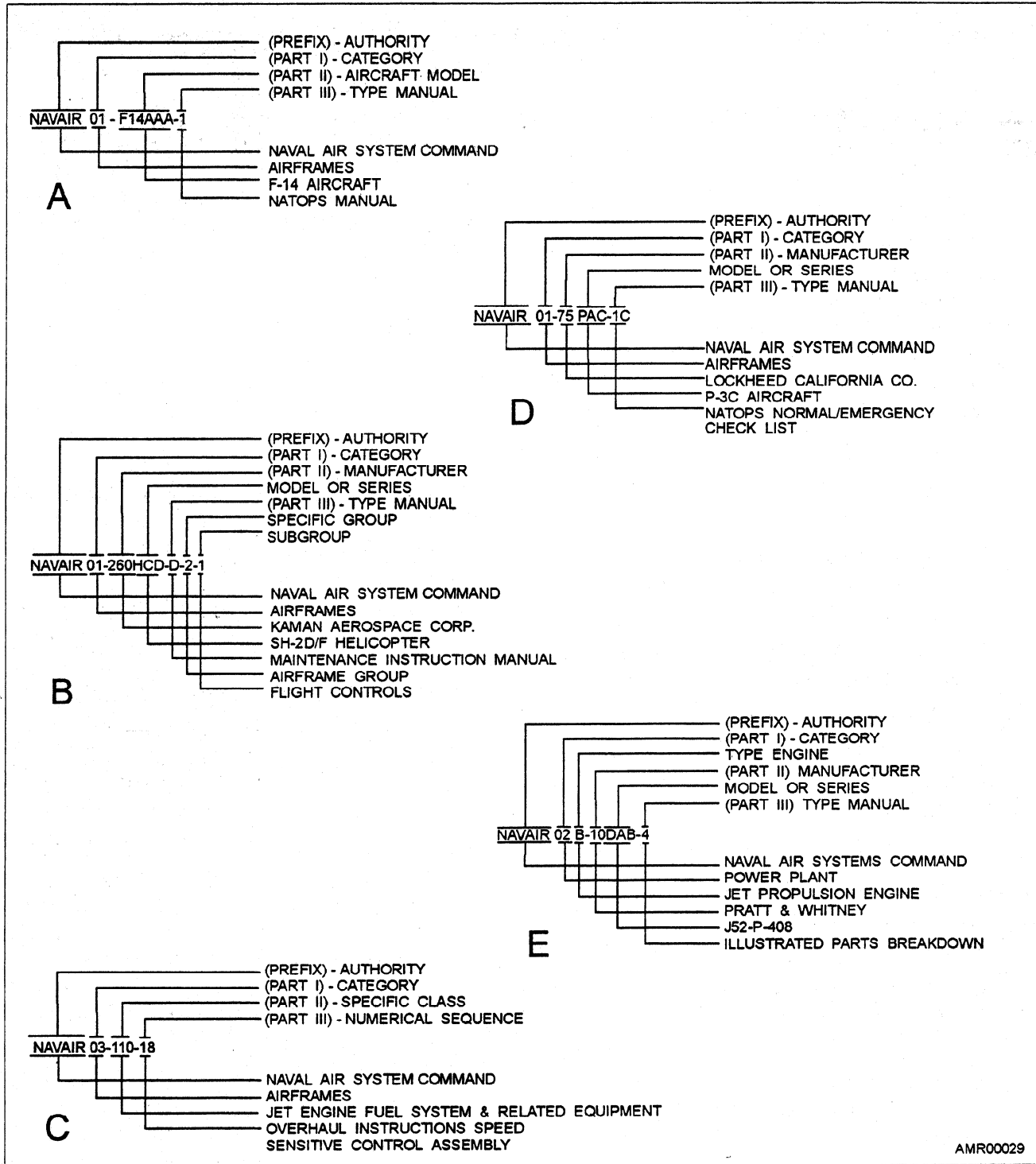


Figure 2-16.—Specific examples of technical manual number assignments.

user-oriented numbering and indexing system. It meets the requirements of all systems commands for identifying, referencing, and requisitioning technical manuals and changes. The system also makes it easier to identify and order manuals for the operating forces and other users. It is compatible with automatic data processing (ADP) procedures. The *Application Guide and Index*. OPNAV N0000-00-IDX-000/TMINS, should be available in your technical library. By using this guide and index, you will be able to understand and use the TMINS.

The TMINS assigns each technical manual a unique identifying alphanumeric designation patterned after the 13-digit National Stock Number (NSN); for example, A1-F18AA-NFM-500. It serves as the technical manual identification number. Additionally, TMINS contains a provision for adding a suffix to give the security classification and other information considered important.

TMINS NUMBER COMPOSITION.—The standard TMINS number (fig. 2-17) is made up of two distinct parts separated by a slash (/). The first part of the TMINS is called the publication identifier (PI). It is the essential root of the number. The PI is always used, and it always has exactly 13 characters.

The second part of the TMINS is called the suffix. It is an added field of up to 17 characters (including the slash). When used, it gives user-oriented information. The suffix is always used for classified manuals and separately bound unclassified portions of classified technical manuals. The suffix for both classified and unclassified TMINS may also supply the user with equipment designation, nomenclature, or model number.

PUBLICATION IDENTIFIER (PI) COMPOSITION.—The publication identifier (PI) is made up of two major components: the hardware/subject identifier and the technical manual (TM) identifier. The first seven characters of the PI make up the hardware/subject identifier. These characters identify the specific hardware (such as an aircraft) or subject (such as an airborne weapons system) to which the technical manual applies. Once assigned, the project serial number (for example, SA-AN/APS-39A radar set) will represent the item throughout its life cycle. The first seven characters of the PI (fig. 2-17) are divided into three groups.

- The first group, cognizant (COG), of the PI is a single letter that tells what command publishes and updates the publication. For example, the COG is A for NAVAIRSYSCOM.

- The second group, standard subject classification code (SSCC), is a four-digit alphanumeric code that identifies the commodity or subject matter; for example, in figure 2-17, the 1 in 1F18 indicates aircraft or aviation. The F18 stands for the F/A-18 aircraft.

- The third group, subject serial number (SUBJ SERIAL), is a two-digit code (either numbers, letters, or both) that is assigned by the Naval Air Technical Services Facility (NAVAIRTECHSERVFAC) for aeronautic manuals. It differentiates between items assigned to a given SSCC series or subseries. In figure 2-17, the subject serial number AC stands for F/A-18 aircraft federal labs.

The remaining six characters of the PI are called the technical manual (TM) identifier. The six

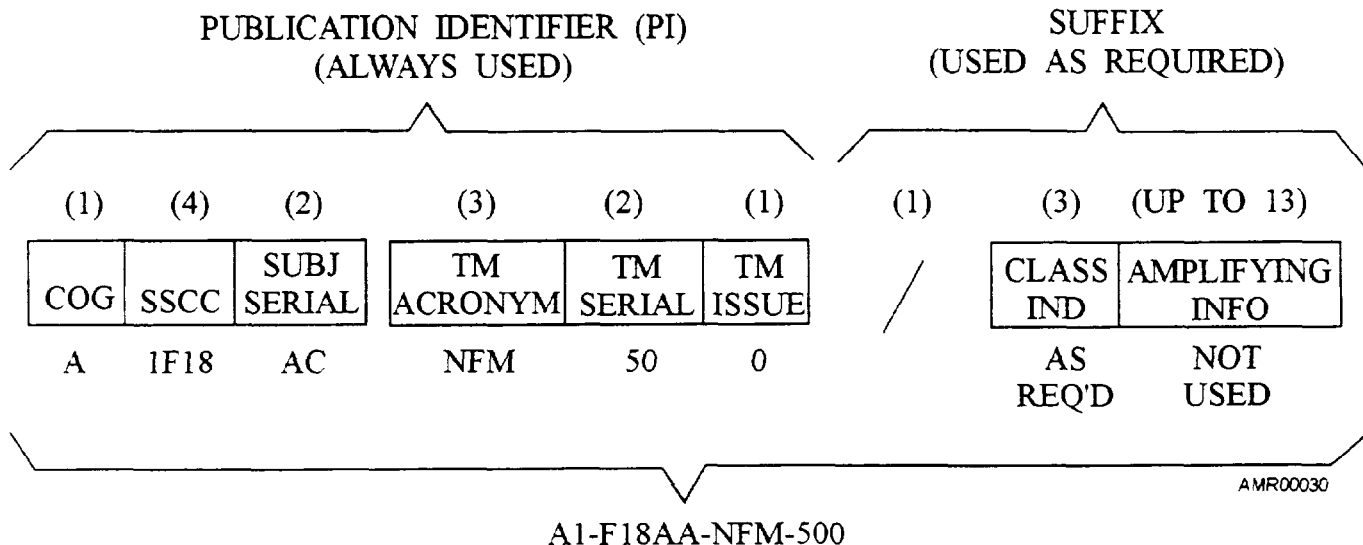


Figure 2-17.—TMINS example (NAVAIR).

characters identify a particular TM and are divided into three groups.

- The first group (TM acronym) consists of three letters or numbers that identify the type of manual; for example, in figure 2-17, the TM acronym NFM identifies the manual as a NATOPS flight manual supplement. Numerically, they can identify the first three digits of a particular Work Unit Code; for example, 520 is an autopilot. In some instances of Work Unit Codes, such as support equipment (SE), a combination of a letter and two numbers are used for the TM acronym; for example, S14 is an air compressor.

- The second group of the TM identifier (TM serial number) is made up of two numbers. It is used to identify different volumes, parts, and changes to specific TMs. For NAVAIR TMs, these numbers range from 00 through 99. In the example shown in figure 2-17, the TM serial number is 50. This stands for a *Pilots Pocket Checklist*.

- The third group of the TM identifier is the TM issue, and is either a number (0 to 9) or a single letter. The number 0 indicates the TM is a basic issue or superseding revision. The letters A through Z (except I and O) designate (in alphabetical sequence) permanent changes or rapid action changes (RACs).

PI SUFFIX COMPOSITION.—The PI suffix has a variable composition, depending upon whether or not the TM has a security classification. For classified TMs, the PI suffix is always used, and the security classification indicator forms the first component of the suffix. The security classification indicator is always three characters (a letter enclosed in parentheses). The entire suffix can contain up to 17 characters, if required.

In figure 2-17, you can see that the PI suffix is not required. Therefore, the TMINS number A1-F18AC-NFM-500 stands for the initial or revised edition of a *Pilots Pocket Checklist* supplement to the NATOPS manual of an F/A-18 aircraft. In-depth information can be found in the OPNAV N0000-00-IDX-000/TMINS publication.

- Q16. *How many numbering systems are currently in use by NAVAIR and what are they?*
- Q17. *What part of the NAVAIR numbering system can the category of the publication be found?*
- Q18. *The standard TMINS number is made up of how many distinct parts and what are they?*

Q19. *The two-digit subject serial number is what group of the PI?*

Q20. *What are the last six positions in the publication identifier (PI) called?*

USING TECHNICAL MANUALS

LEARNING OBJECTIVE: Recognize the procedures for using maintenance instruction manuals (MIMs) and illustrated parts breakdowns (IPBs).

Technical manuals help ensure proper maintenance. In today's Navy, the equipment is complex and you must use technical manuals at all levels of servicing and repair. The purpose of this section is to introduce you, the worker, to the content of technical manuals.

MAINTENANCE INSTRUCTION MANUAL (MIM)

As discussed earlier, the Maintenance Instruction Manual (MIM) is identified by the number 2 in part III of the NAVAIR publication number. For example, the first numeral 2 in NAVAIR 01-75PAA-2-2.3 identifies the MIM for the P-3A aircraft. The MIM is made up from a number of individual publications. Each publication deals with some portion of the maintenance for the applicable model aircraft. It contains essential information that aircraft maintenance personnel require to service and maintain the complete aircraft. Before you attempt any task on an aircraft, consult the MIM for that particular model of aircraft. By using the MIM properly, you may prevent possible aircraft damage and save time. The recommended maintenance methods provide procedures that can be accomplished by the appropriate maintenance level activity.

NOTE: Different aircraft manufacturers may group the material in the various volumes of the MIMs under different titles. For example, the "Survival and Environmental Systems" volume for the older aircraft covers the ejection seat, canopy, liquid oxygen, heating, air conditioning, ventilation, and anti-g systems. Two volumes titled "Personnel Environmental Systems" and "Canopy and Survival Systems" are prepared to cover the same subjects for newer aircraft.

The "General Information and Servicing" volume is designed primarily for the plane captain. This

volume contains a general description of the aircraft, information that is not contained in other specialized manuals, and all information about servicing the aircraft.

Each of the specialized system volumes of the MIM is further divided into four sections. These sections are described briefly in the following paragraphs.

Section I is the same in all volumes for a particular aircraft MIM. It introduces the manual and usually supplies a list of the changes that apply to the particular volume.

Section II describes the system and its components, as well as their operation.

Section III covers such maintenance as the removal and installation procedures and troubleshooting charts for organizational-level maintenance.

Section IV covers component repair procedures for intermediate-level maintenance.

Figure 2-18 is an example of a page from section III of a MIM. This page shows the basic layout of the maintenance-coverage sections of the specialized-type manuals. To make it easier for you to locate the material on the page, each component maintenance procedure is identified by a boldface heading (fig. 2-18, A). All removal and installation procedures provide a recommended manpower requirement (B) for the supervisors to use in assigning personnel to perform the job. All tools and equipment, other than standard tools, are noted (C) before the maintenance procedure. This allows these items to be drawn from the toolroom before starting the operation.

When consumable materials, such as lubricants, lockwire, and cotter pins, are required during an installation procedure, a listing of these items (D) is made before the procedural steps. Miscellaneous small parts (other than standard Air Force/Navy [AN] specification and Military Specification [MS] hardware), necessary for removal and installation, also appear in the materials list. As an aid to quality assurance representatives (QARs), those steps in a procedure that require an inspection are in italics (E).

NOTE: In some MIMs, the steps in a procedure that require a quality assurance (QA) inspection are underlined. The italicized steps are a very important

feature and are summarized (callout F) at the end of each procedure.

The separate sections of these manuals are issued as separate publications under individual identifying numbers. This is done to make it easier for maintenance personnel to procure, store, file, and use specific parts of the manual.

A new format for MIMs was developed with the introduction of manuals for late model aircraft, such as the F-14 and S-3. You should understand this newer format as well as the old because you will use both, depending upon the aircraft on which you are working. Both formats are discussed separately in the following paragraphs.

Under the older format, a volume contains several sections. The number of sections in each volume may differ from one model aircraft to another and from one volume to another. In some cases, organizational maintenance is covered in one section and intermediate maintenance in another. In other cases, two separate volumes cover the two levels of maintenance.

In the newer format, sections I and II of all volumes are usually similar in format. Section I is an introduction to the volume. It provides a general description of the manual, including the scope of coverage, format, and arrangement of the included information. Also, it contains a list of the applicable publications and technical directives required by maintenance activities.

Section II contains a physical description of the equipment or systems covered in the volume. For example, in the volume "Powerplant and Related Systems of the F-14 Aircraft," section II contains descriptions and operating instructions for the power plant and its related systems.

In some volumes, a section is devoted to any support and special equipment required for the maintenance of the system covered. In other volumes, this information is covered in the section that pertains to the specific system. As stated previously, the remaining number of sections may differ; however, in all cases these sections contain the maintenance information for the included systems.

Under the newer format, the MIM is subject-identified in part IV of the manual number code. For example, the manual number codes for the F-14 organizational-level MIM are shown in figure

Section III
Paragraph 3-328 to 3-331

NAVAIR 01-XXXXX-X-X

Removal Procedure

- a. Remove elevators (refer to paragraph 3-331).
- b. Remove three screws from each bracket assembly and remove damper.
- c. Remove bolts, nuts and washers which retain connecting rod assemblies to damper arms.
- d. Remove nut, washer and spacers from top and bottom brackets and remove brackets, leaving damper assembly.

Note

The viscous damper assembly must be stored with the top side up. If stored with the top side upside down for more than four hours, it is possible that air may be entrapped in the fluid between the disc and the housing, thus reducing damping rate. This condition can be corrected by storing the damper in its normal position at room temperature, approximately 21.1° C (70°F) for one week.

3-328. REPAIR AND PARTS REPLACEMENT

Spares and Repair Parts Data

Forward to next higher maintenance level.

3-329. INSTALLATION.

Material List

D	Cotter Pin (2)	MS24665-300
	Spacer (top)	923033-1
	Spacer (bottom)	923033-3

Manpower Requirement

One man is required

Quality Assurance Requirement

An inspection is required when steps appear in *italics*.

Installation Procedure

- a. Install upper bracket using one 923033-1 spacer, AN320-5 nut and MS24665-300 cotter pin.
- b. Install lower bracket using one 923033-3 spacer, AN320-5 nut and MS2466-300 cotter pin.

E *c. Inspect installation of upper and lower bearing brackets in check nut and cotter pin installation.*

d. Install upper rod assembly using an NAS1104.17 bolt and NAS679A4W nut with an AN960D416 washer under the bolt head and under the nut. Bolt head is up.

e. Install lower rod assembly using an AN174H13 bolt and NAS679A4W nut with an AN960D416 washer under the bolt head and under the nut. Bolt head is down. Lock-wire bolt head to lower lever.

E *f. Inspect installation of upper and lower rod assemblies for tightness of attachments and lock-wiring of lower bolt head.*

3-294

- g. Attach brackets to structure using NAS623-3-7 screws and AN960D10 washers in the two upper and two lower holes. Use NAS623-3-6 screws and AN960D10 washers in the two middle holes.

h. *Inspect attachment of brackets to structure. Damper must rotate freely and there must be a minimum of 0.12 inch clearance to structure.* E

- i. Reinstall elevators. (Refer to paragraph 3-332.)

Quality Assurance Summary

a. *Inspect installation of upper and lower brackets to damper assembly to check nut and cotter pin installation.*

b. *Inspect installation of upper and lower rod assemblies for tightness of attachments and lock-wiring of lower bolt head.* F

c. *Inspect attachment of brackets to structure. Damper must rotate freely and there must be a minimum of 0.12 inch clearance to structure.*

3-330. ELEVATOR MAINTENANCE PROCEDURES. A

3-331. REMOVAL (See figure 3-105.)

Tools and Equipment List

Truck, Fork Lift	TC-200	C
Hoist	HSKS-1531B	
Elevator Sling Assembly	551241-1	

Manpower Requirements

Two men are required. B

Removal Procedure

- a. Placard control column.
- b. Open six aft radome latches and roll radome back on track.
- c. Support the elevator with elevator sling assembly, LCC 551241-1 or equivalent and move the elevator to the up position.
- d. Remove the lock-wire and two holes attaching the inboard end of the elevator to the end fitting of the elevator torque tube.
- e. Move the elevator to the down position and remove one bolt attaching the elevator to the torque tube.
- f. Open the four hinged bolt access panels located across the underside of the horizontal stabilizer trailing edge, and panel E207 L/R on top trailing edge of the horizontal stabilizer.
- g. Disconnect the two viscous damper push rods located at horizontal stabilizer station 95.84.
- h. Disconnect, roll, tape and mow elevator trim tab tables for removal with the elevator. Turnbuckles for the right elevator trim tab are disconnected in the fuselage tail cone area. Turnbuckles for the left elevator trim tab are disconnected by gaining access through E206 L access panel on the trailing edge of the lower left horizontal stabilizer.

AMR00031

Figure 2-18.—Typical page of a maintenance instruction manual.

2-19. With the possible exception of maintenance, the subjects are self-explanatory. The maintenance volumes contain step-by-step procedures for the removal and installation of components within the system covered by the particular volume.

Part V of the manual number code is a subvolume number of the subject designated in part IV. In the case of F-14 manuals, -1 in part V is used for landing system; for example, NAVAIR 01-F14AAA-2-2-1 is *Landing Systems, Principles of Operation*; NAVAIR 01-F14AAA-2-3-1 is *Landing Systems, Testing and Troubleshooting*; and NAVAIR 01-F14AAA-2-4-1 is *Landing Systems Maintenance*.

To provide smaller information units, the MIMs are sectionalized into work packages (WPs) and, if necessary, into subordinate work packages (SWPs). WPs and SWPs are identified by a five-digit number. The first three digits represent the WP number, and the last two digits represent the SWP number.

NOTE: The two digits that identify the SWP are usually printed in smaller size type than the three digits that identify the WP.

Figure 2-20 is an example of page A of a testing and troubleshooting MIM. It contains the numerical index of the effective WPs and SWPs in the volume. WP 00 1 00 contains an alphabetical listing of all WPs and SWPs in the volume.

ILLUSTRATED PARTS BREAKDOWN (IPB)

Normally, the IPB consists of several individual volumes; one for each functional element of the

aircraft and one volume that is the Master Parts Index. Each volume pertaining to the different functional elements is identified by a dash and number in part IV of the publications number. For example, the Master Parts Index for the F-14A aircraft is NAVAIR 01-F14AAA-4, and the IPB volume for the landing systems is NAVAIR 01-F14AAA-4-1.

The IPB is useful in identifying and ordering parts. You can determine the exact part or item required for replacement in a repair situation. Figure 2-21 is a typical IPB diagram. It can be used to identify failed or worn parts. To do this, identify the part by locating it on the diagram (i.e., you decide number 6 is the failed component). You can take this number, called the index number, and locate it (a launch bar) on the part list (fig. 2-22). This information in the part list is vital in ordering the part.

The IPB contains a list of weapons systems component parts keyed to simple illustrations. The manual serves a dual function to assist maintenance and supply. Material is illustrated by an exploded view and identified to material availability through source code listings. It is prepared as an associate manual to the related maintenance manual or incorporated in the basic book as a separate section.

NAVAL AERONAUTIC PUBLICATIONS INDEX (NAPI)

All aeronautic publications, changes, technical directives, and forms issued by NAVAIRSYSCOM are cataloged in the Naval Aeronautic Publications Index (NAPI). The NAPI consists of six sections,

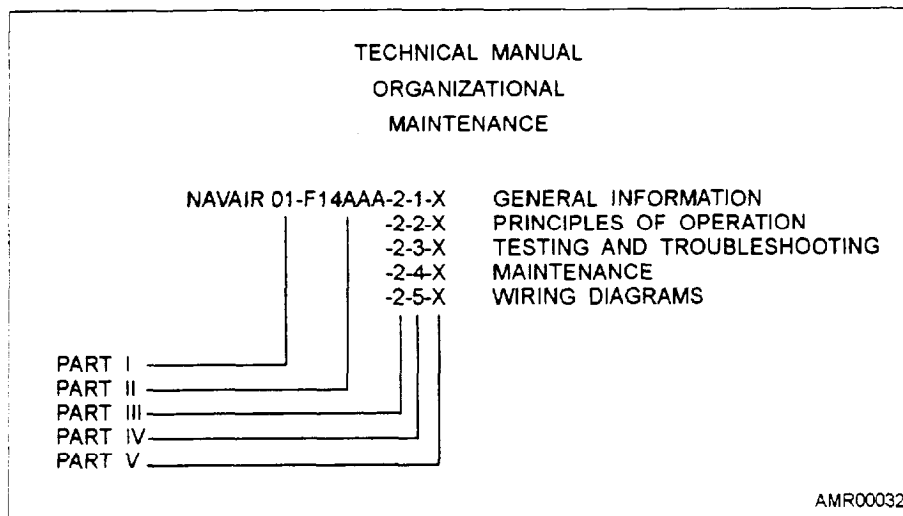


Figure 2-19.—Example of F-14 MIM number codes.

NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES

List of Current Changes

Original 0 . . . 1 November 1977, including previously incorporated Interim RAC 1	Change 3 15 July 1978 (includes Interim RAC 2)
Change 1 15 January 1978	Change 4 1 December 1978
Change 2 1 May 1978	

Only those work packages and subordinate work packages assigned to the manual are listed in this index. Insert Change 4 work packages and subordinate work packages, dated 1 December 1978. Dispose of superseded work packages and subordinate work packages. If changed pages are issued to a work package or subordinate work package, insert the changed pages in the applicable work package or subordinate work package. The portion of text affected in a changed or revised work package or subordinate work package is indicated by the change symbol "R" in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands or change bars, as applicable.

WP/SWP Number	Title	Change Number
Page A	Numerical Index of Effective Work Packages	4
001 00	Alphabetical Index	4
002 00	Introduction	0
003 00	Landing Systems	0
004 00	Cockpit Arrangement - Landing Systems	0
005 00	Automatic Carrier Landing System	0
005 00	Receiving-Decoding Group AN/ARA-63 and AN/ARA-63A	0
005 00	Radar Beacon Set AN/APN-154B(v)	0
006 00	Landing Gear Systems and Safety Interlock Circuits	3
006 01	Landing Gear Systems	3
006 02	Deleted	0
006 03	Deleted	0
006 04	Deleted	0
006 05	Landing Gear Safety Interlock Circuits	2
007 00	Emergency Landing Gear System	0
008 00	Nosewheel Steering System	0
009 00	Aircraft Skid Control	0
010 00	Wheel Brake System and Wheel-and-Tire Assemblies	0
011 00	Arresting Hook System	4
012 00	Launch Bar (Catapult) System	0

AMR00033

Figure 2-20.—Typical page A of a MIM.

which make it easier to locate and order specific publications and changes. They are as follows:

- NAVSUP PUB 2002, *Navy Stock List of Publications, Forms, and Directives*
- NAVAIR 00-25-501, *NAVAIR Technical Manuals and Technical Directives Distribution Listing*
- NAVAIR 00-500A, *Equipment Applicability List*
- NAVAIR 00-500C, *Directives Application List*
- NAVAIR 00-500SE, *Support Equipment Changes Cross-Reference*
- NAVAIR 01-700, *Airborne Weapons/Stores, Publication Index*

Each section of the NAPI contains an introduction, which explains the purpose of that particular section, and specific instructions on the use of the index. A complete NAPI should be maintained by the quality assurance (QA) division in its technical library.

For more in-depth information concerning the parts of the NAPI, refer to NAVAIR 00-25-100.

Q21. In the NAVAIR publication number NA 01-75PAA-2-4, what does the number "2" designate?

Q22. How are quality assurance inspection requirements identified in maintenance instruction manuals (MIM)?

Q23. What technical publication is most helpful in identifying and ordering replacement parts?

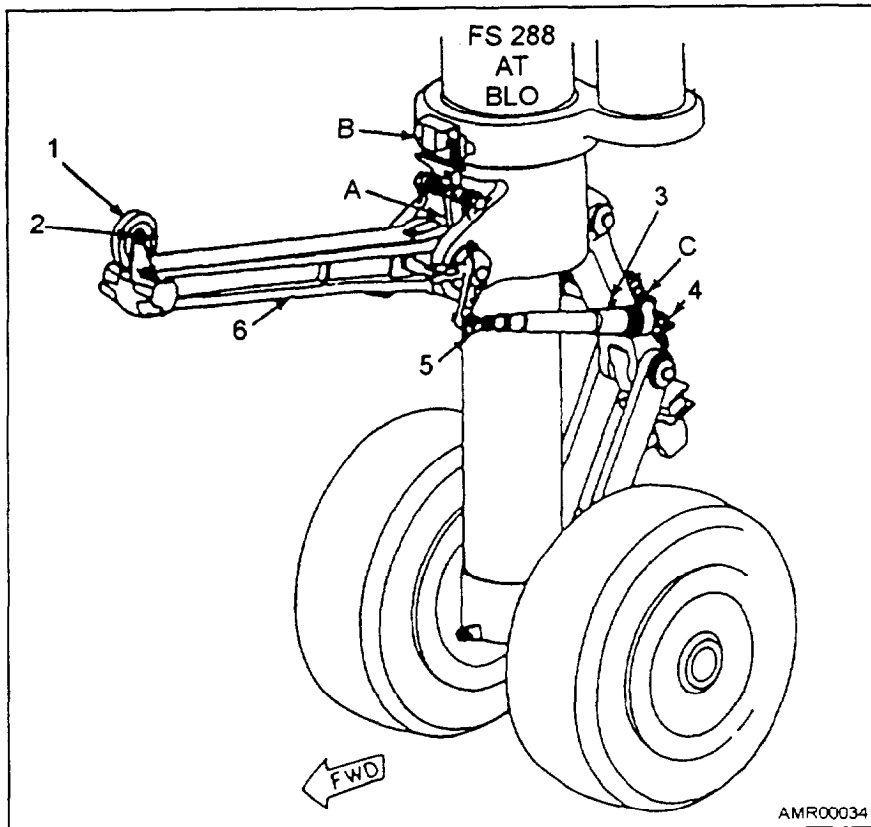


Figure 2-21.—Typical diagram page of IPB (launch bar abort mechanism).

- Q24. *The Naval Aeronautic Publications Index (NAPI) has how many sections?*
- Q25. *Where are all NAVAIR aeronautical publications changes, technical directives, and forms cataloged?*
- Q26. *What division maintains a complete Naval Aeronautic Publications Index (NAPI) in its library?*

MAJOR CATEGORIES OF NAVAIR TECHNICAL MANUALS

LEARNING OBJECTIVE: Identify the major categories of technical manuals.

NAVAIR technical manuals are grouped in categories according to type and peculiarities of the requirement. Based on intended use, publications are tailored to improve usability. Manuals that you will use the most are discussed in the following paragraphs.

GENERAL SERIES MANUALS (00 SERIES)

As indicated by its title, the technical manuals within this series contain information of interest to a major portion of the aviation community. Part of this series is the technical manual indexes, which will be discussed later in this chapter. Also included are standard aircraft characteristics manuals, Deputy Chief of Naval Operations (DCNO) (Air Warfare) training literature, documentation management and procedures manuals, and other miscellaneous publications.

The general series (00 series) contains the aviation training literature (00-80 series). These publications are issued by the authority of the DCNO (Air Warfare). Included are various air safety manuals and general aviation manuals prepared on subject material related to military skills, ratings, or operational maintenance procedures. These manuals are available through normal supply channels.

An additional volume has been added to the new technical manual system for late model aircraft. This is the “zero” volume. For the S-3A aircraft, the NAVAIR publication number is NAVAIR

INDEX NO.	PART NUMBER	DESCRIPTION	UNIT USE	SMCR
			PER ASSY	ON CODE
	A51G10001-3	• MECHANISM, LAUNCH BAR ABORT /SEE .. FIGURE 060-00 FOR NHA/	REF	APL UU
	A51G10001-5	• MECHANISM, LAUNCH BAR ABORT /SEE .. FIGURE 060-00 FOR NHA/	REF	APK UU
1	550-209	• ROLLER, LAUNCH BAR /05262/ .. /GRUMMAN SCD A51G9008-1/ /ATTACHING PARTS/	1	
2	NAS5676V150	• BOLT	1	P10Z0
	AN960-616	• WASHER	1	P10Z0
	GB1006-8	• BUSHING, PLAIN	1	P10Z0
	MS17825-6	• NUT	1	P10Z0
	MS24665-155	• PIN	1	P10Z0
3	A51G10006-1	• BUNGEE, NLG LAUNCH BAR /SEE .. NAVAIR 03-25GA-31 FOR DETAIL BREAKDOWN/ /ATTACHING PARTS/	2	P10GD
4	MS17B26-5	• NUT	1	P10Z0
	GW10A5	• WASHER, LAMINATED	1	P10Z0
5	MS24665-153	• PIN	1	P10Z0
	VEPS132121-4F 8	• BOLT, SHEAR /06710/ /GRUMMAN SCD .. GB11B4D18/	1*	P10Z0
	EWSB224018	BOLT, SHEAR /56878/ /GRUMMAN SCD .. GB511B401B/	1*	P10Z0
	BM17020-4-18	• BOLT, SHEAR /85495/ /GRUMMAN SCD .. GB511B4018/	1*	P10Z0
	VS3071-4F18	BOLT, SHEAR /92215/ /GRUMMAN SCD GB511BG018/	1*	P10Z0
	GW10A2	• WASHER, LAMINATED	1	P10Z0
	AN960-416	• WASHER	1	P10Z0
	MS17825-4	• NUT	1	P10Z0
	MS24665-153	• PIN	1	P10Z0
6	A51G10500-3	• LAUNCH BAR /SEE NAVAIR 03-25GR-28 ... FOR DETAIL BREAKDOWN/	1	VU P10GD
	A51G10500-1	• LAUNCH BAR /SEE NAVAIR 03-25GR-28 ... FOR DETAIL BREAKDOWN/	1	VT P10GD
7	G104-575	• SPRING, TORSION	1	APK
8	A51G10145-13	• BRACKET, LAUNCH BAR SWITCH	1	APK
9	A51G10502-1	• ROLLER ASSEMBLY .. /ATTACHING PARTS/	1	APK
10	NAS674V160	• BOLT	1	APK
	AN960-416	• WASHER	2	APK
	MS27183-10	• WASHER	1	APK
	GB1004-8	• BUSHING, PLAIN	1	APK
	MS17825-4	• NUT	1	APK
	MS24665-153	• PIN	1	APK

AMR00035

Figure 2-22.—Typical part list of IPB (launch bar abort mechanism).

01-S3AAA-0. Its title is the *Technical Documentation List*. The purpose of this volume is to provide information concerning the availability and applicability of technical manuals for the maintenance of the particular aircraft model. The listings are presented in three basic formats:

- Numerically by assigned technical manual number.
- By system, subsystem, and component part number or type designator to technical manual number.
- By support equipment part number or type designator to technical manual number.

As you can see, the -0 volume is very important. The alphanumeric listings help you determine if

publication information is required for an aircraft component or item of SE. The associated manuals are listed for each level of maintenance.

PRIMARY WEAPONS SYSTEMS TECHNICAL MANUALS (01 SERIES)

Technical manuals issued within this series are a combination of operation and maintenance publications. These manuals specifically apply to major weapons systems, such as aircraft, missiles, and unmanned drones or targets. The manuals are broken down by subject material and appear in a variety of formats. Short descriptions of some of these manuals are contained in the following paragraphs.

Operational Manuals

Three types of manuals are discussed here. One is the NATOPS flight manual. The other two are checklists, the Pilot's Pocket Checklist/Flight Crew Checklist and the Functional Check Flight Checklist.

Natops Flight Manual. The Naval Air Training and Operating Procedures Standardization (NATOPS) flight manual contains the complete operating instructions for a specific aircraft and its operational equipment. It is identified by the number 1 in part III of the publication number and is generally called a dash 1 (-1) manual. It contains emergency as well as normal operating instructions.

NATOPS manuals enhance operational safety through standardization of ground and flight procedures. The manuals are issued by the direction of NAVAIR under a Chief of Naval Operations (CNO) letter of promulgation. This letter stipulates that the procedures are mandatory. NATOPS flight manuals are issued primarily for the use of the pilots and aircrew. Maintenance personnel should become familiar with the contents of the flight manual for their specific aircraft.

NATOPS flight manuals are kept up-to-date by two types of changes: routine changes and interim changes. Routine changes are generally issued every 90 days. Interim changes cover vital operating instructions, and are issued when immediate action is necessary. Interim changes are issued either in printed or message form and are later incorporated as routine changes.

Pilot's Pocket Checklists/Flight Crew Checklists. These items are an abbreviated extension to the NATOPS data released in a special "knee pad" checklist format. They contain performance and reference data and emergency procedures, as well as normal and special procedures. They are step-by-step abbreviations of the amplified NATOPS procedures prepared for direct cockpit application.

Functional Check Flight Checklist. These checklists are used during a functional check flight. They are used to determine whether the airframe, power plant, accessories, and other items of equipment are functioning in accordance with predetermined standards while subjected to the intended operating environment. These flights are conducted when it is not possible to determine proper operation by ground checks. The data is provided in an abbreviated checklist format. The checklist is applied by the pilot

or crew members for recording the results of the flight test.

Tactical Manuals

The tactical manual supplements the flight manual; it provides information to the pilot and crew on how to "fight" the aircraft. It provides information on tactics, weaponry, and air combat maneuvering, with procedures and techniques based on tactical situations and mission assignments. These manuals are being made part of the Naval Warfare Publications program. Refer to *Tactical Warfare Publications Guide*, NWP-0.

Airborne Weapons/Stores Loading Manuals (Conventional and Nuclear)

These publications provide information required to convert aircraft armament systems to respond to various mission assignments, perform functional checkout of aircraft weapons control and release systems, and describe the loading or unloading of airborne weapons or stores. The conventional portion of the manual explains standard loading criteria and procedures predicted on tactical doctrine. The nuclear portion standardizes loading procedures and includes in-flight weapons procedures. These publications are also released by letter from CNO, specifying that the procedures stipulated are mandatory.

Weapons Loading Checklists. These checklists are abbreviated step-by-step procedures taken from the amplified procedures displayed in the weapons or stores loading manuals. These are normally used for training as well as for direct loading support.

Stores Reliability Cards (SRCs). SRCs contain abbreviated procedures for use in high-tempo operational areas. They may be used by trained and certified personnel instead of conventional weapons loading checklists. SRC's are pocket-size, laminated cards that contain information to ensure the aircraft is ready to receive the weapon, the weapon is ready to be loaded, the weapon was properly loaded, and to show the final steps to prepare the weapon for flight and intended use.

Nuclear Weapons Cargo Loading Manuals. These manuals provide information for transporting nuclear weapons. The instructions cover loading, securing, transporting, and unloading in cargo or transport aircraft and helicopters.

Cargo Loading Manuals. These manuals have been prepared for selected cargo-type aircraft. They provide instructions on authorized procedures for loading, securing, and unloading. All typical loads (ground equipment, troops, engines, etc.) and other assigned transport missions are covered and illustrated. Most cargo loading manuals are subject to controls identical to NATOPS. In fact, for aircraft that do not have separate cargo loading manuals, the information can normally be found in the applicable NATOPS flight manual.

MAINTENANCE MANUALS

Maintenance manuals contain instructions for the effective use and support of weapons systems or equipment. These instructions include, but are not limited to, troubleshooting, installation, removal, and repair of system components.

General Engineering Series Manuals (01-1A Series)

The general engineering series manuals cover standard aviation maintenance practices that apply to all aircraft rather than to a particular aircraft. These publications serve as useful training tools, and they prevent duplication of standard practices within other manuals.

Aircraft Maintenance Instruction Manuals (MIMs)

Aircraft MIMs are prepared on a systems maintenance concept. They appear in two basic formats, conventional and work package. The older conventional manual specification required that the coverage reflect both organizational and selected intermediate maintenance for contractor-furnished equipment (CFE). The more recent, task-oriented work package manuals cover organizational-level maintenance only. (Both conventional and work package formats for technical manuals were covered earlier in this chapter.)

Work Unit Code (WUC) Manual

WUC manuals are provided for each model of aircraft. They are identified by a -8 in part III of the NAVAIR publication number. For example, NAVAIR 01-F14AAA-8 is the *WUC Manual for the F-14 Aircraft*. There are WUC manuals provided for every type of aircraft and support equipment.

The WUC manual is used as a maintenance aid and recording guide in conjunction with the Maintenance Data Systems. It identifies assigned system-related equipment codes pertaining to various servicing and maintenance functions. These codes are used to record maintenance information into an automated data base. The information is processed to produce management reports that are used to determine material failure analysis and supply statistics, as well as maintenance and equipment design improvements.

Weight and Balance Data Manual, NAVAIR 01-1B-40

The weight and balance data manuals are used jointly with the U.S. Air Force. They provide a standard system for recording field weight and balance of certain aircraft. The initial forms, charts, and records contained in the manual are prepared by the original manufacturer before delivery of the aircraft to the Navy. The manual remains with the aircraft during its entire service life. It provides a means of maintaining a continuous, current record of the aircraft's basic weight, balance, and loading data. The records are maintained by the aircraft reporting custodian and overhaul activities. It must be brought up-to-date before transfer of aircraft. The procedures for maintaining this manual are contained in the USN *Aircraft Weight And Balance Control Manual*, NAVAIR 01-1B-50.

Crew Station Manuals and In-Flight Maintenance Manuals

Crew station and in-flight maintenance manuals are designed for large, high-density avionics aircraft with sophisticated, computer-controlled, integrated weapons systems. They provide the operators of the individual stations the capability of monitoring logic analysis and signal flow data. They aid in maintaining mission capability and assist in rapid fault detection, and possible corrective action, while still airborne.

Airborne Missiles-Guided Weapons and Target and Drone Manuals

Because of the similarity of missiles and drones to aircraft, these manuals are prepared to the same general specifications as aircraft manuals. However, they are tailored to missile and drone specific functional application. These manuals cover basic description, theory and troubleshooting, checkout,

assembly, disassembly, maintenance, servicing and handling.

Airborne Missile Weapons Assembly Checklists

Airborne missile and weapons assembly checklists are an abbreviated, unclassified procedural reference. These checklists can be used as a guide for step-by-step assembly of missiles and weapons. They are provided as a convenient “line maintenance” reference document. The checklist manual is used as a backup in the event of difficulty.

Structural Repair Manual (SRM)

The SRM is used as a guide in making structural repairs to the airframe. It contains general information on airframe sealing, control surface rebalancing, general shop practices, damage evaluation and support of structure, and a description of the structure. Descriptions of structures are made by using indexed illustrations and repair drawings.

SRMs contain specialized repair information required by maintenance personnel to determine the extent of aircraft structural damage. It also contains instructions for performing a permanent or onetime flight repair.

Basic structural repair data, common to all aircraft, is released in a general engineering series manual, *General Manual for Structural Repair*, NAVAIR 01-1A-1. Aircraft structural repair manuals are prepared by the original design manufacturer. They contain aircraft specific information and are considered a supplement to the general series (01-1A) manuals discussed earlier.

The SRM for most new aircraft is published in two volumes because the volumes are used by different activities. Volume I is used by all levels of maintenance. Volume II supplements volume I, and contains information for use at intermediate- and depot-level facilities.

You can identify the SRM by a -3 in the manual code. The two volumes are further identified by an additional dash number; for example, NAVAIR-01-75PAA-3-1. This is the code for volume I of the SRM for the P-3A.

Each volume of the SRM is divided into sections. Section I contains general information. Each of the other sections contains more specific information. These sections cover portions of the aircraft, such as

wings, tail, fuselage, landing gear, and engines. There is also a section that covers typical repairs.

The scope of SRMs is being revised to expand and complement their application. The manuals are to be published as four volumes: (1) structural repair, (2) corrosion control, (3) nondestructive inspection, and (4) an illustrated parts breakdown (IPB).

Before you attempt to use the SRM, you should read the introduction in volume I. It includes information on how to use the manual.

NOTE: Since the formats of SRMs differ, the instructions on how to use a particular manual also may differ from other SRMs.

POWER PLANT MANUALS (02 SERIES)

Power plants are reciprocating engines, jet propulsion engines, jet propulsion/turboshaft engines, rocket-type jet engines and Auxiliary Power Units (APU). Organizational (installed) maintenance is covered in the power plants volume of the MIM that is prepared by the aircraft designer. However, intermediate and depot (uninstalled) information is defined in specialized engine publications prepared by the engine manufacturer. These manuals include information on intermediate servicing and repair, complete engine repair (CER), overhaul, and an IPB. In some cases, CER is supported by a deck of Complete Engine Repair Requirements Cards (CERRCs).

Unique to engine systems is a Three-degree, Gas Turbine Engine Repair Program at the intermediate maintenance level. Under this program, each engine intermediate maintenance manual defines specific engine maintenance actions as either first-, second-, or third-degree functions. Specific guidelines and responsibility information are provided in OPNAVINST 4790.2.

In most power plant manuals, the maintenance and service instructions manual is identified by a -2 or a -502 in part III of the NAVAIR publication number. These manuals contain all the information necessary for you to routinely service and maintain the engine models covered. They also include instructions for troubleshooting, dismantling, reassembling, and testing.

Under the NAVAIR publication numbering system, the overhaul instructions manual is identified by a -3 or a -503 in part III of the publication number. This manual

contains the instructions necessary for a complete overhaul of the engine (overhaul as performed by naval aviation depots). It is used by organizational and intermediate maintenance activities.

Under the NAVAIR publication numbering system, the IPB manual is identified by a -4 or a -504 in part III of the publication number. The IPB is divided into three sections—an introduction, a group assembly parts list, and a numerical index. The IPB illustrates, lists, and describes all parts and special SE necessary to maintain the particular engine model.

Under the TMINS numbering system, there are three basic types of engine manuals—one each for intermediate maintenance, depot maintenance, and an IPB. Several other special manuals are available for some engine models, but they usually apply to intermediate or depot maintenance.

AERONAUTICAL COMPONENT AND EQUIPMENT MANUALS

Aeronautical component and equipment manuals cover all types of aircraft accessory and related equipment. Some of the most common types are listed below:

- Accessory (03 series)
- Instrument (05 series)
- Armament/Ordnance (11 series)
- Electronics/Avionics (16 series)
- Machinery, Tools and Test Equipment (17 series)
- Ground Servicing and Mobile Equipment (19 series)

General component and equipment manuals can be prepared as individual intermediate or depot volumes, or as a combination. Occasionally, these manuals include general or specialized organizational data not included in the weapons systems series. However, organizational data appears in the prime weapons system manual whenever feasible. Design complexity, data volume, and the maintenance plan or engineering analysis determine the selection of content coverage and volume assembly.

If the equipment is of a highly complex design with variations in maintenance capability and support materials at different levels, the manuals are normally coded for separate intermediate- and depot-level coverage. However, when logistic support

requirements, workload procedures, and basic support equipment are similar at the intermediate- and depot-level, the manuals are coded for a combined intermediate- and depot-level publication.

SPECIAL APPLICATION TECHNICAL MANUAL SERIES

Technical manuals within this category contain operation and maintenance and/or procedures that apply to a variety of equipments associated with aircraft maintenance. Short descriptions of these types of manuals are contained in the following paragraphs.

Aircraft Hardware and Rubber Material (04 Series)

The 04 series manuals provide descriptive maintenance information on maintenance consumables, such as aircraft wheels and tires.

Electronics, Airfield Lighting and Related Accessories (08 Series)

These manuals provide information and instructions covering the installation, adjustment, operation, maintenance, and IPB of airfield lighting facilities for night operation at temporary or advanced air bases. The 08 series is being combined with the 16 series for electronics equipment. The 08 entry in the NAVSUP 2002 will refer you to the 16 entry.

Aviation Life Support Systems (ALSS) Manuals (13 Series)

The 13 series manuals provide information and instructions for operation and maintenance of all personal survival equipment. These manuals include instructions for ejection seats, parachutes, survival equipment, portable oxygen equipment, and anti-G and exposure suits. Manuals are provided for each item covering description, special tools, preparation for use, storage or shipment, operation instructions, inspection, maintenance, lubrication, troubleshooting, and an IPB. Each manual contains only those portions applicable to that item of equipment.

Standard Preservation and Packaging Information (15 Series)

The 15 series manuals provide instructions for the initial preservation treatment, procedures for maintaining preservation, procedures for depreserving

aircraft, uninstalled aircraft engines, and dangerous materials. They also contain instructions for long-term, extended shipment, short-term (fly away), and water damage or fire-fighting chemical damage types of preservation. Included in these manuals are required material and equipment and individual detailed preservation procedures for each component.

Electronics (16 Series)

Manuals in the 16 series are identified by a numbering system like the one used with aircraft manuals. It consists of a three-part designation that follows a prefix. The subdivisions of some of the 16 series manuals are discussed in the following paragraphs.

General. The general (NAVAIR 16-1 series) manuals publications of many types. The contents do not fit any other subseries. They include manuals that pertain to general maintenance practices, training manuals, design guidance data, etc. A complete list is available in the current index of each publication.

Radio and Radar. Manuals in the 16-5Q and 16-5S subseries pertain to older equipment. As such, they do not conform to present standardization formats. They include miscellaneous operation and maintenance data for radio and radar equipment.

Joint Nomenclature Electronic Test Equipment. Manuals found in this subseries normally appear in the standard format. One example of a manual in this subseries is the *Handbook Service Instructions for the Radio Sets AN/ARC-94, AN/ARC-102, AN/ARC-119, and AN/ARC-120*, NAVAIR 16-30ARC-94-1.

Support Equipment Manuals (17 and 19 Series)

Although Aviation Support Equipment Technicians (ASs) perform maintenance on support equipment, personnel in the other aviation maintenance ratings must operate the equipment. Therefore, operating instructions should be available.

The 17 series (machinery, tools, and test equipment) and 19 series (ground servicing and mobile equipment) of aeronautic technical publications cover most types of support equipment (SE). The manufacturer of each item of SE must furnish instructions for operating and maintaining the equipment throughout its service life. Like aircraft MIMs, these publications are prepared by the

manufacturer and issued under the authority of NAVAIRSY SCOM. SE manuals are stocked and listed the same as technical manuals.

DEPARTMENT OF DEFENSE PUBLICATIONS

Navy technical manuals, because of multiple application, are used jointly between other elements of the Navy, such as the Naval Sea Systems Command (NAVSEA), Space and Naval Warfare Systems Command (SPAWARSSYSCOM), and other services (U.S. Army and U.S. Air Force). These manuals normally carry the identification number of each using service. They are under the management control of the primary executive service, which can be easily identified because their publication code number will be the first listed on the cover. However, to simplify their identification and index listing, they are indexed in the NAVSUP 2002 by their NAVAIR or TMINS number.

AUTOMATION-TYPE TECHNICAL MANUALS

Automation-type technical manuals do not follow normal documentation practices and standards. They appear on paper or mylar punch tape, magnetic tape, molded templates, or film. Often, they are used with programmed automatic or semiautomatic test equipment. They are used to monitor the operation of the equipment. Policy for the management of these manuals is contained in NAVAIRINST 13630.1.

PLANNED MAINTENANCE SYSTEM PUBLICATIONS

Planned Maintenance System (PMS) publications consist of maintenance requirements cards (MRCs), periodic maintenance information cards (PMICs), checklists, and sequence control charts and cards (SCCs). These publications provide a basis for planning, scheduling, and complying with scheduled maintenance requirements. The requirements are scheduled with intervals, such as calendar time, flight or operating hours, or number of cycles or events based on the predominant failure mode. In instances where conflict exists among PMS publications and other directives, the PMS publication takes precedence. PMS publications are discussed in the following paragraphs.

Q27. What is the purpose of the "Technical Documentation List"?

- Q28. *What information does the NATOPS Flight Manual contain?*
- Q29. *What type of manual describes how to “fight” an aircraft?*
- Q30. *Which manuals prevent the need for duplication of standard practices in other manuals?*
- Q31. *What does the “-3” in the publication number 01-75PR4-3-1 indicate?*
- Q32. *Aeronautical component and equipment manuals, 03 series, cover information on what type of equipment?*
- Q33. *MRCs, PMCs, and SSCs provide a basis for planning, scheduling, and complying with scheduled maintenance requirements under what system?*

Phase/Daily/Special/Preservation/Conditional Maintenance Requirements Cards (MRCs)

Phase MRCs divide the total scheduled maintenance tasks into small packages (phases) of approximately the same work content, which are accomplished sequentially at specific intervals.

The remaining cards cover the minimum daily inspection requirements, as well as servicing and preservation, special inspections, and, if applicable, conditional inspections. Aircraft service period adjustment (ASPA) evaluations are conditional maintenance actions that are depot-level evaluations of an aircraft's general material condition.

Periodic Maintenance Information Cards (PMICs)

PMICs identify scheduled or forced removal items and their replacement intervals. They also contain a record of applicable technical directives, a maintenance requirements index, by system, and a conditional inspection listing.

Checklists

The checklist format for inspections provides maintenance personnel with abbreviated requirements for turnaround and preoperational inspections. The requirements cover those items necessary to determine obvious defects that may have occurred during each flight. Inspection requirements are consecutively numbered and sequentially arranged in logical working order.

Sequence Control Charts/Cards (SCCs)

SCCs aid the planning and accomplishment of scheduled and unscheduled maintenance tasks during inspections. SCCs, as an integral part of the maintenance program, provide a means of controlling the assignment of work and personnel. These SCCs indicate which MRCs are to be complied with, numbers and specialties of personnel required, times during which the separate jobs are scheduled for completion, POWER/AIR OFF or ON condition required during the work, and the area where the work is to be performed.

MANUFACTURERS' SERVICE BULLETINS AND MAINTENANCE DIGESTS

Service bulletins and other publications, such as maintenance digests, prepared by weapons systems and equipment manufacturers are neither authorized nor approved for distribution to naval personnel. Information of a technical nature furnished by weapons systems and equipment manufacturers, or their representatives, should not be used to perform maintenance on NAVAIR cognizant equipment. **Technical manuals or publications issued through the NAVAIR distribution system are the only documents authorized for operational or maintenance performance on naval aircraft and related equipment.**

AERONAUTICAL PERIODICALS

Naval activities and commands publish periodicals of interest to the aviation maintenance technician. Some of the most important publications (*Naval Aviation News*, *Approach*, and *Mech*) are discussed in the following paragraphs. These magazines are intended for the worker and contain excellent information. They should be available in the work center.

Naval Aviation News

The *Naval Aviation News* is published bimonthly for the Chief of Naval Operations (CNO) by NAVAIRSYSCOM and the Naval Historical Center. It provides information about aircraft training and operations, space technology, missiles, rockets, aviation ordnance developments, aeronautical safety,

aircraft design, power plants, aircraft recognition, technical maintenance, and overhaul procedures.

As its name implies, this publication is a news magazine. By reading it, you can keep up with the latest unclassified developments in naval aviation. In addition, the coverage of fleet operations, the human interest articles, and accomplishments of individuals (both officer and enlisted) make the *Naval Aviation News* an entertaining as well as an informative periodical.

Approach

Approach, the *Naval Aviation Safety Review*, is published monthly by the U.S. Naval Aviation Safety Center. It is distributed to all naval aeronautic organizations. *Approach* gives the most accurate information currently available on the subject of aviation accident prevention.

A large number of aviation accidents are maintenance induced; that is, they occur during the preparation for, performance of, and securing from maintenance. They may be the result of sloppy or improper maintenance.

Approach reports the results of accident investigations. For those accidents that are maintenance-induced, it describes what was done wrong and how it should have been done; suggests corrective measures to prevent future accidents resulting from these causes; and, when appropriate, cites aeronautic technical publications that provide authority for changes in techniques or materials to improve the maintenance product. In short, if you read and heed the messages in *Approach*, you will benefit from other mechanics' experience. Put *Approach* on your required reading list, and look for it every month.

Mech

Mech is published bimonthly by the U.S. Naval Safety Center. It is distributed to naval aeronautic organizations on the basis of one copy per 10 persons. It presents the most accurate information from aircraft accident reports, incident reports, medical officers' reports, and reports of special investigations of aircraft mishaps. The content is information, and it should not be considered as regulatory, as orders, or as directives. Any reference to commercial products does not imply Navy endorsement of those products. Currently, *Crossfeed* is an insert of *Mech*.

Q34. *Periodic Maintenance Information Cards (PMICs) identify what information?*

Q35. *What are the only documents authorized for operational or maintenance performance on naval aircraft and related equipment?*

SAFETY PUBLICATIONS

LEARNING OBJECTIVE: Identify safety-related publications that relate primarily to naval aviation.

Safety is always the responsibility of every Navy man and woman. A discussion of safety publications follows.

THE NAVAL AVIATION SAFETY PROGRAM, OPNAVINST 3750.6

The purpose of OPNAVINST 3750.6 is to preserve human and material resources. The first few chapters contain instructions regarding command aviation safety programs, pre-mishap planning, and reporting of hazards. The remaining chapters describe actions to be taken in case of an aircraft mishap, mishap classification, initial required reports, investigations, endorsements, and the monitoring of corrective actions to eliminate hazards. All naval aviation personnel should be familiar with this instruction.

NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) PROGRAM MANUAL, OPNAVINST 5100.23

This program provides policies and guidelines for administration of the NAVOSH program Navywide. The total program encompasses all safety disciplines, such as systems safety, aviation safety, weapons or explosives safety, off-duty safety, as well as occupational safety and health. The provisions of this manual apply to all Navy civilian and military personnel and operations ashore and afloat worldwide.

NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) PROGRAM MANUAL FOR FORCES AFLOAT, OPNAVINST 5100.19

As the title implies, OPNAVINST 5100.19, also referred to as the *Safety Manual Afloat*, contains safety precautions applicable to forces afloat. It contains information on aviation safety, and covers precautions

applicable to aircraft carrier flight and hangar deck operations. It is a valuable reference for planning a predeployment training program to qualify maintenance personnel for carrier operations.

NAVAIROSH REQUIREMENTS FOR THE SHORE ESTABLISHMENT, NAVAIR A1-NAOSH-SAF-000/P5100-1

The purpose of this manual is to provide, in one document, guidance on acceptable work place safety and health standards ashore that are to be implemented within the Naval Air Systems Command. You should study all safety instructions and make them a permanent part of your training syllabus.

- Q36. *What is the purpose of the Naval Aviation Safety Program, OPNAVINST 3750.6?*
- Q37. *What safety-related publication provides guidance on the administration of the NAVOSH program Navywide?*
- Q38. *What information is contained in OPNAVINST 5100.19?*
- Q39. *What is the purpose of the manual NAVAIROSH Requirements for the Shore Establishment, NAVAIR A1-NAOSH-SAF-00/P5100-1?*

TECHNICAL DIRECTIVE SYSTEM

LEARNING OBJECTIVE: Identify the Technical Directive System and how technical directives are updated, numbered, and categorized.

The Technical Directive (TD) System controls and issues all technical directives. This system standardizes the method of issuance for such directives. It is the only authorized means for directing the accomplishment and recording of modifications and onetime inspections of NAVAIR accepted equipment. The TD system is an important element designed to maintain equipment in a configuration that provides the optimum conditions of safety, operational, and material readiness. This system encompasses two styles of technical directives differentiated by their method of issue. The two styles are formal TDs (letter) and interim TDs (message). In general terms, they are both handled as letter technical directives. These directives contain instructions or information of a technical nature that cannot be satisfactorily distributed as revisions or changes to technical manuals. This information (instructions) is

distributed and classified into four TD types: changes, interim changes, bulletins, or rapid action minor engineering changes (RAMECs).

A change is a document containing instructions and information that directs the accomplishment and recording of a material change, a repositioning, a modification, or an alteration in the characteristics of the equipment to which it applies. A change directs that parts be added, removed, or changed from the existing configuration, or that parts or material be altered, relocated, or repositioned.

Normally, a change is issued as a formal (hard copy) document identified as a Power Plants Change (PPC), Airframe Change (AFC), Support Equipment Change (SEC), etc.

An interim change is a technical directive issued by message or message format letter that dictates urgent dissemination.

A bulletin is an interim document comprised of instructions and information that directs a onetime inspection to determine whether a given condition exists. It specifies what action is to be taken if a given condition is found or not found.

A rapid action minor engineering change (RAMEC) is a message TD, which provides for quick action on minor changes that offer significant advantages to the operating forces. NAVAIRINST 5215.10 contains complete information on the RAMEC program. Management and procedure functions of the NAVAIR RAMEC TD system are described in *NAVAIRSYSCOM Technical Directives System*, NAVAIR-00-25-300.

- Q40. *What is the purpose of the Technical Directive System?*
- Q41. *What are the two styles of Technical Directives (TDs)?*
- Q42. *What are the four types of instructions to be distributed under the Technical Directive System?*
- Q43. *A technical directive issued by message or message format letter that dictates urgent dissemination is known as what type of change?*
- Q44. *An interim document that directs a onetime inspection to determine if a given condition exists is known as what type of technical directive?*
- Q45. *What is a rapid action minor engineering change (RAMEC)?*

TECHNICAL DIRECTIVE UPDATING METHODS

Sometimes, a change or bulletin is not the complete answer to a problem, and it is necessary to amend or revise a current directive.

An amendment clarifies, adds to, deletes from, makes minor changes to, or cancels an existing technical directive. It only supplements the existing directive and not a complete directive in itself. A maximum of three amendments may be applied to a TD, each remaining in effect until rescinded or superseded. A requirement for further amendment action requires the issuance of a revision.

A revision is a completely new edition of the existing directive. It supersedes the original directive or revision and all existing amendments.

TECHNICAL DIRECTIVES (RESCISSION/SUPERSEDURE/ CANCELLATION/AMENDMENT)

In this section, rescissions, supersedures, cancellations, and amendments are discussed.

A rescission is the process by which TDs are removed from active files after requirements have been incorporated. Final rescission action is directed in NAVSUP 2002. Activities maintaining active technical libraries should maintain the TDs on file until they are deleted from the NAVSUP 2002 index.

A supersedure is the process by which interim changes are removed from active files after a formal TD has been issued.

A cancellation is the process by which a TD is removed from the active files. A TD is canceled if it is determined that a previously issued TD is not to be incorporated. TDs are canceled by an amendment to the TD. The cancellation explicitly states the required configuration of each article initially specified for modification; for example, whether installed modifications are to remain installed or whether they are to be removed.

TD TITLES AND NUMBERING

There are many title subjects of changes and bulletins. A few example titles are as follows:

- Power Plant (PPC, PPB)—The last letter identifies the TD as a change (C) or bulletin (B)
- Avionics (AVC, AVB)

- Aviation armament (AAC, AAB)
- Support equipment (SEC, SEB)
- Airborne weapon (AWC, AWB)
- Accessory (AYC, AYB)

The following are examples of the numbering system:

- Aviation Armament Change No. 537
- Support Equipment Change No. 1299
- F- 14 Interim Airframe Change No. 261
- F- 14 Interim Airframe Bulletin No. 111

The numbering system is a consecutive numerical application. For example, Avionics Change 204 would be the 204th avionics change issued.

The numbers assigned to changes and bulletins are provided by the Technical Directive Control Center, which is located at the Naval Air Technical Services Facility (NATSF). Changes or bulletins that have been amended will have their basic number followed by the words “Amendment 1,” “Amendment 2,” etc. A revised directive will have the basic directive number followed with the words “Rev. A.” “Rev. B,” as appropriate, to denote the first or second revision to that basic directive.

The changes and bulletins are automatically distributed to the concerned activities. All TDs are issued by NAVAIR or NATSF, except in cases where the time delay in obtaining approval is unacceptable. In such cases, the controlling custodians are authorized to issue interim TDs to prevent unacceptable risks to personnel or equipment. The changes or bulletins are generally based on contractor service bulletins, other letters of recommendations, or proposed modifications from field service activities.

TECHNICAL DIRECTIVE CATEGORIES

Technical directives are assigned a category according to the importance and urgency of accomplishing the work involved. A category of immediate, urgent, routine, or record purpose is assigned to each technical directive.

Immediate action TDs are issued when an uncorrected, unsafe condition exists that could result in fatal or serious injury to personnel, or extensive damage to or destruction of valuable property. These unacceptable risks require immediate action to either ground aircraft, prevent launch of missiles, or deny use of related support equipment or munitions.

Urgent action TDs are issued under the governing factors of combat necessity or hazardous conditions that could result in injury to personnel, damage to valuable property, or unacceptable reductions in operational efficiency. These safety and material risks are acceptable only within definite time limits. When compliance is not accomplished within these time limits, urgent action TDs require that affected aircraft be grounded, and that the use of any missiles, munitions, equipments, or materials involved be discontinued.

Routine action TDs are used to authorize, accomplish, or modify only. They are issued when conditions embody risks acceptable within broad time limits. If uncorrected, these conditions could constitute a hazard through prolonged use, have a negative effect on operational efficiency, reduce tactical or support utility, or reduce operational life or general service use of systems or equipment. Routine action is not assigned to bulletins.

Record Purpose is used to confirm a modification that has been completely incorporated by the contractor or in-house activity in all accepted equipment (before issuance of the TD). This category is not used to formalize interim changes, assign message TDs, or to assign bulletins.

- Q46. *What are the two methods of updating a technical directive?*
- Q37. *Define a rescission.*
- Q38. *How long should an activity maintain a TD on file?*
- Q49. *How are TDs cancelled?*
- Q50. *What activity assigns the numbers for changes and bulletins?*
- Q51. *When an uncorrected, unsafe condition exists that could result in serious injury to personnel or damage or destruction of property, what category of TD is issued?*
- Q52. *What category of technical directive is issued to complete an action that, if uncorrected, could constitute a hazard through prolonged use?*
- Q53. *What category of TD is used to confirm that a modification has been completely incorporated by the contractor or in-house activity in all accepted equipment?*

TECHNICAL PUBLICATIONS LIBRARY PROCEDURES

LEARNING OBJECTIVE: Recognize the procedures followed by central and dispersed technical libraries.

The aeronautical technical publications library (TPL) serves two important functions. First, it serves as a centralized source of up-to-date information for all mechanics and technicians. Second, it gives all personnel an excellent source of reference material to help with personal training and individual improvement. To do the job, the TPL contains copies of all technical manuals that apply to an activity's assigned aircraft, its related systems and equipment, and the level of maintenance involved.

Each aviation maintenance activity operates TPL services to support local operations and maintenance. A central TPL (CTPL), once established, controls technical publication activities within the command. This includes the setting up and operation of dispersed libraries. The QA division has overall management responsibility for the technical library. The paragraphs that follow discuss the functions of the central and dispersed libraries.

CENTRAL TECHNICAL PUBLICATIONS LIBRARY (CTPL)

When an activity needs more than one library, it sets up a CTPL. This CTPL manages the technical publications in the activity. The CTPL is responsible for determining the activity's publication needs. The CTPL also procures and distributes publications and provides for the security, maintenance, and updating of all the technical publications. The CTPL is the activity's point of contact with NATSF and Naval Aviation Supply Office (ASO).

DISPERSED LIBRARY

When an activity with a central library has other technical libraries within the command, these other libraries are called dispersed technical publications libraries (DTPL). The CTPL manages these dispersed libraries. The CTPL also provides initial outfitting and issues updated material to DTPLs. The CTPL holds the DTPLs responsible for the storage and availability of publications that it issues to them. If a DTPL needs additional information on a subject or technical

manual, the library requests the information or manual through the CTPL.

INITIAL OUTFITTING

Initial outfitting is a onetime supply action for the technical manuals of a weapons system. ASO, Naval Publications and Forms Directorate, provides the basic publication and all the changes.

For mission-essential publications, the central library submits the automatic distribution requirements listing (ADRL). The ADRL is a tool of the NATSF Technical Publications Library (TPL) Program.

There are two types of publications initial outfitting allowance lists. They are the General Aeronautical Publications List and the Aeronautical Publications By Weapons System List.

The General Aeronautical Publications List includes publications and directives of a general nature that have no application to a specific weapons system.

The Aeronautical Publications by Weapons System List includes publications and directives that apply to a specific weapons system or equipment. This list can be further divided by level of maintenance; for example, organizational, intermediate, or depot.

PUBLICATIONS MANAGEMENT

NOTE: Commands functioning with minimal publications (10 or less) and no automatic data processing (ADP) support may use the older Naval Warfare Publication Library (NWPL) system for publication management rather than the Technical Publications Library Program.

CTPL personnel manage all libraries aboard a particular activity. The central and dispersed libraries work as a team.

Central Technical Publications Library Stamp

All publications and changes, including TDs received by the CTPL, are marked with an identifying stamp for inventory control. The stamp identifies and numbers all controlled publications. As a minimum, the stamp includes the name of the activity, the publication copy number, and location of the publication. On basic and revised publications, this information is stamped on the title page where the date

of publication appears. On changes and technical directives, the information is stamped on the first page of the publication.

Change Entry Certification Record (CECR)

The Change Entry Certification Record (CECR), OPNAV Form 5070/12, (fig. 2-23) ensures that changes and revisions to technical publications have been issued and incorporated in a timely manner. Library personnel distribute the change data. Change or revision material must reach all dispersed librarians who hold a copy of the affected publication or directive. The holder incorporates change pages in the affected publication.

The CTPL librarian prepares a CECR form. Dispersed librarians regularly pick up CECR forms and the change materials. The dispersed librarian acknowledges receipt for the materials by signing part 1 of each CECR. The central librarian then dates and files part 1 of the CECR in a 2- to 5-day tickler file. When the dispersed librarian completes the change, he or she signs part 2 of the CECR form and returns it to the central librarian. He or she also returns the pages that were removed from the affected publication with the completed CECR. Appropriate security measures are followed when classified material is returned. The central librarian receives the completed part 2 of the CECR and annotates it with the date received, and then files it for use in the next audit of the dispersed library. The central librarian then updates the NWPL catalog card. After completion of the next quarterly audit of the dispersed library, the central librarian disposes of all part 2 copies of the CECRs that were issued.

TECHNICAL LIBRARY AUDIT

The QA division audits the CTPL at least annually. QA does additional audits when any change in mission of aircraft assignment occurs, when a CTPL clerk is replaced, or when directed by higher authority. The librarian for the CTPL (as a minimum) inventories all CTPL publications by using TPL Program inventory list as the primary inventory tool.

Discrepancies to the inventory list must be corrected as they are detected. Other audit responsibilities are performed at this time. This means each publication must be stamped, arranged alphanumerically, and have its binder annotated. The verified NWPL catalog cards of the inventory list should be compared with the latest copy of NAVSUP

* G. P. O.: 1982-805-7-34

SHORT TITLE (1)	COPY NO. (2)	CHANGE OR CORRECTION (3)
REMARKS: (4)		
<p><i>I acknowledge receipt of the above change or correction and certify that this change or correction will be entered within five (5) working days and that the superseded pages will be returned in the Naval Warfare Publications Library.</i></p>		
SIGNATURE (5)	DATE (6)	
PART 1 S/N 0107-LF-050 7062		
<p><i>I certify that the above change or correction has been entered and the list of effective pages was checked against the contents of the basic publication, and the superseded pages and residue of the change were returned to the Naval Warfare Publications Library.</i></p>		
NOTE: Missing pages or other defects should be reported in the REMARKS space above.		
SIGNATURE (7)	ENTRY DATE (8)	
PART 2 S/N 0107-LF-050-7062		
CHANGE ENTRY CERTIFICATION OPNAV 5070/12 (REV. 1-79)		RETURN TO NAVAL WARFARE PUBLICATIONS LIBRARY

AMR00036

Figure 2-23.—Change Entry Certification record.

2002 for currency, and a requisition must be prepared for any changes needed to update the CTPL. Complete verification and audit requirements are contained in NAVAIR 00-25-100. The central library audits dispersed libraries at least quarterly to ensure that their publications are current and in good material condition.

- Q54. *What division has overall management responsibility for the technical library?*
- Q55. *In an activity with more than one publications library, who is responsible for determining the activity's publication needs?*
- Q56. *When a central library has other technical libraries within the command, these libraries are known as what type of libraries?*
- Q57. *What list includes publications and directives of a general nature that have no application to a specific weapons system?*

- Q58. *What list includes publications and directives that apply to a specific weapons system or equipment?*
- Q59. *What is the purpose of the central technical publications library stamp?*
- Q60. *What form does the CTPL use to ensure that changes and revisions to publications are incorporated in a timely manner when issued to a dispersed library?*
- Q61. *How long are part 2 copies of the CECR maintained by the central librarian?*
- Q62. *To ensure their publications are current and in good material condition, the central library audits dispersed libraries at least how often?*

**TECHNICAL PUBLICATION
DEFICIENCY REPORT (TPDR)**

LEARNING OBJECTIVE: Identify the procedures used in reporting technical publication deficiencies.

The Technical Publication Deficiency Report (TPDR) is used to improve the quality and accuracy of technical manuals. Personnel can use this program to report errors and discrepancies found in technical manuals. These deficiencies include, but are not limited to, printing and grammatical errors, omissions, and microfilm deficiencies, such as film density and legibility.

All routine technical publication deficiencies are reported on the Technical Publications Deficiency

Report, OPNAV Form 4790/66 (fig. 2-24). The deficiencies and recommendations are described on this form. The original of the completed form is sent to NATSF. A copy is sent to the cognizant field activity (CFA). Since NATSF acts as the central manager of all technical publications, it maintains a record of all technical manual deficiencies reported and acknowledges receipt of each deficiency report to the originator. Additionally, NATSF coordinates with the CFA to determine if each deficiency is valid or

TECHNICAL PUBLICATIONS DEFICIENCY REPORT									
NAVAIRTECHSERV/VAC USE ONLY			a. QA SEQUENCE NO.	b. DATA MANAGER CODE	c. CFA/PRIME CODE				
1. REPORTING ACTIVITY			2. REPORT CONTROL NUMBER						
			3. REPORT DATE (YR/MO/DA)	4. WEAPON SYSTEM APPLICATION	5. DISCREPANCY CODE				
6. TECHNICAL MANUAL NUMBER			7. TECH. MAN. DATE		8. CHG. NO. & DATE		9. W/P NO.		
10. SEC/PG NO.	11. PARA NO.	12. FIG/TBL NO.	13. CART. NO.		14. CART. DATE		15. FRAME NO.		
16. DEFICIENCY									
SAMPLE									
17. RECOMMENDATIONS									
18. IMPACT									
19. MEDIA EVALUATED: (Only one check block is requested per item)									
<input type="checkbox"/> FILM <input type="checkbox"/> PAPER <input type="checkbox"/> PAPER & FILM									
REMARKS									
20. REPORTED BY (Name, rank/rate)					21. RELEASED BY (Name, rank/rate)				
AUTOVON					AUTOVON				
OPNAV 4790/66 (REV. 5-88)			SN 0107-LF-002-4400			INSTRUCTIONS ON REVERSE SIDE			

AMR00037

Figure 2-24.—Technical Publication Deficiency Report (TPDR), OPNAV 4790/66.

invalid, and provides a follow-up on each deficiency report to ensure the appropriate action is taken.

All technical publication deficiencies that meet the criteria for safety messages must be submitted in the prescribed message format. You should refer to the *Naval Aviation Maintenance Program*, OPNAVINST 4790.2, for the format and content of the message and the procedures for filling out OPNAV 4790/66.

Discrepancies or change recommendations of a routine nature concerning the technical content of a NATOPS or tactical type of manual deficiency are submitted on a NATOPS/Tactical Change Recommendation, OPNAV Form 3500/22, and submitted to the cognizant NATOPS and/or tactical model manager. Changes of an urgent nature should be submitted directly to the NATOPS advisory group member, through the chain of command, by priority message.

Q63. What report is used to improve the quality and accuracy of technical publications?

Q64. What manual provides format and content of the information required in a technical publications deficiency report?

SUMMARY

This chapter discussed the different types of publications and manuals as well as the methods used in updating them. However, it is beyond the scope of this manual to cover each type of Navy publication. We have attempted to cover the main manuals, directives, and indexes that will aid you in your daily tasks. You are not expected to be an expert in all areas of your job. With the correct use of publications, however, you can be knowledgeable. When in doubt, look it up. It goes without saying that the most updated information and resources must be maintained by you, the technician. If you're working from memory, then you're in doubt. Things change rapidly, and you can only be sure by looking it up. You, the technician, should be aware of the changed materials and methods. Be a good example, not a statistic of ignorance. Use your publications.

ANSWERS TO REVIEW QUESTIONS

- A1. *Technical publications.*
- A2. *NAVAIR 00-25-100, Naval Air Systems Command, Technical Manual Program.*
- A3. *Military Specifications and commercial.*
- A4. *Two major types-operational and maintenance.*
- A5. *By function and task.*
- A6. *Visible lock-on format, logical arrangement structure, and quick understanding.*
- A7. *The 7-digit WP number and the page within the work package.*
- A8. *A change issues correction pages for an existing technical manual, and a revision is the complete reissue of the entire technical manual with the changes incorporated.*
- A9. *Technical publication deficiency reporting program.*
- A10. *Routine and Rapid Action Changes.*
- A11. *To help the user insert new pages and maintain a record of current pages.*
- A12. *To allow data to be added or changed without making a direct impact on existing information.*
- A13. *The numerical index of effective work packages.*
- A14. *Capital letter suffixes are added to the number of the preceding illustration or table.*
- A15. *To expedite the dissemination of urgent operation and maintenance change information.*
- A16. *Two. The NAVAIR (NA) numbering system and the newer Technical Manual Identification Numbering System (TMINS).*
- A17. *Part I.*
- A18. *Two. The publication identifier (PI) and the suffix.*
- A19. *The third group.*
- A20. *The technical manual (TM) identifier.*
- A21. *That this publication is a maintenance instruction manual.*
- A22. *In most cases the QA required inspections are shown in italics; in some cases those requirements are underlined.*
- A23. *Illustrated Parts Breakdown (IPB).*
- A24. *Six.*
- A25. *Naval Aeronautical Publication Index (NAPI).*
- A26. *Quality assurance division.*
- A27. *To provide information concerning the availability and applicability of technical manuals for maintenance of a particular aircraft model.*

- A28. *Complete operating instructions for a specific aircraft and its operational equipment.*
- A29. *Tactical manual.*
- A30. *General engineering series manuals (01-1A).*
- A31. *Part III is the "type manual. "A "-3" in this position indicates a structural repair manual.*
- A32. *Accessories.*
- A33. *Planned Maintenance System (PMS).*
- A34. *Scheduled or forced removal items and their replacement intervals.*
- A35. *Technical manuals or publications issued through the NAVAIR distribution system.*
- A36. *To preserve human and material resources,*
- A37. *Navy Occupational Safety and Health (NAVOSH) Program, OPNAVINST 5100.23.*
- A38. *Safety precautions applicable to forces afloat.*
- A39. *To provide guidance on acceptable workplace safety and health standards ashore within the Naval Air Systems Command.*
- A40. *It controls and issues all technical directives.*
- A41. *Formal TDs (letter) and interim TDs (message).*
- A42. *Change, interim change, bulletin, and rapid action minor engineering change (RAMEC).*
- A43. *Interim change.*
- A44. *A bulletin.*
- A45. *A message TD, which provides for quick action on minor changes that offer significant advantages to the operating forces.*
- A46. *An amendment and a revision.*
- A47. *The process by which TDs are removed from active files after requirements have been incorporated.*
- A48. *Until it is deleted from the NAVSUP 2002 index.*
- A49. *By an amendment to the TD.*
- A50. *The Technical Directive Control Center at the Naval Air Technical Services Facility.*
- A51. *Immediate action TD.*
- A52. *Routine action TD.*
- A53. *Record purpose.*
- A54. *The quality assurance division.*
- A55. *The central technical publications library (CTPL).*
- A56. *Dispersed technical publications libraries (DTPL).*

- A57. *General Aeronautical Publications List.*
- A58. *The Aeronautical Publication by Weapons System List.*
- A59. *The stamp identifies and numbers all controlled publications.*
- A60. *The Change Entry Certification Record (CECR).*
- A61. *Until completion of the next quarterly audit.*
- A62. *Quarterly.*
- A63. *Technical Publications Deficiency Report (TPDR).*
- A64. *Naval Aviation Maintenance Program, OPNAVINST 4790.2.*

CHAPTER 3

AVIATION SUPPLY

Previous chapters introduced you to some of the purposes for the various levels of maintenance and the associated maintenance reports and publications. This chapter discusses the actions you perform that affect the logistics support (supply) of your activity.

ORDERING AIRCRAFT REPLACEMENT PARTS

LEARNING OBJECTIVES: Identify the purpose and composition of Project/Priority codes. Define the purpose of Force/Activity and Urgency of Need Designators. Describe how the supply department justifies stocking replenishment items.

The information you provide so readily about your car cannot be given as easily about aircraft parts. Therefore, the Navy has shop supervisors and material specialists, Aviation Storekeepers (AKs), available to help you identify components and bits and pieces of components. The AK is the representative of the aviation supply department, and fills a position similar to that of the clerk in the automobile parts store.

Remember how you removed the broken water pump from your car and obtained a replacement for it? The clerk in the parts store ordered the part by filling out a form or even more recently, responding to questions asked by a computer. When you discover a part on an aircraft that needs replacement, you order that part on a Visual Information Display System/Maintenance Action Form (VIDSMAF) or in Naval Aviation Logistics Command Management Information System (NALCOMIS).

When entering data on the VIDS/MAF (a 5-part form), you must use a black ballpoint pen. Press hard so that all copies are readable, and PRINT LEGIBLY. Failure to write clearly cannot only cause receipt of the wrong part, but the AK might order an item that costs thousands of dollars simply because YOU DID NOT WRITE A PART NUMBER CLEARLY. There are many reasons for mistakes. Often: mistakes are as simple as a transposed part number or NSN. The lack of a dash number (-1, -2, -3) can cause supply to put the next higher assembly on order.

When entering a part number, you need to make sure that the part number is 100-percent correct. DO NOT GUESS! You should use the publications available and, if in doubt, ask for help. Not all items for a particular type of aircraft are interchangeable. Some examples of differences are different part numbered items for different models of the same type of aircraft, and different dash numbers in a part number to designate which side (left-hand or right-hand) an item is designed for.

PROJECT AND PRIORITY CODES

Once your work center determines that a part is required, maintenance control assigns the Project and Priority codes that material control uses to requisition the part.

Project Codes

Project codes identify requisitions and related documents that apply to specific projects or programs. They are mandatory on Navy requisitions. Their absence is cause for rejection.

The codes consist of a combination of three codes (alpha/alpha/numeric) constructed from a matrix that relates to the type of activity or weapon, the reason, and the cause/effect (fig. 3-1). Some commonly used Project codes in an organizational maintenance activity are as follows:

- **AK0.** Assigned by organizational maintenance activities only when they requisition material to restore an aircraft to mission capable (MC) status.
- **AK7.** Assigned by organizational maintenance activities when they requisition material to return mission essential subsystems to an operational condition when an aircraft is in a partial mission capable (PMC) status,
- **ZA9.** Forced high-time removal items required for immediate end use on primary mission weapons systems. The aircraft concerned is within days of becoming not mission capable supply (NMCS) or partial mission capable supply (PMCS) due to high time forced removal of the required item (15 days in CONUS and 20 days outside continental limits of the United

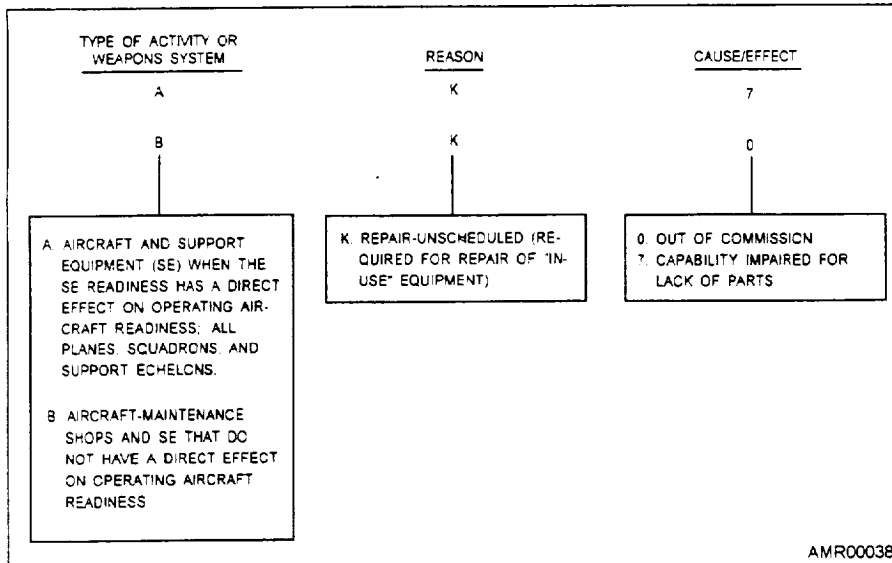


Figure 3-1.—Project code breakdown.

States [OUTUS]). After meeting the established time limit, organizational maintenance activities modify it to AK0 or cancel it.

For a complete listing of Project codes, refer to the *Operating Procedures Manual, MILSTRIP, Military Standard Requisitioning and Issue Procedures. MILSTRAP, Military Standard Transaction Reporting and Accounting Procedures*, NAVSUP Publication 437 (also known as *MILSTRIP/MILSTRAP Manual*), and *Afloat Supply Procedures*, NAVSUP Publication 485.

Force/Activity Designator (FAD) and Priority

Maintenance control assigns a priority to individual material requisitions according to the military importance and the urgency of need of the item. Most fleet operational activities have a FAD II or III assigned.

Maintenance control in the requisitioning activity determines the urgency-of-need designator (A, B, or C). The requisitioning activity uses the FAD and urgency-of-need to determine the Uniform Material Movement and Issue Priority System (UMMIPS) priority designator (Arabic numeral) (table 3-1).

NOTE: Abuse of the priority system weakens the effort that the supply system devotes to units directly involved in combat.

SUPPLY PROBLEMS AND SOLUTIONS

The discovery of a leaking valve or an inoperable radio will cause a problem for your squadron. Think of the number of people that this one discrepancy will affect. Once the requirement is passed to material control, the AK contacts the aviation support division (ASD) or the supply support center (SSC). If you filled out the VIDS/MAF correctly, you should receive a replacement part. If your squadron or activity has a FAD I designation and the part is available on station, you should have the replacement part within 1 hour.

Almost all items used by the Navy have NSNs. If you give an incorrect part number to material control and the part is not available locally (on the station or ship), the AK will cross-reference the NSN to the wrong item, and the order will not meet your requirements. The most common result of this type of error is additional downtime (nonflyable status) for the aircraft you are trying to repair. When the wrong part arrives at your squadron, you must reorder the part and use the correct part number. Then, you must wait while supply processes the order again. Another situation that might occur when a wrong part number is cross-referenced to an NSN is the awarding of a contract to manufacture parts that are not needed.

When repairing aircraft, your paperwork must be complete and accurate because data from the paperwork provides usage statistics. The supply department uses these statistics to justify the need to stock an item.

Table 3-1.—Priority Number Chart

"Force/Activity" Designators	"Urgency-of-Need" Designators		
	A Unable to perform	B Impairs capability	C Routine
I Combat	1	4	11
II Positioned	2	5	12
III Ready	3	6	13
IV Reserve and support	7	9	14
V Others	8	10	15

All personnel in the repair process must take pride in the ability to repair the part, translate what is wrong with the broken part, and obtain the required repair parts. The pride and professionalism this involves will pay off in many ways, especially when a squadron can report that all the aircraft are ready for a mission or commitment. Everyone should strive for ZERO NMCS.

- Q1. State the composition of the Project code.
- Q2. What FAD is assigned to most fleet operating activities?
- Q3. Aircraft repair usage statistics are used by the supply department for what purpose?

MATERIAL IDENTIFICATION

LEARNING OBJECTIVE: Identify and understand the terminology used in aviation supply.

If all publications and all types of situations were presented here, this training manual (TRAMAN) would be extremely large. Therefore, this chapter

covers the typical research that you and your squadron AK can effectively perform.

TERMINOLOGY USED IN THE SUPPLY CATALOGING SYSTEM

Before you can find information, you must understand supply terms. The terms listed below are some common supply terms.

Alphanumeric sequence. An alphanumeric sequence begins at the extreme left-hand position of a number and continues from the left to the right, one position at a time, until all digits have been considered. The order of digit precedence for the part number begins at the left and moves to the right. It begins with A, and then the other letters in alphabetic sequence through Z. (The letter O is considered a numeric zero.) After the letter Z, the numbers 0 through 9, in sequence, have precedence. Diagonal lines (/), points (.), and dashes (-) can be used in the second or succeeding positions of the part number. When used, they take precedence over letters and numbers, and come before the other part numbers that have letters or numbers.

The following is a two-column example of part numbers in alphanumeric sequence. Read all part numbers in the left column first, then start at the top of the right column.

<u>Column 1</u>	<u>Column 2</u>
AN515-25	123-1347
AN515A21	123C1121
A506-26	223476
B-24376	23A176
B1234	232176
C.24-60789	23176
C-2467089	33126
C/2460789	33-126
DBC16789	943762
D156789	95672A2
Z-14073	95673-2
Z/24076	992468A3

Numeric sequence. The numeric sequence for a part number also begins at the extreme left position and continues from left to right, one position at a time.

Manufacturer's part number. The manufacturer assigns this number. It is stamped, etched, or attached to the part or applicable container. All illustrated parts breakdown (IPB) manuals, stock catalogs, and equipment lists use part numbers. The Navy publishes several cross-reference catalogs. These let you cross-reference part numbers to NSNs or NSNs to part numbers. There are two types of part numbers—definitive and nondefinitive.

Definitive part numbers also are called “identifying” part numbers. The identifying part number appears in Navy cross-reference catalogs with only one NSN for both the part number and the Commercial and Government Entity Code (CAGE).

Nondefinitive part numbers cannot be directly related to an applicable NSN without the use of additional information. Thus, the same part number and CAGE together may have two or more applicable NSNs. Some conditions that cause this are the size or color of the item. More identifying data can be obtained from the *Afloat Shopping Guide* (ASG), which is discussed later in this chapter.

Commercial and Government Entity Code (CAGE). The CAGE is a five-digit number the federal

government assigns to activities, such as manufacturer, vendor, or government agencies. It identifies the agent or agency that has design control over an item. CAGE codes are also known as vendor's codes or manufacturer's codes. CAGE codes are important in the identification of material. For example, the same part number may be listed in a cross-reference catalog four or five times with a separate NSN for each part number listed. If the CAGE is known, it is easy to order the correct item. When you know only the name of the manufacturer and need to find the CAGE code for a manufacturer, ask the AK for assistance. A microfiche kept in material control cross-references the name of a manufacturer to the manufacturer's CAGE code. Also, the AK can cross-reference the CAGE code back to the manufacturer's name.

Description. In a supply catalog, the description will be at least the noun name. It may also contain the type of alloy or material the part is made of; the outside/inside diameter; type of thread, head, and grip (in the case of screws); the watts, ohms, number and type of terminals (in the case of electronic parts); or the pressure and chemicals that aircraft hoses are made to withstand.

Repairable. The inventory manager for a part assigns Material Control codes to each part. Material Control codes D, E, G, H, Q, or X identify mandatory turn-in repairables (MTRs) that must be turned in to the local supply department when they become unserviceable. These components are then repaired (thus the term *repairable*) and returned to the supply system for issue against future requests for the same item.

Next higher assembly. The term *next higher assembly* refers to the part, component, or system in which the requisitioned part is used. For example, an electronic circuit board for the repair of a receiver-transmitter is plugged directly into the chassis of the receiver-transmitter. In this case, the receiver-transmitter is the next higher assembly for the circuit board. On the other hand, if the circuit board were made up of several resistors and capacitors, the circuit board would be the next higher assembly for the component parts.

- Q4. What are the two types of part numbers?
- Q5. What is the correct nomenclature for what is commonly referred to as the "manufacturer's code"?
- Q6. What term is used for a part, component, or system in which the requisitioned part is used?

MATERIAL NOT IN CATALOG SYSTEMS

LEARNING OBJECTIVE: Describe the publications used by the maintenance technician to order replacement parts.

At times you will need a part that is not subject to the cataloging system and cannot be identified by an NSN. You must describe your requirement for a part not identified by an NSN in terms familiar to the supplier. If you can provide the following information about the part to supply, you will have supplied enough information for supply to requisition the needed part. In most situations, the information required can be found in the illustrated parts breakdown (IPB) or the maintenance instruction manual (MIM).

- Name of the manufacturer of the part or the CAGE code.
- Part number.
- Nomenclature (noun name).
- Description of specific application, including the model aircraft, engine, accessory, or other end assembly where the part is used.
- Source, Maintenance, and Recoverability (SM&R) code and reference, if available. (SM&R and reference are dealt with later in this chapter.)
- The NSN or part number of the next higher assembly.

USE OF MAINTENANCE MANUALS

Maintenance manuals can provide you with useful supply information. Along with repair information, they provide the following additional information:

- A picture of the desired part
- Interchangeability, equipment application, and next higher assemblies
- Bureau numbers of aircraft and serial numbers of equipment on which a part is used
- CAGEs
- The number of times a particular part is used on a component
- Parts kits needed for repair
- Source codes or SM&R codes

- Justification for buying aircraft parts or support equipment (SE) parts

ILLUSTRATED PARTS BREAKDOWN (IPB)

An IPB is prepared by the manufacturer for each model aircraft, engine, accessory, electronic equipment, or other aeronautical equipment purchased for the Naval Air Systems Command (NAVAIR). The IPB helps supply and maintenance personnel identify and order replacement parts for the aircraft or equipment. The IPB shows and lists procurable assemblies and detail parts so you can quickly identify assemblies and their components. Items are arranged in assembly breakdown order, with the illustrations placed as near as possible to their listing.

Slight format variations exist among IPBs. However, each includes an introduction, a table of contents or alphabetical index, a group assembly parts list, and a numerical index.

Introduction

The introduction includes general information and instructions for using the publication. Refer to it before using an unfamiliar IPB. The introduction of a single volume IPB is at the front of the publication. In multivolume IPBs, the introduction is usually in the same volume as the numerical index. The introduction provides the following types of information.

- Table of contents or alphabetical index.
- Listing of supplementary handbooks.
- Procedures on using that particular IPB.
- Definition of columns and terms used in the group assembly parts list section of the IPB.
- Brief explanation and listing of applicable technical directives (TDs) to the IPB.
- Information concerning the arrangement of the numerical index section.
- Explanation of SM&R and "Usable On" codes used in the IPB. This is particularly useful when problems arise with cross-referencing a part number to an NSN.

Alphabetical Index or Table of Contents

The alphabetical index or table of contents shows the breakdown of the publication by sections. It is an

alphabetical listing of assemblies and lists the pages or figure numbers where they are shown.

In some IPBs, especially one-volume IPBs, the alphabetical index is the first part of the publication. The alphabetical index lists the general contents of each volume. Then, each volume has its own alphabetical index that defines the contents of that

particular volume. Figure 3-2 shows a page from the alphabetical index of a landing systems IPB.

As seen in figure 3-2, the alphabetical index lists the main parts of the systems. Figure 3-2 lists the different component breakdowns of the landing gear systems. Beside each item in the index is the figure number of the assembly parts list where that particular

NAVAIR 01-XXXXXX-X-X-X		INDEX
Change 5 - 1 September 1987		Page 1 of 14
ALPHABETICAL INDEX		
ORGANIZATIONAL MAINTENANCE		
ILLUSTRATED PARTS BREAKDOWN		
LANDING SYSTEMS		
This Index supersedes Index, dated 1 April 1986.		
Title	Figure Number	
Nose Landing Gear System	027-00	
NLG Actuator	033-00	
NLG Aft Door Linkage	027-00	
NLG Downlock Actuator	032-00	
NLG Drag Brace	027-00	
NLG Drag Brace Fairing	027-00	
NLG Forward Doors	027-00	
NLG Sequencing Control Valve	038-00	
NLG Shock Strut	027-00	
NLG Timer Valve and Check Valve	034-00	
NLG Uplock and Forward Door Actuator	030-00	
NLG Uplock Mechanism and Forward Door Linkage	027-00	
Nose Strut Position Switch	042-00	
Nosewheel	046-00	
Nosewheel Steering Damper Unit	043-00	
Nosewheel Steering Monitor	043-00	
Nosewheel Steering Position Transducer	043-00	
Nosewheel Steering Swivel Installation	044-00	
Nosewheel Steering System	043-00	
Nosewheel Steering Damper Unit	043-00	
Nosewheel Steering Monitor	043-00	
Nosewheel Steering Position Transducer	043-00	
Nosewheel Well Door Installation, Aft, Fuselage Station 276.00 to 292.00	036-00	
Nosewheel Well Hydraulic Lines Installation, Station 213.00 to 292.00	029-00	
Nosewheel Well Installation, Fuselage Station 213.00 to 276.00	035-00	
Open Timer Valve Installation, MLG Outboard Door	012-00	
Panel, Landing Gear Control	001-00	
Panel, Launch Bar	060-00	

AMR00039

Figure 3-2.—IPB alphabetical index.

component appears. For example, the nose landing gear system appears in figure number 027-00.

Group Assembly Parts List

A group assembly parts list consists of a figure with its associated parts list. The illustration of a particular component is shown broken down into the detailed parts that make up the component. Each item in the illustration is numbered. A listing of parts in the assembly follows each illustration of the assembly. This parts list is in the same order as the part numbers shown in the illustration. The parts list gives the manufacturer's part number of the part, its description, and other information. Figure 3-3 shows a typical IPB illustration. Figure 3-4 shows a listing of parts for the nose landing gear in figure 3-3.

Use of the IPB When the Part Number Is Not Known

At times, you will need to find a part number for an item that does not have the part number inscribed on it. Suppose you need a bracket assembly. You should be able to identify the following facts:

- What type of aircraft the component you are repairing is from
- The component the bracket was removed from
- The bureau number of the aircraft from which the component was removed

For the purposes of this particular problem, assume that the nose landing gear strut was removed from an aircraft with Bureau Number 158620. If you follow the steps listed below, you can get a replacement part.

1. Obtain the landing gear IPB for the aircraft.
2. Refer to the alphabetical index of the IPB (fig. 3-2).
3. Locate the Nose Landing Gear Shock Strut, figure No. 027-00 (fig. 3-2).
4. Turn to figure 027-00 and look at the IPB illustration (fig. 3-3). Callout 2 of this illustration is for the nose landing gear strut. At this point, you should compare the old strut to the strut shown in the illustration. Select the desired part. In this case, callout 2 of figure 3-3 is the desired part.
5. Refer to the parts listing for the illustration index number 2 (fig. 3-4). This index number establishes the relationship of the part in the illustration and the part in the list. It is for part number 2577818-011E<F, Strut

NLG Shock, and it has a CAGE or manufacturer's code of 55284.

6. Check the Use-On Code column to see if this strut is used on that particular aircraft, Bureau Number 158620.

7. Refer to the Usable-On codes list A at the foot of the list.

8. Have material control cross-reference the part number to its applicable NSN in the Master Cross-Reference List (MCRL) and verify it as a good number in the Management Data List Navy (ML-N).

IPB Information Elements

The following text is a detailed discussion of the various features found in the group assembly parts list in figure 3-4.

- Title (callout 1 in fig. 3-4). The title is on the first line under description. It describes what major component system is being broken down in the parts list. It is identical to the title in the illustration (fig. 3-3).

- Index number. As stated previously, this number (callout 2 of fig. 3-4) establishes the relationship between parts in the illustration and the corresponding parts list.

- Part number. The part number (callout 3 in fig. 3-4) is the manufacturer's part number. Two other terms also may appear in this position, NO NUMBER and COMMERCIAL. The term no number indicates that the item has no assigned part number, but may have a model or type number that appears in the index. The term *commercial* in this column indicates that the item should be procured from a commercial source.

- Unit per assembly column. Refer to figure 3-4. There are three different types of codes that could appear in this column: 2, showing a specific quantity, shown by callout 4; AR, shown by callout 5; and REF shown by callout 6. Lets examine callouts 4, 5, and 6 in figure 3-4.

In callout 4, the number designates the quantity used on a particular assembly. For example, there are two screws with part number MS27039-1-22.

In callout 5, the abbreviations AR (as required) indicates a specific quantity has not been established for this part. The quantity necessary to achieve a desired result is used.

NOTE: When the letters AR appear, no specific quantity is recommended. Sometimes, when

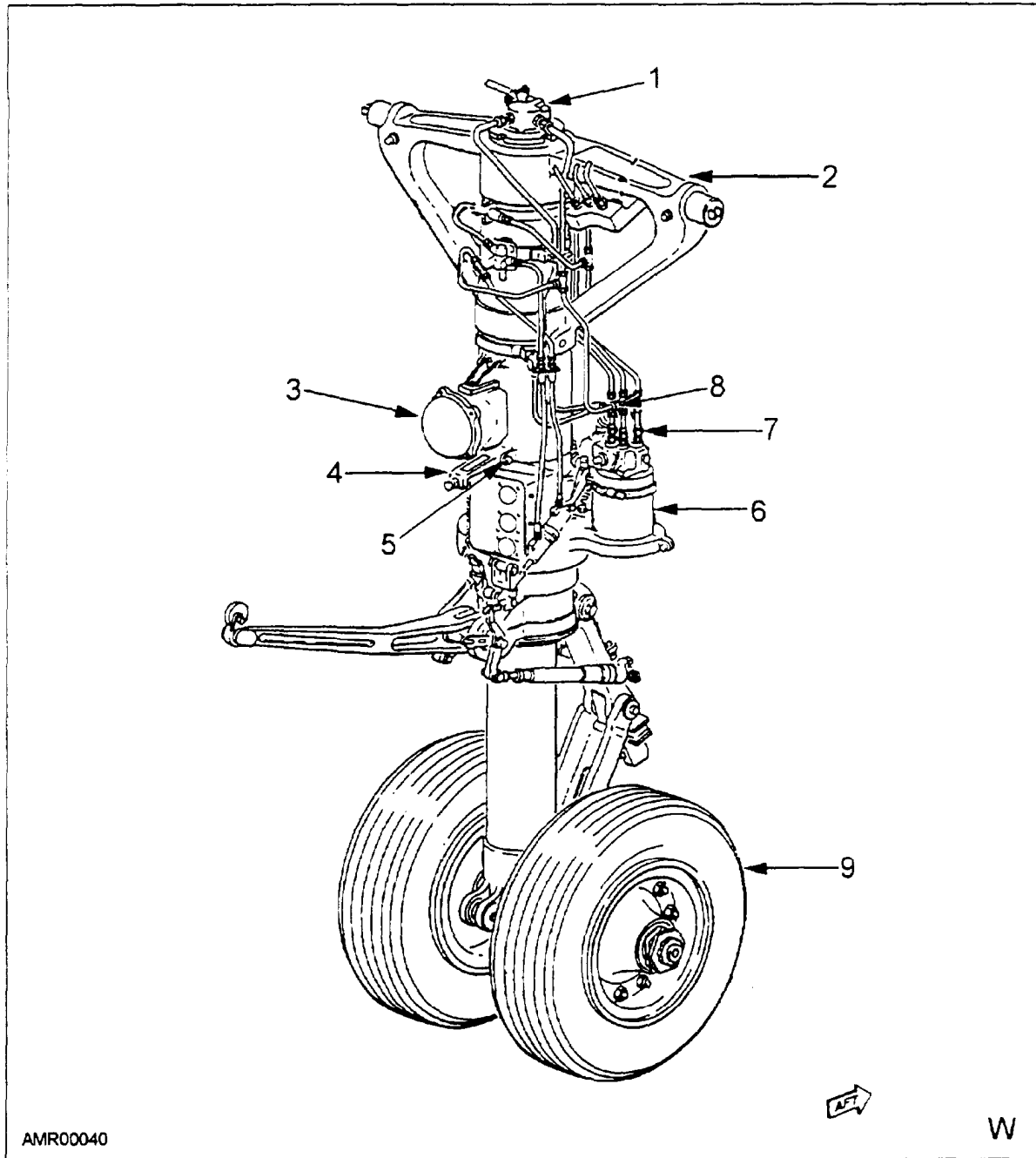


Figure 3-3.—An IPB illustration of a nose landing gear system from a group assembly parts list.

maintenance personnel remove hardware from an item, screws, nuts, or bolts become stripped. This is when you should order the quantity that needs replacing.

In callout 6, the abbreviation *REF* (reference) indicates that the part is listed for reference purposes only. In these cases, the nomenclature in the description column is followed by the notation "**SEE FIG X-XX FOR REQ,**" as shown in callout 7 of figure

3-4. This notation is used to reference an item to another figure for the next higher assembly and required units per assembly.

- **CAGE.** This term (callout 8 in fig. 3-4) is the five-digit Commercial and Government Entity code, commonly known as the manufacturer's code. CAGE code 55284 is the number for the specific manufacturer of this part.

INDEX NO.	PART NUMBER	DESCRIPTION	UNIT USE PER ON ASSY CODE				SM&R CODE
			1	2	3	4	

① NOSE LANDING GEAR SYSTEM							
② 1	6125	REGULATOR, FLOW /06177/ / GRUMMAN REF SCD A51H9093/ /SEE FIGURE 029-00 FOR NHA/					
2	2577818-011E<F	STRUT, NLG SHOCK /55284/ 1 *A PAOOD /GRUMMAN SCD A51G9000-43/ /SEE NAVAIR 03-25EA-56, SWP003 06, FOR DETAIL BREAKDOWN/ /SEE FIGURE 037-00 FOR PARTIAL BREAKDOWN/					⑨
3	2577818-013A<F >	STRUT, NLG SHOCK /55284/ 1 B PAOOD R /GRUMMAN SCD A51G9000-49/ /SEE NAVAIR 03-25EA-56, SWP003 06, FOR DETAIL BREAKDOWN/ /SEE FIGURE 037-00 FOR PARTIAL BREAKDOWN/					⑧
3	30-0561	LIGHT, FIXED POSITION LANDING TAXI REF /72914/ / GRUMMAN SCD A51A9035/ /SEE NAVAIR 01-F14AAA-4-9, FIGURE 019-00 FOR NHA/					
4	A51G10121-21	BRACKET 1 MDOZZ (ATTACHING PARTS)					
5	MS27039-1-22 MS21042L3	SCREW 2 PAOZZ NUT AR PAOZZ					④
6	A51G10021-5	STEERING SYSTEM INSTALLATION 1 XCOOO NOSEWHEEL /SEE FIGURE 043-00 FOR DETAIL BREAKDOWN/					⑤
7	A51G10561-1	FITTING ASSEMBLY /USE UNTIL EXHAUSTED/ 2 *C PAOZZ					
8	A51G10561-13	FITTING 2 PAOZZ					
9	3-1328	WHEEL ASSEMBLY, NLG /97153/ REF /GRUMMAN SCD A51G900R/ /SEE FIGURE 046-00 FOR REQ/ /SEE NAVAIR 03-25BA-20, WPO01 001, FOR DETAIL BREAKDOWN/					⑥ ⑪
⑩	USABLE ON CODES						

- A 158620 THROUGH 159637 NOT MODIFIED BY AFC 534
- B 158620 THROUGH 159637 MODIFIED BY AFC 534, 159825 AND SUBSEQUENT
- C 158620 THROUGH 159874
- D 158620 THROUGH 162953

AMR00041

Figure 3-4.—An IPB list of parts corresponding to the IPB illustration in figure 3-3.

• Usable-on code. The Usable-on code (callout 9 of fig. 3-4) designates the bureau number of the aircraft or serial number of the component on which this part can be used. It refers to **USABLE-ON CODE** for a figure. These codes are listed after the last item of the group assembly parts list. Callout 10 is an example of such a listing.

The line on which callout 9 of figure 3-4 appears is for the Nose Landing Gear Shock Strut, part number 2577818-011E<F. It has a Usable-on code of A. Refer

to the Usable-on codes listing in callout 10. It indicates that this particular nose landing gear strut assembly can be used only on aircraft with bureau numbers of 158620 through 159637.

Q7. What are the two primary technical manuals used by the maintenance technician to order replacement parts?

Q8. What information is contained in the "Introduction" of the IPB?

Q9. What part of the IPB contains information concerning detailed parts that make up a component?

JOINT SERVICE UNIFORM SOURCE, MAINTENANCE, AND RECOVERABILITY (SM&R) CODES

LEARNING OBJECTIVE: Identify where information can be obtained concerning national stock numbers (NSN), source of supply, and level of maintenance for aircraft components.

A joint service uniform SM&R code is a five- or six-position alphanumeric code (callout 11 of fig. 3-4). These codes identify the source of spares and the levels of maintenance authorized to maintain, repair, overhaul, or dispose of all equipment. This information helps maintenance and supply personnel identify parts. Figure 3-5 shows a breakdown of an SM&R code. This SM&R code has four parts with six positions.

In an SM&R code, the first position indicates the source from which you can acquire the item for replacement.

The second position in the SM&R code identifies either the restrictions on acquiring the item or the level of maintenance required to manufacture or assemble the item.

The third and fourth positions of the SM&R code identify maintenance-level codes. The third position indicates the lowest maintenance level authorized to remove, replace, and use the item. The fourth position indicates the lowest maintenance level authorized to perform complete repair of the item.

The fifth position in the SM&R code indicates the recoverability code. This code tells maintenance and supply personnel the lowest level of maintenance authorized to condemn the item, if necessary.

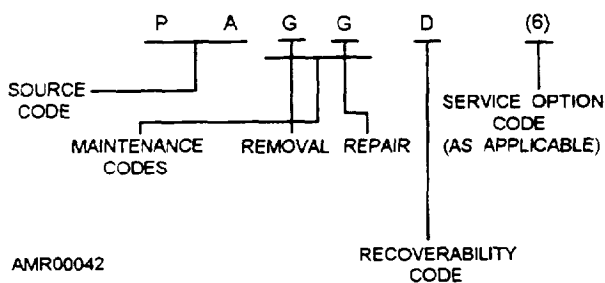


Figure 3-5.—Breakdown of a Source, Maintenance, and Recoverability (SM&R) code.

A sixth position of the SM&R code is the Service Option code. Not all SM&R codes have six positions. This code's sole use within the Navy is to further define certain conditions not covered by the Maintenance and Recoverability codes (third, fourth, or fifth positions).

The SM&R codes are initially assigned during provisioning conferences, and they change to reflect actual fleet item usage.

Detailed information concerning policies, procedures, definitions, and responsibilities applicable to SM&R codes is available in Navy *Uniform Source, Maintenance and Recoverability (SM&R) Codes*, NAVSUPINST 4423.14, and in *Policies, Procedures, Responsibilities For Assignment and Application of Uniform Source, Maintenance and Recoverability Codes*, NAVAIRINST 4423.3.

NAVSUP PUBLICATIONS

The operation of your squadron or AIMD material control center is influenced by the Naval Supply Systems Command (NAVSUP). NAVSUP outlines the procedures that affect your material control center and supply department in manuals, publications, and directives. The NAVSUP publications that you will come in contact with are discussed in the following text.

Master Cross-Reference List (MCRL). The MCRL comes in microfiche. It provides cross-reference information from a reference number (a manufacturer's part number, a drawing number, or a design control number) to its NSN. Another edition of the MCRL cross-references from NSN to manufacturer's part number.

Master Repairable Item List (MRIL) (NAVSUP P-4107). The MRIL lists those items of Navy-managed repairable items issued on a one-for-one basis (you must turn in the unserviceable item before you can draw a replacement item from supply). AKs refer to these items as MTRs. If you need to know whether or not to remove a component before ordering it from supply, you should consult the Consolidated Remain In Place List (CRIPL).

Consolidated Remain In Place List (CRIPL-01). At the O-level of maintenance, it is not always possible to remove a component from an aircraft until a replacement is on hand. If this is the case, you should refer to the CRIPL. The CRIPL lists the items that are exempt from the mandatory one-for-one turn-in. An example of an item listed in the CRIPL is the main

landing gear. It is listed as exempt from turn-in until 24 hours after a serviceable component is received from supply. The CRIPL-01 is a microfiche publication. The items listed in it are the only authorized exceptions to the one-for-one turn-in rule.

Individual Component Repair List (ICRL). The ICRL lets intermediate maintenance activity (IMA) personnel determine if they can repair an individual item based on its SM&R code. There are actually two ICRLs. The ICRL-A is an overall statement of the repair capability at a specific IMA. It shows the local repair capability for each item. The ICRL-C is a combined ICRL used by aircraft controlling custodians (ACCs) to monitor and review the standard ICRL programs at the IMAs under their command.

The ICRL-A is in microfiche and is revised quarterly. It lists all the repairables processed by your specific IMA, showing the local repair capability for each item. ICRL items are listed, in sequence, by the nine-digit national item identification number (NUN) assigned to the particular item. The NIIN is part of the NSN. The ICRL-A indicates when you must forward a Scheduled Removal Component Card, OPNAV Form 4790/28A, to the IMA or depot repair activity.

Each component in the ICRL has a Capability code that indicates the degree of repair capability and the reason for lack of repair capability at the IMA. The codes in figure 3-6 give some reasons why an IMA may not repair all the parts of the supported squadron's aircraft.

A1	<u>Check and Test Only</u> Used to identify A-799 or Failure
C1	<u>Full Repair/IMA Disposition</u> Entire range of failures can be entirely repaired with AIMD/IMA (Aircraft Intermediate Maintenance Dept./intermediate Maintenance Activity) facilities and skill levels including test and RFI (ready for issue) certification. This code includes disposition authority at intermediate level. (SM&R code has F, G, or H in fifth position.)
C3	<u>Limited Repair</u> Some types of failures are fully repairable with AIMD/IMA facilities and skills including test and RFI certification, but repair of certain failures is not normally initiated at the intermediate level (repair is limited to external switches, plugs, fittings, corrosion or replacement of some but not all subassemblies, etc.).
X1	<u>Repair Not Authorized</u> This code is the equivalent to BCM-1 and indicates that the intermediate level is not authorized to repair the component (may not be used for Field Level Repairable equipment, e.g., IRD cog items).
X2	<u>Lack of Authorized Equipment/Tools/Facilities</u> This code is the equivalent to BCM-2 and indicates that authorized equipment, tools or facilities are not available. (This code <u>must always</u> be accompanied by a target capability date.)
X3	<u>Lack of Required Technical Skills</u> This code is the equivalent to BCM-3 and indicates that required skills are not available. (This code <u>must always</u> be accompanied by a target capability date.)
X6	<u>Lack of Technical Data</u> This code is the equivalent to BCM-6 and indicates that repair cannot be accomplished due to lack of maintenance manuals, drawings, etc., which describe detailed repair procedures and requirements. (This code <u>must always</u> be accompanied by a target capability date.)
Z1	<u>Consumable Material</u> This code identifies material assigned a SM&R code with ZZ in the fourth and fifth positions or B in the fourth position for which the IMA is capable of performing a servicing function.

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Figure 3-6.—ICRL Capability codes.

Afloat Shopping Guide (ASG). The ASG is one of the most frequently used identification tools in the Navy. It helps maintenance personnel convert a description of an item that does not have a part or reference number to an NSN. Figure 3-7 is a page from an ASG catalog.

Aviation Consolidated Allowance List (AVCAL). The Aviation Consolidated Allowance List is developed and published by the Aviation Supply Office (ASO). The AVCAL lists the items and quantities of aeronautical material authorized to be stocked by an aircraft carrier to support the


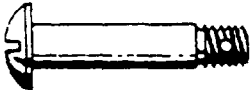


CLASS 5306			
BOLTS			
BOLT, ASSEMBLED WASHER		1/4-28 UNF-3A, AN 24	
SQUARE EXTENDED WASHER HEAD. Brass, lead plated. Overall dimensions, head height 23/32, width across flats 3/4 in., washer diameter 1-1/8 in.		00-156-2695	23/32 3/8
		00-156-2696	25/32 7/16
		00-156-2698	29/32 9/16
		00-156-2699	31/32 5/8
		00-156-2703	1-7/32 7/8
		00-156-2704	1-9/32 15/16
		00-151-0523	1-11/32 1
		00-151-0524	1-13/32 1-1/16
		00-151-0531	1-1/2 17/32
		00-151-0533	1-5/8 1-3/8
		00-151-0538	2-17/32 2-3/16
5/16-18 UNC-2A		5/16-24 UNF-3A, AN 25	
00-025-1012 15/32 lg		00-144-3852 1-3/64 11/16	
HEXAGON HEAD		1/2-20 UNF-3A, AN28	
Steel, Flatwasher, head height 15/64, width across flats 1/2 in., washer diameter 1/2 in.		00-151-0659 3-51/64 3-3/8	
5/16-18 UNC-2A		7/16-20 UNF-3A, AN 27	
00-613-9396 7/8 lg		00-151-0934 1-43/64 1-1/4	
Steel, Spring tension washer, head height 3/32 in., width across flats 1-1/16 in., washer diameter 1-35/64 in.		3/4-16 UNF-3A, AN 32	
		00-156-2745 2-11/16 2-3/16	
		00-156-2753 3-11/16 3-1/8	
		Flat Chamfer, Slot Drive	
		Steel, corrosion resistant	
11/16-11 UNS-2A		3/8-24 UNF-3A	
00-953-0262 3-11/32 lg		00-990-3927 2-11/16 13/64	
Steel, Zinc plated, flat external teeth washer, head height 3/16 in., width across flats 1-1/16 in., washer dia 15/32 in.		BOLT, CLOSE TOLERANCE	
1/4-20 UNC-2A		HEXAGON HEAD BOLTS. Steel Alloy, AMS 6300, cadmium plated. Bolt head marked with an "X" within a triangle. Air Force-Navy Aeronautical Standard. (fastener length and grp length in in., shown below.	
00-208-1601 1/2 lg			
BOLT, CLEVIS		DRILLED HEAD	
		No. 10-32 UNF-3A, AN 173	
AIRCRAFT CLEVIS BOLTS, Alloy steel, cadmium plated. Button head, slot drive. Head marked with single or double "X". Air Force-Navy Aeronautical Standard. Fastener length and grp length in in., shown below.		Fas Gnp Lg/in. Lg/in.	
		00-550-3404 15/32 1/16	
		1/4-28 UNF-3A, AN 174	
		00-141-4517 21/32 7/16	
		00-285-5325 29/32 7/16	
		5/16-24 UNF-3A, AN 175	
		00-685-8155 1-15/32 15/16	
		00-144-4048 1-31/32 1-7/16	
		00-144-4051 2-11/32 1-13/16	
DRILLED SHANK		DRILLED SHANK	
No. 10-32 UNF-3A, AN 23		1/4-28 UNF-3A, AN 174	
Fas Grip		00-151-1942 1-5/32 11/16	
Lg/in. Lg/in.		00-180-1738 1-9/32 13/16	
00-151-1961 19/32 1/4		00-855-3610 1-13/32 15/16	
00-151-1962 21/32 5/16		00-292-8261 1-17/32 1-1/16	
00-151-1963 23/32 3/8		00-180-1739 1-21/32 1-3/16	
00-151-1964 25/32 7/16		00-283-0169 2-1/32 1-9/16	
00-151-1965 27/32 1/2			
00-151-1966 29/32 9/16			
00-151-1967 31/32 5/8			
00-151-1968 1-1/32 11/16			
00-151-1969 1-3/32 3/4			
00-151-1970 1-5/32 13/16			
00-151-2312 2-5/32 1-13/16			
		5/16-24 UNF-3A, AN 175	
		00-180-0469 1-19/32 1-1/16	
		00-180-0471 1-27/32 1-5/16	
		00-180-0482 3-11/32 2-13/16	
		DRILLED HEAD AND SHANK	
		5/16-24 UNF-3A, AN 175	
		Fas Grip	
		Lg/in. Lg/in.	
		00-174-4118 1-3/32 9/16	
		00-174-4117 1-7/32 11/16	
		00-151-0330 2-9/32 1-13/16	
		3/8-24 UNF-3A, AN 176	
		00-151-2322 2-21/64 1-11/16	
		BOLT, EYE	
		AIRCRAFT SHOULDERED TYPE. Applicable Air Force-Navy Aeronautical Standard. Shank length and grp length in in., shown below.	
			
		Steel, Cadmium Plated	
		No. 10-32 UNF-3A, AN 42	
		Shank Gnp	
		Lg/in. Lg/in.	
		00-638-2214 15/32 1/16	
		00-638-2216 17/32 1/8	
		00-285-2611 1-19/64 57/64	
		1/4-28 UNF-3A, AN43	
		00-260-7578 21/32 3/16	
		AIRCRAFT TURNBUCKLE TYPE. Right hand thread. Shank length, thread length, and eye inside diameter given in inches.	
			
		Steel, cadmium plated. Mil Std MS21254	
		1/4-28 UNF-3A	
		Shank Thd Eye	
		Lg/in. Lg/in. ID/in.	
		00-057-7184 1.328 0.625 0.251	
		Steel, corrosion resisting. Non Mil Std.	
		No. 10-32 UNF-3A	
		00-891-3397 0.900 0.900 0.129	
		00-882-2226 1.250 1.250 0.129	
		1/4-28 UNF-3A	
		00-824-9117 1.850 0.500 0.441	

Figure 3-7.—Page from the Afloat Shopping Guide.

maintenance and operations of embarked aircraft. It is tailored for each carrier, and the items listed are selected from all allowance requirement registers and allowance lists (ARRs and ALs) from each type of aircraft embarked. The allowance quantities are based on the ships' demand records. The AVCAL is comprised of seven basic parts; they are titled as follows:

- Part I. AVCAL Index List
- Part II. ARR Gross Item List
- Part III. AVCAL Net List
- Part IV. Part Number to NSN Cross-Reference
- Part V. Requirements List
- Part VI. Excess Material List
- Part VII. Stock Rotatable List

For more detailed information on the AVCAL and the specific parts, refer to *Afloat Supply Procedures*, NAVSUP PUB-485, and FASOINST 4441.15

CODED NATIONAL STOCK NUMBER

Each Navy item stocked under centralized inventory control has assigned an NSN. The NSN is used for all supply management functions and in all supply publications.

The NSN is a 13-digit number that identifies an item of material in the supply system. It consists of the four-digit federal supply classification (FSC) plus a nine-digit national item identification number (NIIN). The NIIN consists of a two-digit National

Codification Bureau (NCB) code and seven digits that uniquely identify each NSN item in the Federal Supply Distribution System. Additionally, within the Navy supply system, code prefixes and suffixes are used. These prefixes and suffixes are used only within the Navy and not in interservice transactions. So, when you requisition an item from supply in the Navy, you use the coded NSN for that item. Figure 3-8 shows you a complete coded NSN. The parts of this number are discussed in the following text.

Cognizance Symbol. The cognizance symbol is a two-character prefix. It identifies the systems command, office, agency, or Navy inventory manager that controls the category of material. The cognizance symbol 7R, shown in figure 3-8, tells you that the item of supply is under the control of the Aviation Supply Office (ASO).

Material Control Codes. Material Control codes divide inventories into segments that show similar demand or repairability. Look at figure 3-8 again. Here, Material Control code H tells you that the item is a depot-level repairable. Since the item cannot be repaired locally, it must be shipped to a naval aviation depot (NADEP) or commercial concern for repair.

Material Condition Codes. Material Condition codes classify material in terms of readiness for issue and use. They also identify action under way to change the status of material. Condition codes A through S (less I and O) are assigned to Navy material. The Material Condition code F, shown in figure 3-8, tells you that the item of supply is fast moving, in high demand, and used quite often.

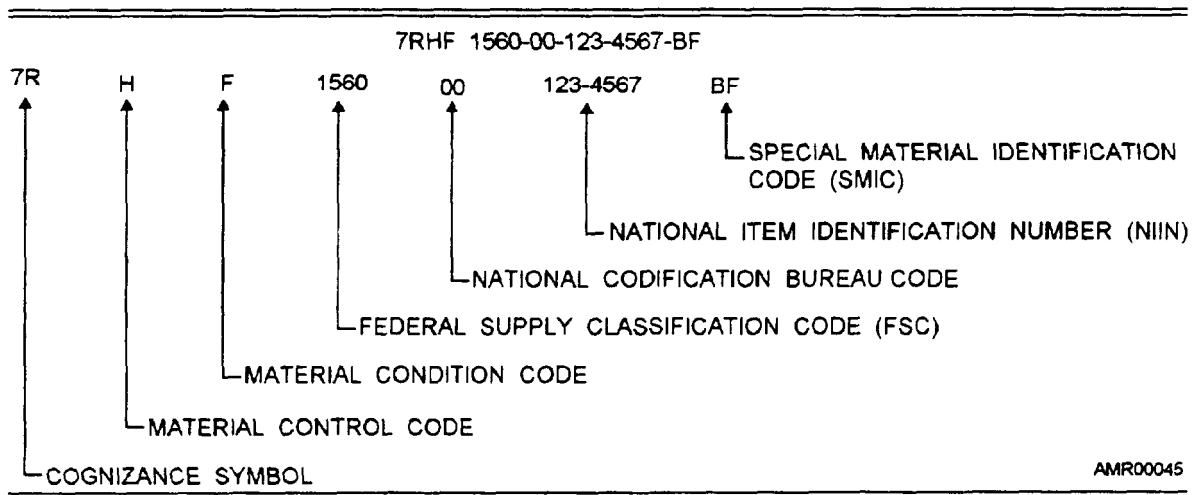


Figure 3-8.—Breakdown of a coded national stock number.

Material Condition codes apply to specific quantities of material held in the supply system. Therefore, you will not find them listed in stock catalogs. You will see Material Condition codes on stock records and on documents that affect stock records.

Special Material Identification Code (SMIC). The SMIC is a two-digit code. It is a suffix of the NSN. ASO uses the SMIC to identify items to aircraft models, engine models, certain commodities, and special projects or programs.

- Q10. *In figure 3-3, what is the SW&R code for the fitting, part number A51G10561-I3, item number 8?*
- Q11. *What position(s) of the SM&R code indicate(s) the source from which you can acquire the item?*
- Q12. *Which NAVSUP publication provides cross-reference information from a reference number to its national stock number (NSN)?*
- Q13. *What NAVSUP publication provides information on exceptions to the one-for-one turn-in rule?*
- Q14. *How often is the ICRL-A revised?*
- Q15. *What is the purpose of the Aviation Consolidated Allowance List (AVCAL)?*
- Q16. *What are the first two-digits of the nine-digit NIIN called?*

AIRCRAFT MAINTENANCE MATERIAL READINESS LIST (AMMRL) PROGRAM

LEARNING OBJECTIVE: Define the purpose of the Aircraft Maintenance Material Readiness List (AMMRL) program.

AMMRL is the title of an overall program that provides the data required for effective management of SE at all levels of aircraft maintenance. This program involves more than 27,000 line items of aircraft/SE maintenance (IMRL items), and 10,000 tailored outfitting list (TOL) items that are used throughout the Navy by aircraft maintenance activities. Two NAVAIR instructions describe the procedures for allowance and inventory control, NAVAIRINST 13650.1 for IMRL items and NAVAIRINST 13630.1 for TOL items. The AMMRL program recognizes the many ship-and-base loading combinations and various requirements for numerous airframe configurations, power plants, and avionics

systems. The objective of this program is to document data and in-use asset information concerning SE that management uses for the following purposes:

- To set allowance requirements for SE at activities performing I-, O-, and D-level maintenance
- To provide standardized accounting and inventory control procedures
- To assist in the redistribution of in-use assets
- To provide a base for budgeting requirements
- To assist in measuring material readiness

Terms

This section contains definitions of terms used within the AMMRL program.

Support Equipment (SE). The equipment required on the ground to make a system, subsystem, or end item of equipment operational in its intended environment. This includes all equipment required to install, launch, arrest (except Navy shipboard and shore-based launching and arresting equipment), guide, control, direct, inspect, and test (including automatic test equipment [ATE] hardware and software). Also included is equipment required to adjust, calibrate, appraise, gauge, measure, assemble, disassemble, handle, transport, safeguard, store, actuate, service, repair, overhaul, maintain, or operate the system, subsystem, end item, or component. This definition of SE applies regardless of the method of development, funding, or procurement.

Support Equipment Resources Management Information System (SERMIS). A collection of technical and cataloging data that identifies each end item of SE required for O- and I-level aircraft maintenance. SERMIS provides the support equipment controlling authority (SECA) with on-line visibility of source, allowance, inventory, and rework data to aid in inventory control. SERMIS is the repository of master data for printing IMRLs. It also provides in-use visibility to ASO, Naval Aviation Maintenance Office (NAVAVNMAINTOFF or NAMO), the Naval Air Engineering Center (NAVAIRENGCEN), and Commander Naval Air Systems Command (COMNAVAIRSYSCOM).

Individual Material Readiness List (IMRL). A consolidated allowance list specifying authorized quantities of aviation SE required by a particular activity to perform its assigned maintenance level

functions. AKs normally maintain the IMRL, which is discussed in more detail later in this chapter.

Responsibilities

The following paragraphs contain explanations of the responsibilities of the various commands and activities regarding the AMMRL program. Figure 3-9 illustrates the flow of authority and information from and to these activities.

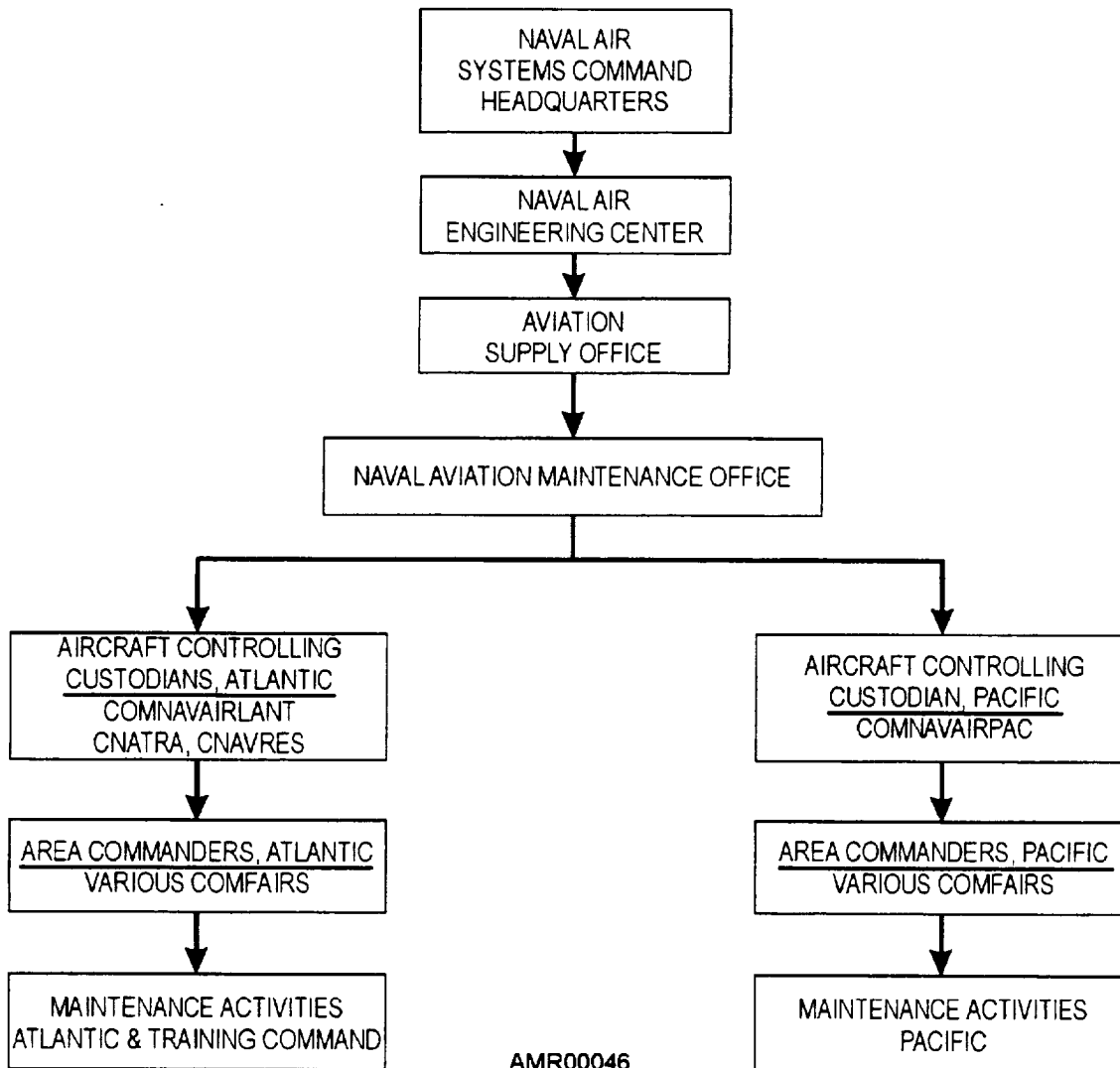
Naval Air System Command (NAVAIRSYS-COM) Headquarters. This command exercises overall program management and authority for the AMMRL program. This includes the correlation of the efforts of all activities concerned and for all facets of the program.

Naval Air Engineering Center (NAVAIRENG-CEN). This activity is responsible for the approval or disapproval of all SERMIS revisions of SE submitted

by aviation maintenance activities for engineering or funding investigations. It advises all concerned activities of its decisions and forwards all approved revisions to ASO for updating the master SERMIS file.

Aviation Supply Office (ASO). The ASO maintains the SERMIS file by establishing and maintaining a SERMIS application guide, which includes SERMIS codes, avionics system number, and standard allowance symbols. The ASO also enters technical revisions in the SERMIS as provided by NAVAIRENGCEN and used in the AMMRL program. The ASO also enters nontechnical revisions according to current supply system data maintenance procedures. The ASO maintains the consolidated accountable SE in-use inventory file as reported by the NAVAIRSYSCOM representatives.

Naval Aviation Maintenance Office (NAMO). The NAMO representative manages the AMMRL



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Figure 3-9.—Flow of authority and information from and to activities involved in the AMMRL Program.

program within his/her geographical areas. This representative also makes recommendations to the AMMRL program manager about changes to overall management and operational policies and procedures. They schedule, prepare, and maintain IMRLs for all applicable Navy aircraft maintenance activities; obtain accountable in-use inventory reports from all activities under assigned geographical areas, and forward a quarterly inventory report to the ASO. They also update the SERMIS, various IMRLs, and asset reports regularly or as requested by activities in the chain of command.

Support Equipment Controlling Authority (SECA). SECAs are major aviation commands that exercise administrative control of AMMRL program SE end items for allowance and inventory control. The following is a list of designated SECAs:

- Commander, Naval Air Force, Atlantic (COMNAVAIRLANT)
- Commander, Naval Air Force, Pacific (COMNAVAIRPAC)
- Chief of Naval Air Training (CNATRA)
- Commander, Naval Air Reserve Force (COMNAVAIRESFOR)
- Commander, Naval Air Systems Command (COMNAVAIRSYSCOM)
- Naval Air Maintenance Training Group (NAMTRAGRU)

Commanders, Fleet Air (COMFAIR). COMFAIRs represent the SECA within their geographical areas of responsibility.

Aircraft Maintenance Activities. These activities are responsible for the operation, maintenance, review, and submission of requests for revision of the IMRL. They also hold the annual inventory and ensure that required custody cards are on hand.

- Q17. *What two instructions describe the procedures for allowance and inventory of the AMMRL program?*
018. *How is Naval Air Systems Command (NAVAIRSYSCOM) involved in the AMMRL program?*

INDIVIDUAL MATERIAL READINESS LIST (IMRL)

LEARNING OBJECTIVE: Describe the sections of the Individual Material Readiness List (IMRL) and their purposes.

The IMRL is constructed for Navy and Marine Corps aviation maintenance activities by extracting applicable portions of SERMIS data. Physical inventories and IMRL transaction reports are the basis for the on-hand quantity listed in the IMRL. This data determines the material supportability for each IMRL activity. The data is also consolidated to produce functional wing, SECA, and Navywide listings. IMRLs identify material requirements and provide a basis for SE procurement. This information aids in decisions on overall readiness posture, budget forecasts, equipment procurement, and redistribution of assets.

The IMRL serves as the allowance and inventory management list for SE end items. IMRLs identify material requirements and provide a measure of supportability of aviation maintenance by identifying authorized SE allowances and providing inventory data. Inventory records within the SERMIS data base provide information used to determine the total inventory quantities. ASO also uses the IMRL inventory and authorized allowance data to develop the Aviation Consolidated Allowance List (AVCAL) and Shore Based Consolidated Allowance List (SHORECAL) for piece part support of SE end items.

The IMRL has five major sections: employment data, change list, index, main body, and the activity inventory record. An IMRL legend introduces every IMRL. The legend lists all SERMIS data elements printed in the IMRL with the headings as they appear. A general description of the major IMRL sections with an explanation of their contents and related terminology are as follows:

Employment data section. This section gives the activity the list of the employment data used to create that IMRL. This list allows the activity to see the data used to calculate the allowances shown in their IMRL.

Change list section. This section is a listing of all the changes to an activity's IMRL since the printing of the previous IMRL. An update action code shows additions, deletions, or changes that affect an activity.

Index section. This section has six parts or cross-references. The six cross-references are part

number (PN), national item identification number (NIIN), nomenclature, avionics system name, avionics system number, and line item number. The line item number cross-reference is optional, provided only when specifically requested by the user. The cross-references provide a rapid means of identifying and locating the position of an item in the body section. They are the key to proper use of the IMRL. An example of a part number cross-reference listing is shown in figure 3-10.

IMRL main body. This section lists all items allowed for the activity, and shows the authorized allowance quantity for each item allowed. Each subsection of the IMRL lists applicable nonavionic, government furnished, aircraft equipment (GFAE) following the last line item number listed in that subsection. Each page in the IMRL main body (fig. 3-11) presents identification data, description data, and land vessel (LV) code, maintenance level data, accountability data, and allowance data. Depending on the type of activity to which the IMRL applies, the main body may have one or more subsections (or support categories of equipment).

Each subsection (or support category) may have two parts, depending on single model application or multimodel applications. Part I contains items that apply to a specific model in an activity's IMRL. Part II contains items that apply to more than one model in an activity's IMRL. The facility subsection contains only part II and defines all applicable work centers.

The page heading format for the IMRL main body (fig. 3-11) is presented both vertically and horizontally. The IMRL legend lists page headings. Each IMRL main body page starts with preparation date, report title, file name, page number, subsection, model, AAI, activity name, and activity reportable code. For multiple applications, "multi" appears as the model.

The column headings identify the type of information contained in each column. These headings and the data element contents of each column are defined in NAVAIRINST 13650.1.

IMRL Activity Inventory Record. This record lists all items that are on inventory at the applicable activity on the date this section is prepared. It is reissued in its entirety each month. It provides identification data, management data, inventory status, authorized allowances, and nomenclature for each item (fig. 3-12).

Current procedures provide for IMRL "tailoring," since SERMIS source data does not necessarily reflect peculiarities such as geographic factors or certain operating conditions. Upon receipt of a new IMRL, each activity will review the allowances for accuracy and adequacy for its support requirements. A primary function of tailoring is to eliminate or reduce common or general-type SE quantities by supporting a mix of weapons systems or components. Tailoring also serves to uncover errors in the IMRL that affect not only the particular aircraft mix supported, but also may affect the support of aircraft and systems at other similar activities. The two methods of tailoring an IMRL are IMRL activity tailoring and the SECA tailoring conference.

- **IMRL activity tailoring.** All maintenance activities are responsible for submitting IMRL revision requests (fig. 3-13) as a post-review of tailoring actions. Maintenance activities submit IMRL revision requests following the procedures outlined in NAVAIRINST 13650.1.

- **SECA tailoring conference.** The SECA representative makes on-line tailoring actions as a result of a SECA-held tailoring conference.

Q19. What are the major sections of the IMRL?

Q20. What section of the IMRL lists all of the items allowed for the activity along with allowance quantities?

Q21. How often is the IMRL Activity Inventory Record reissued?

MATERIAL REQUIREMENTS

LEARNING OBJECTIVE: Define the purpose of the Material Control work centers and the jobs performed by the personnel assigned.

Whenever a need arises to do a job, the tools, supplies, and equipment that are needed generate material requirements. The supply department fills these requirements.

The material control center (MCC) at the organizational and intermediate levels (O and I levels) of maintenance is the point of contact for material needed by maintenance personnel.

INDIVIDUAL MATERIAL READINESS LIST
 PART NUMBER CROSS REFERENCE

ACTIVITY NAME HC-18

PART NUMBER	CAGE	NSN DATA	LINE ITEM NR	NOMENCLATURE
PWC30793	75245	9C 4730-00-006-7895	00207	FITTING DRAIN OIL .500-20 UNF-3A
PWC30840	00198	1R4720-01-054-9132-ND	00238	HOSE ASSY - COMPRESSOR WASH RING
PWC30840	75245	1R4720-01-054-9132-ND	00238	HOSE ASSY - COMPRESSOR WASH RING
PWC3080A	00198	1R4720-01-054-9132-ND	00238	HOSE ASSY - COMPRESSOR WASH RING
PWC3080A	75245	1R4720-01-054-9132-ND	00238	HOSE ASSY - COMPRESSOR WASH RING
PWC3059	00198	1R4920-01-174-1799-NQ	00239	PUSHER/PULLER-OUTPUT SHAFT SEAL
PWC3059	75245	1R4920-01-174-1799-NQ	00239	PUSHER/PULLER-OUTPUT SHAFT SEAL
PVCA30610	75245	1R3940-00-601-6588-ND	00233	SLING - REDUCTION GEAR BOX
R453	28480	7Z4625-01-032-6914-TE	00358	OSCILLOSCOPE
R057001	84987	6R4920-00-789-7813-TX	00331	TEST SET TACHOMETER
R03010	20227	6R4820-01-317-4865-DH	00402	SPECTROM ANALYZER
REV JB 186-111	RF000	6R4920-01-090-9307-EO	00284	TESTER, DELTA 'P' FILTER F.C.
R122	07479	1R45120-00-372-6853-CS	00328	RESET TOOL
S157Q-10170-1	78286	1R45120-00-241-9250-DH	00087	SCREW
S157Q-10170-3	78286	1R41730-00-797-4793-DH	00132	PROTECTOR-MAIN ROTOR
S157Q-10257-1	78286	90 5120-00-704-3243	00106	BEARING/PUSHER
S167Q-10969-006	78286	1R1730-00-704-3231-DH	00105	POLE BLADE HANDLING
S157Q-10969-1	08844	1R1730-00-704-3231-DH	00105	POLE BLADE HANDLING
S157Q-10969-5	78286	1R1730-00-704-3231-DH	00105	POLE BLADE HANDLING
S167Q-10479-14	78286	90 5120-00-631-5766	00099	PULLER ASSY, TRANSMI
S167Q-15000-1	78286	6R4920-00-019-8957-VH	00198	CHECK/FILL UNIT
S167Q-15000-25	55476	6R4920-00-963-5882-VH	00195	CHECK/FILL UNIT
S167Q-15000-25	78286	6R4920-00-963-5882-VH	00195	CHECK/FILL UNIT
S167Q-15000-25	01091	6R4920-00-963-5882-VH	00195	CHECK/FILL UNIT
S6000-400	12839	9G 4920-00-718-6677	00024	SUPPORT, ROTOR ADJUS
S617Q 70060 1	2L266	6R1740-00-860-6125-DH	00146	CART BLADE
S617Q-10003	78286	90 5120-00-720-0958	00125	WRENCH, SPANNER
S617Q-10012	78286	90 5120-00-704-9656	00100	WRENCH, PISTON
S617Q-10013	78286	90 5120-00-704-9656	00124	WRENCH-MAIN ROTOR HEAD ASSY
S617Q-10017	78286	90 5120-00-451-5219	00094	INSTALLER BOLT
S617Q-10018-041	78286	1R4920-01-256-8237-DH	00197	PIN PULLER, HORIZONTAL HINGE
S617Q-10027	78286	90 5120-00-702-9657	00101	SOCKET, WRENCH, FACE
S617Q-10036	78286	1R45120-00-720-0960-DH	00126	WRENCH SPANNER
S617Q-10036-3	78286	1R45120-00-860-3820-DH	00141	WRENCH, HUB WING ROTARY
S617Q-10039-003	78286	1R45340-00-978-2846-DH	00174	BRACKET SWEEP
S617Q-10039-1	78286	1R45340-00-978-2846-DH	00174	BRACKET SWEEP
S617Q-10039-5	78286	1R45340-00-978-2846-DH	00174	BRACKET SWEEP
S617Q-10043-1	78286	1R45120-00-860-8181-DH	00177	WRENCH-SLEEVE AND SPINDLE
S617Q-10043-4	78286	90 5120-00-981-8121	00177	WRENCH-SLEEVE AND SPINDLE
S617Q-10057-1	78286	1R45120-00-087-4418-DH	00082	WRENCH ROTARY JING HUB
S617Q-10057-2	51145	1R45120-00-087-4418-DH	00082	WRENCH ROTARY JING HUB
S617Q-10100-1	78286	6R4920-00-988-0885-DH	00178	FIXTURE ASSY-PRE-TRACK TOOL
S617Q-10108-1	78286	90 5120-00-756-4490	00130	TOOL REMOVAL
S617Q-10108-1	78286	1R4920-00-124-9615-DH	00085	RESTRAINER, HUB ASSY
S617Q-10108-1	91750	1R4920-00-124-9615-DH	00085	RESTRAINER, HUB ASSY

Figure 3-10.—Typical IMRL part number cross-reference index.

PREPARED 20/AUG/92		INDIVIDUAL MATERIAL READINESS LIST				FILENAME MOSIMR53826		PAGE 4	
SUBSECTION	DESCRIPTION	MODEL	ACTIVITY	ACTIVITY	ACTIVITY	ACTIVITY	ACTIVITY	ACTIVITY	ACTIVITY
LINE	ITEM	NSN DATA	DESCRPTIVE INFORMATION	L 3	R R	C C	C C	C C	T
NR	CAGE-PN			V D	M L	C C	C C	C C	COMP C AUTH
18	97499 T101600		0.01 LB 0.0001 CF PADZZ						
			PROJ ROM DATE:						
			TEC:\$1AA						
19	184130-00-472-3310-41		ADAPTER HOLDING MAT						
	184130-00-472-3310-41		3.20 LB 0.0700 CF PADZZ						
	30891 PD2860		PROJ ROM DATE:						
	87641 PD2660		TEC:\$1AA						
	97059 PD2660								
	87941 SWE24375								
20	9C 1750-00-876-5412		FIXTURE, RIGGING CYCLIC STICK						
	26215 T101330		3.20 LB 0.0700 CF PADZZ						
	97499 T101330		PROJ ROM DATE:						
			TEC:NA						
21	9C 4920-00-876-5431		BENCH ASSEMBLY						
	97499 T101356		0.01 LB 0.0001 CF PADZZ						
			PROJ ROM DATE:90381						
			TEC:NA						
22	9C 4920-00-718-4673		LINK GRIP POSITIONER						
	07292 1288		0.50 LB 0.0200 CF PADZZ						
	81996 4920HU1-002		PROJ ROM DATE:						
	97499 T101402		TEC:\$1AA						
23	184130-00-718-4674-AM		BLADE ALIGNMENT SCOPE						
	81996 4920HU1-000		0.00 LB 1.0000 CF PADZZ						
	81996 4920HU1-000		PROJ ROM DATE:						
	97499 M503		TEC:NA						
	97499 T101401								
24	9C 4920-00-718-4677		SUPPORT ROD/ADJUS						
	81996 4920HU1-008		10.25 LB 0.0001 CF PADZZ						
	81996 4920HU1-008-1		PROJ ROM DATE:						
	12839 S6000-400		TEC:\$1AA						
	97499 T101400								
	15476 T101400-16676								

AMR00048

Figure 3-11.—Typical IMRL main body.

- 1. This form is for requesting
- 2. The original controlling authority obtained by the IMRL request
- 3. Completion
- 4. Completion
 - a. Block 1
 - b. Blocks 2
 - c. Blocks 3
 - d. Block 4
 - e. Block 5
 - f. Block 6
 - g. Block 7
 - h. Block 8
 - i. Block 9
 - j. Block 10
 - k. Blocks 11
 - l. Blocks 12
 - m. Block 14 being so
 - n. Block 15 if applicable maintenance times, if required addition
- 5. Part II is forwarded to
- 6. Part III is disposition of

See Instructions on Reverse				
INDIVIDUAL MATERIAL READINESS LIST REVISION REQUEST				
FROM		REV. REQ. SER. NO.	DATE	
TO		VIA		
PART I IMRL/SE IDENTIFICATION DATA				
1. REVISION REQUESTED <input type="checkbox"/> AUTHORIZED ALLOWANCE CHANGE FROM QUANTITY OF _____ TO _____ <input type="checkbox"/> ADD/DELETE ITEM OF SE <input type="checkbox"/> OTHER (Describe in Block 12) 				
2. AAI	3. IMRL DATE	4. IMRL SUP. DATE	5. IMRL ITEM NUMBER	
6. NOMENCLATURE		7. PSCH	8. PART NUMBER	9. APPLICATION
10. NSM	11. COMPUTED ALLOW	12. AUTHORIZED ALLOW	13. QUANTITY ON-HAND	
14. REFERENCE(S)				
15. DESCRIPTION/JUSTIFICATION				
SAMPLE				
SIGNATURE AND TITLE		CODE	TELEPHONE NO.	DATE
PART IA SUPPORTING IMA IMRL DATA				
ACTIVITY NAME		16. AAI	17. IMRL DATE	
18. COMPUTED ALLOW	19. AUTHORIZED ALLOW.	20. QUANTITY ON-HAND	RECOMMENDATION	
REMARKS			<input type="checkbox"/> APPROVAL <input type="checkbox"/> DISAPPROVAL (See Remarks)	
SIGNATURE AND TITLE		CODE	TELEPHONE NO.	DATE
PART II INTERMEDIATE COMMAND ENDORSEMENT				
FROM		TO		
<input type="checkbox"/> FORWARDED RECOMMENDING APPROVAL <input type="checkbox"/> FORWARDED RECOMMENDING DISAPPROVAL (See Remarks)		APPROVED IMRL REVISION APPLIES TO THE FOLLOWING ACTIVITIES		
REMARKS				
SIGNATURE AND TITLE		CODE	TELEPHONE NO.	DATE
PART III SECA DISPOSITION				
FROM		TO (Originating Activity)		
<input type="checkbox"/> DISAPPROVED (See Remarks)		<input type="checkbox"/> IMRL REVISION APPROVED		<input type="checkbox"/> SOURCE DATA REVISION RECOMMENDATION
REMARKS				
SIGNATURE AND TITLE		CODE	TELEPHONE NO.	DATE

NAVARS FORM 130 (REV 9-68)
EXHIBIT (1)

DA FORM 413-4 (REV 7-67)

Previous editions of this form are obsolete

FRONT

BACK

AMR00050

Figure 3-13.—IMRL revision request.

O-LEVEL MATERIAL CONTROL CENTERS

While performing maintenance on a squadron aircraft, you find that you must remove a malfunctioning part. The maintenance chief agrees; so, you wrap the unserviceable item in the approved wrapping material or put it in the proper container. You complete all the required information, ensuring accuracy, in NALCOMIS or fill out the VIDS/MAF, making sure that the entries are readable on all five copies. Then, you take the VIDS/MAF to the squadron material control center.

The material control center is your squadron's contact point for parts and material. The material control center passes the requirements to the ASD/SSC of the supply department. The material control center does this in a timely manner to prevent work stoppage. When the parts arrive, your squadron AK ensures that the replacement parts are forwarded to your work center after receipt from supply.

AKs in the material control center perform other duties in addition to filling material requirements. The material control center prepares documents for material required for operational support: for example, indirect material requirements, such as aviation fuel and lube oil, that the squadron uses in the aircraft. The material control center also provides flight clothing and special equipment (such as safety shoes and foul weather jackets). Also, squadron AKs make up requests for material carried in the service market (SERVMART) outlets. Often, they are the "gopher" on SERVMART runs. Squadron AKs ensure that personnel prepare surveys for lost, damaged, or stolen material. They keep maintenance control advised of the overall supply situation and its effect upon the maintenance actions. The material control center also performs accounting and charting of operational target (OPTAR) funding and budgeting. Material control also validates NMCS and PMCS requisitions to make sure that supply is carrying all the outstanding requisitions on their list. Finally, the AK is the individual your supervisor will contact when he or she submits an IMRL change request.

The material control center also prepares and accounts for flight packets. While assigned to a squadron, you may be deployed away from your home base. If aircraft parts fail or if you need to buy gas or oil while deployed, the flight packet prepared by your squadron AK will contain the paperwork to pay for the services you receive, whether the activity that provides

the parts or services is a Navy activity or some other activity. A flight packet has the following items.

- DOD Single Line Item Requisition System, DD Form 1348 (6 part). This DD Form 1348 allows a military activity rendering a service to bill your squadron. The pilot of the aircraft enters what was purchased, the number purchased, and the date. He or she signs the requisition as proof of receipt.

- Purchase Order Invoice Voucher, Standard Form 44. Commercial as well as government activities accept these vouchers in payment for goods and services. There are monetary limits placed on the Standard Form 44s, and if the pilot wishes to exceed this limit, he or she must get permission from his or her commanding officer. The flight packet contains instructions on how to fill out these forms. Because Standard Form 44s can have monetary value, the pilot accounts for each voucher in his or her possession.

- DD 1896 or DD 1897 (identiplat). This identiplat is used to procure jet fuel or aviation gasoline from commercial airports holding Defense Logistics Agency, (DLA) into-plane refueling contracts and most DOD activities.

I-LEVEL MATERIAL CONTROL CENTER

The material control center at the I-level operates like the material control center in a squadron. The difference is in the volume of the parts requisitioned. The volume can be two or three times greater at the I-level than at the O-level. The volume is greater because the I-level maintenance activities repair more than 90 percent of the unserviceable parts turned in by the squadrons.

The aeronautical material screening unit (AMSU) processes components turned in to the ASD/SSC (aviation support division/supply support center) to determine the capability of the intermediate maintenance activity (IMA) to check/test or repair the item. The AMSU makes this determination by using the ICRL. The supply managers at the IMA consult maintenance personnel about ICRL management. They also support local efforts to improve repair capability.

Q22. What work center is the point-of-contact for parts and material at the organizational maintenance level?

- Q23. *DD form 1348, Standard Form 44, and an identiplate (DD 1896 or 1897) are all issued as part of what package?*
- Q24. *What level of maintenance orders the greater volume of parts?*
- Q25. *The Individual Component Repair List (ICRL) is used by what work center to determine the repair capability of a component received by supply?*

**AVIATION SUPPORT
DIVISION/SUPPLY SUPPORT CENTER
(ASD/SSC)**

LEARNING OBJECTIVE: Define the purpose of an Aviation Support Division/Supply Support Center.

The ASD/SSC of a supply department is the point of contact for maintenance activities requiring direct support. To accomplish this task, the ASD/SSC has two sections—the supply response section (SRS) and the component control section (CCS).

**SUPPLY RESPONSE SECTION
(SRS)**

The squadron or IMA material control centers refer all material demands directly related to aircraft maintenance to the ASD/SSC. Machines in the SRS connect with the Naval Aviation Logistics Command Management Information System (NALCOMIS), Shipboard Uniform Automated Data Processing System (SUADPS), or Status, Inventory Data Management Systems (SIDMS) telephones or teletype machines. Here, the SRS verifies the requisition for accuracy or makes a referral on the transceiver copy. Then the SRS prepares a requisition and records the document number, as well as the Status and Action codes in a log. Most requirements for components from organizational maintenance are for items carried in the local repair cycle assets (LRCA). Then, the SRS passes those requirements to the CCS. If the item is available in stock or the LCRA, CCS sends the material to the material delivery unit.

Material Delivery Unit (MDU)

The MDU receives a document from the stock locator unit (SLU) for the material. Then, the MDU delivers the material to the customer. When the MDU delivers a repairable component, the unserviceable part and appropriate paperwork are exchanged for the

replacement part (unless the CRIPL lists it). If the CRIPL lists the part, the maintenance activity has 24 hours after receipt of the replacement component to furnish the unserviceable part. Then, the driver from the MDU delivers the unserviceable component to AMSU. AMSU checks the ICRL, and, if IMA can repair the part, production control assigns a work priority and work center to the task.

Pre-expended Bins (PEBs)

PEBs contain high usage, low cost, maintenance-related materials, such as nuts, bolts, gaskets, O-rings, switches, abrasive, and glues. The PEB shortens the procedures for issuing and accounting for low-cost recurring issues. SRS in supply manages the PEBs. This includes display, labeling, and restocking of the bins. SRS stocks material in the PEBs that have a MINIMUM demand frequency of three per month. SRS also limits the quantity of any item in the PEB to a 30-day supply. If an item costs more than the maximum permitted (\$150), the commanding officer must approve the item for PEB stockage.

Pre-expended bins may be located in the maintenance area. Locating bins in the spaces of a maintenance activity makes high-usage, low-cost items immediately available to maintenance personnel.

How you use the PEB affects the number of items that SRS stocks. If you take 50 bolts for a project that only requires 20 bolts, you may keep another shop from getting the parts that are causing an aircraft to be NMCS. Or, if you show usage one month and none the next of an item in stock, supply may drop the item from the PEB, since the stock of a PEB is based upon use. Supply reviews stock records for the PEB quarterly. If there has been no demand for an item within the previous 12 months, supply will remove the item from the PEB and you will have to order the item.

Before you go to the PEB to draw an item, know what part number you need and check the PEB list. If the part number is on the PEB list, go to the PEB. If the part number is not on the PEB list, order the item through material control. When you use a low-cost item three or more times a month and it is not carried in the PEB, tell your supervisor so he or she can present the item for inclusion in the PEB. To do this, provide your supervisor with the part number and name of the end component on which the item will be installed.

COMPONENT CONTROL SECTION

The function of the CCS is to manage the LRCA held at the ASD/SSC. These assets consist of all supply assets in the ASD/SSC, whether they are held in the LRCA storage area, at the IMA undergoing work, sitting upon the shelf in AWP status. or being processed for shipment to a designated overhaul point (DOP).

Local Repair Cycle Asset (LRCA) Storage Unit

The LRCA storage unit receipts, stores, issues, and accounts for all repairable assets under the control of the CCS, including the rotatable pool. The LRCA allowance depends on an activity's maintenance data report (MDR) usage data and average turnaround time (TAT). There are four workload priorities that can be assigned to a LRCA.

Priority 1 is assigned to support NMCS/PMCS aircraft for requisitions held by supply. Also, priority 1 is assigned to 30-day predeployment requirements.

Priority 2 is assigned for the repair of critical LRCAs and SE, in addition to organizational maintenance activity (OMA) work stoppage requirements.

Priority 3 is assigned for the repair of noncritical LRCAs and SE. It covers the repair or manufacture of material for nonfixed allowance stock.

Priority 4 is assigned for processing salvaged material and nonaeronautical work.

If a squadron submits a requirement for a part and the LRCA has no assets, the CCS will dispatch a driver to your squadron to pick up the failed component. The driver will deliver the part to AMSU as an expeditious repair (EXREP). When the IMA can do the work, IMA inducts the expeditious repair component for overhaul under work priority 1. If IMA can put the part back in ready-for-issue (RFI) condition, the component will be delivered to the squadron immediately. The AMSU looks at similar components in work priority 3 for possible cannibalization to RFI the EXREP component from the squadron. If the component cannot be overhauled by IMA due to lack of repair

parts, the component is sent to the awaiting parts (AWP) unit.

AWP Unit

The AWP unit receives, stores, and controls all AWP components returned to the ASD/SSC from IMA because repair parts are not available. The AWP unit personnel requisition piece parts and maintain requisition files: registers, and records that are needed to monitor, follow up, expedite, recycle, and report material demand for component repairs.

- Q26. *What are the two sections of the Aviation Support Division/Supply Support Center (ASD/SSC)?*
- Q27. *If a part is listed in the CRIPL, the maintenance activity has how many hours after receipt of the replacement component to furnish the unserviceable part?*
- Q28. *What items are maintained in the pre-expended bins (PEBs)?*
- Q29. *How often does supply review stock records for the PEB?*
- Q30. *What section of ASD/SSC manages local repair cycle assets?*
- Q31. *How many workload priorities can be assigned to a LRCA storage unit?*
- Q32. *If a squadron requisitions an NMCS component from supply and, except for the turn-in, the only other part on station is in the IMA for repair, what priority will be assigned to the component received from the squadron?*

SUMMARY

You should now have an idea of the various jobs that some of the supply personnel perform and how the supply system works, at least locally. More importantly, you should have an understanding of how important it is to accurately document part numbers and stock numbers. Ordering the wrong part not only costs your command money, it causes unnecessary delays in the repair of aircraft. When ordering replacement parts, take time to ensure accuracy and neatness. When in a hurry, that "Z" may look like a "2" or that "5" like an "S." Take your time and don't be part of the problem.

ANSWERS TO REVIEW QUESTIONS

- A1. *Alpha/alpha/numeric.*
- A2. *FAD II or III*
- A3. *Usage statistics justify stocking replenishment parts.*
- A4. *Definitive and nondefinitive.*
- A5. *Commercial and Government Entity Code (CAGE).*
- A6. *Next higher assembly.*
- A7. *The illustrated parts breakdown (IPB) and the maintenance instruction manual (MIM).*
- A8. *General information and instructions for using the publication.*
- A9. *The group assembly parts list.*
- A10. *PAOZZ.*
- A11. *The first position.*
- A12. *Master Cross-Reference List (MCRL).*
- A13. *Consolidated Remain in Place List (CRIPL).*
- A14. *Quarterly.*
- A15. *AVCAL lists the items and quantities of aeronautical material authorized to be stocked by and aircraft carrier to support the maintenance and operations of embarked aircraft.*
- A16. *The National Codification Bureau (NCB) code.*
- A17. *NAVAIRINST 13650. I for IMRL items and NAVAIRINST 13630. I for TOL items.*
- A18. *NAVAIRSYSCOM exercises overall program management and authority.*
- A19. *Employment data, change list, index, main body, and the activity inventory record.*
- A20. *The IMRL main body.*
- A21. *It is reissued in its entirety each month.*
- A22. *Material control.*
- A23. *A flight packet.*
- A24. *Intermediate level.*
- A25. *Aeronautical material screening unit (AMSU).*
- A26. *Supply Response Section (SRS) and Component Control Section (CCS).*
- A27. *24 hours.*
- A28. *High usage, low-cost, maintenance-related consumable materials that have a minimum demand frequency of three per month.*

A29. *Quarterly.*

A30. *Component control section (CCS).*

A31. *Four.*

A32. *Priority 1, and the part would be designated "EXREP" or expeditious repair.*

CHAPTER 4

CORROSION PREVENTION AND CONTROL

As a maintenance crew member, you will work in two main areas when combating corrosion on naval aircraft. These areas include aircraft structures and avionics corrosion control.

AIRCRAFT STRUCTURES AND CORROSION

LEARNING OBJECTIVES: Describe how metal corrosion can threaten the structural integrity of an aircraft. Identify the personnel required to obtain corrosion control training. Identify the primary reason for selecting materials in aircraft construction.

Modern high-speed aircraft depend on the structural soundness of the metals that make up the largest percentage of their thousands of parts. Metal corrosion is the greatest threat to the soundness of metals and to the structural integrity of an aircraft. The materials used to construct an aircraft are designed to carry certain loads, to withstand given stresses, and to provide strength for safety. Corrosion reduces the strength and changes the mechanical characteristics of the materials, thus endangering the aircraft and reducing the margin of safety.

The corrosion that occurs on avionics equipment is similar to that which occurs on the basic airframe structure. The main difference is the amount of corrosion that is detrimental. A small amount of corrosion on avionics equipment can cause serious degradation or complete system failure. However, the same amount of corrosion on aircraft exterior surfaces might go unnoticed.

You can detect corrosion on the exterior of aircraft or equipment visually. If you follow the scheduled inspection requirements on a day-to-day basis, you will ensure adequate detection of external corrosion. It is harder to detect corrosion on the internal surfaces of an aircraft because such surfaces are not easily accessible. Thus., internal surfaces require special attention.

Corrosion often progresses unnoticed by the untrained technician. Therefore, the responsibility for the detection and treatment of corrosion on the aircraft

is assigned to all work centers in each activity. This ensures that sufficient knowledge is available to perform all required inspections. Formal training in corrosion control is a requirement for ALL MAINTENANCE PERSONNEL. Through this training, maintenance personnel are qualified to perform inspections, corrosion damage repair, and corrosion prevention. The corrosion control program established by the Naval Aviation Maintenance Program (NAMP) is an ALL HANDS participation concept.

Aerodynamic efficiency is the primary consideration of a manufacturer during the design and production of an aircraft. The materials used for construction are chosen for their weight-to-strength ratio-NOT their corrosion-resistant properties. This is one of the reasons your job as a maintenance crew member is so important. When performing maintenance on an aircraft, you must constantly look for surface decay on all internal and external areas of the aircraft. You should learn the corrosion-prone areas of your activity's aircraft. Then, you can constantly inspect these areas while performing maintenance. When a new aircraft is delivered from the manufacturer, corrosion is already present. Unless this corrosion is detected and treated, it can become a serious problem that can endanger the flight safety of the aircraft.

In addition to corrosion inspection of aircraft surfaces, maintenance personnel must be equally aggressive in preventing corrosion damage to aviation support equipment (SE). This equipment keeps the aircraft flying. The reliability and effectiveness of SE also depend largely upon the structural soundness of the metals that make up its parts. SE is used in a variety of climatic and atmospheric conditions, ranging from the hot, arid desert to cold, arctic regions. In addition, the equipment is used in the salt-filled atmosphere of coastal shore bases, islands, and aboard aircraft carriers. In this environment, the sea winds carry 10 to 100 pounds of salt per cubic mile of air. These varying environmental conditions promote corrosion and alter the speed and intensity of its development. Severe corrosion can cause components or systems to fail, perhaps during critical demand times. When this happens, replacements or corrective actions are costly,

time-consuming, and reduce equipment usage time. These problems can be avoided through good preventive maintenance practices and procedures.

To have good preventive maintenance practices and procedures, you must know and be able to apply the common types of corrosion prevention and moisture protecting materials.

- Q1. *How does corrosion endanger aircraft or reduce the margin of safety?*
- Q2. *All maintenance personnel must be formally trained in what program?*
- Q3. *What is the primary factor to consider when selecting materials for constructing an aircraft?*

CORROSION THEORY

LEARNING OBJECTIVES: Define the theory of corrosion and its process. Identify the publications and materials used in the prevention of corrosion.

Metal corrosion is the decay of metals as they combine with oxygen to form metallic oxides. Corrosion is a chemical process that is the reverse of the process of smelting the metals from their ores. Very few metals are found in their pure state in nature. Most are found as metallic oxides. These oxides have other undesirable impurities in them. The refining process involves the extraction of the base metal from the ore. The base metal is then mixed with other elements (either metallic or nonmetallic) to form alloys. Alloying elements are added to base metals to develop a variety of useful properties. For instance, in aircraft structural applications, high strength-to-weight ratios are the most desirable properties of an alloy.

After the base metals are refined, whether alloyed or not, they have a potential to return to their natural state. However, potential is not sufficient in itself to begin and promote this reversion; a corrosive environment must also exist. The significant element of the corrosive environment is oxygen. The process of oxidation (combining with oxygen) causes wood to rot or bum and metals to corrode.

Control of corrosion depends upon maintaining a separation between susceptible alloys and the corrosive environment. This separation is accomplished in various ways. A good intact coat of paint provides most of the corrosion protection on naval aircraft. Sealants used at seams and joints prevent entry of moisture into the metal. Preservatives are used

on unpainted areas of working parts. Finally, shrouds, covers, caps, and other mechanical equipment provide varying degrees of protection from corrosive mediums. However, none of these procedures will provide 100-percent protection. Weathering causes paint to oxidize and decay. Sealants may be worked out by vibration or be eroded by rain and windblast. Preservatives offer only temporary protection when used on operating aircraft. The mechanical coverings can be installed improperly or negligently.

Control of corrosion begins with an understanding of the causes and the nature of corrosion. Corrosion is the process of electrochemical or direct chemical attack on metals. The reaction is similar to that which occurs when acid is applied to bare metal. Corrosion in its most familiar form is a reaction between metal and water, and is electrochemical in nature.

The electrochemical attack involves metals of different electrical potential. These metals do not have to be in direct contact. If one metal contains positively charged ions and the other negatively charged ions, all that is needed is an electrical conductor. When the conductor is present, current will flow between the two metals, as in the discharge of a dry-cell battery. In electrochemical corrosion, the electrical conductor may be any foreign material, such as water, dirt, grease, or any debris that is capable of acting as an electrolyte. The presence of salt in any of the foregoing mediums accelerates the current flow and increases the rate of corrosive attack.

Once an electrical connection is made, the electron flow is established in the direction of the negatively charged metal (cathode). This action eventually destroys the positively charged metal (anode). Preventive measures include avoiding the establishment of the electrical circuit and removing corrosion as soon as possible to avoid serious damage. Figure 4-1 shows the electron flow in a corrosive

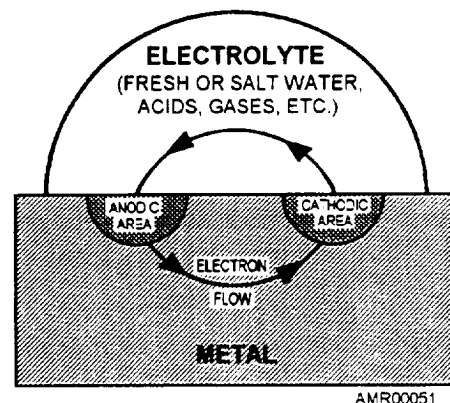


Figure 4-1.—Simplified corrosion cell.

environment destroying the anodic area. Note that the surface of a metal may contain anodic and cathodic areas because impurities or alloying constituents may have different potentials than the base metal.

Electrochemical attack is evident in several forms. The form you find depends upon the metal involved, its size and shape, its specific functions, atmospheric conditions, and type of corrosion-producing agent (electrolyte) present.

There are many factors that affect the type, speed, cause, and the seriousness of metal corrosion. Some of these factors you can control; others you cannot. Preventive maintenance factors, such as inspections, cleaning, painting, and preservation, are within the control of the operating squadron. They offer positive means of preventing corrosion.

The electrochemical reaction, which causes metal to corrode, is more dangerous under wet, humid conditions than under dry conditions. The salt in seawater and the salt in the air are the largest single cause of aircraft corrosion. Hot climates speed the corrosion process because the electrochemical reaction develops fastest in a warm solution. The warm moisture in the air is usually enough to start corrosion of the metals if they are uncoated. As expected, hot, dry climates usually provide relief from constant corrosion problems. Extremely cold climates will produce corrosion problems when a salt-laden atmosphere is present. Melting snow or ice provides the necessary water to begin the electrochemical reaction.

Thick structural sections are subject to corrosive attack because of possible variations in their composition, particularly if they were heat-treated during fabrication. Similarly, when large sections are machined or cut out after heat treatment, thinner sections have different physical characteristics than the thicker areas. Usually a difference in physical characteristics provides enough difference in electrical potential to make the piece highly susceptible to corrosion. Another factor relating to the size of materials is the relationship between dissimilar metals. (See figure 4-2.) If electrical contact develops between two dissimilar metals, the corrosion attack on the more active metal or anode (smaller size compared to the less active one) will be severe and extensive. See figure 4-2, bottom view. If the area of the less active metal is small compared to the other, anodic attack will be slight (fig. 4-2, top view).

Corrosion on avionics equipment is a continuing process. The equipment does not have to be installed, operating, or exposed to a particularly harsh environment to corrode. The rate of the corrosion process is determined by the temperature, humidity, and chemicals in the environment. Moisture is the single largest contributor in avionics corrosion. It makes little difference whether the moisture is in the form of vapor or liquid. Its affects are detrimental to metals.

A clean aircraft retains its aerodynamic efficiency and safety. Serious damage to the exterior and interior surfaces of aircraft can result from the lack of correct information about cleaning materials and equipment and their use. Shipboard procedures are not necessarily the same as procedures ashore, but the same materials are available to produce comparable results.

A problem you may face when fighting corrosion is knowing what materials to use, where to find them, and their limitations. You should use only those materials that have military specifications. Corrosion control information can be found in many directives

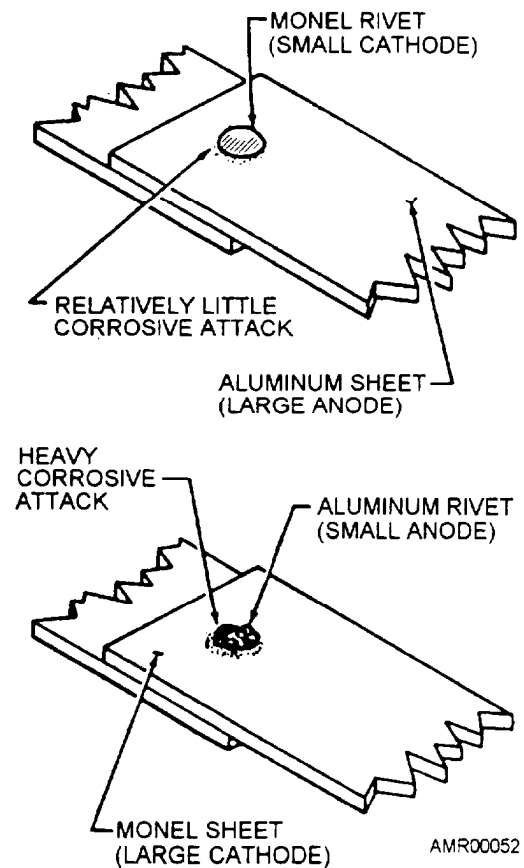


Figure 4-2.—Effects of area relationships in dissimilar metal contacts.

and instructions. This information is constantly revised to give you up-to-date knowledge and procedures. You can find the following sources of information on corrosion in your unit's technical library or corrosion control work center.

- *Aircraft Weapons System Cleaning and Corrosion Control for Organizational and Intermediate Maintenance Levels*, NAVAIR 01-1 A-509

- *Avionics Cleaning and Corrosion Prevention/Control*, NAVAIR 16-1-540

- *Preservation of Naval Aircraft*, NAVAIR 15-01-500

- *Chart-Corrosion Preventive Compounds used by Naval Air Systems Command*, NAVAIR 01-1 A-518

- *General use of Cements, Sealants, and Coatings*, NAVAIR 01-1A-507

- *Ground Support Equipment Cleaning And Corrosion Control*, NAVAIR 17-1-125

- *Corrosion Control, Cleaning, Painting, and Decontamination* (One volume of the maintenance instruction manuals (MIMs) for all late model aircraft is devoted to these subjects.)

- *Periodic Maintenance Requirements Cards*

Q4. *The decay of metals as they combine with oxygen is known as what type of corrosion?*

Q5. *What does an intact coat of paint provide to naval aircraft?*

Q6. *In an electrochemical attack, electron flow is established in which direction?*

Q7. *How will heat, humidity, and moisture affect the electrochemical reactions that cause metal to corrode?*

Q8. *Why are thick structural sections most susceptible to corrosive attack?*

Q9. *In relation to corrosion, what affect does moisture have on avionics equipment?*

Q10. *Which NAVAIR publication is entitled Aircraft Weapons Systems Cleaning and Corrosion Control?*

Q11. *NAVAIR 16-1-540 provides what information?*

Q12. *Information on the preservation of Naval aircraft and aircraft engines can be found in what publication?*

Q13. *What information can you find in NAVAIR 01-1A-507?*

PREVENTIVE MAINTENANCE

LEARNING OBJECTIVE: Define the purpose of a preventive maintenance program.

“An ounce of prevention is worth a pound of cure.” Where corrosion prevention on naval aircraft is concerned, this is an understatement. Compared to the cost of naval aircraft, the cost of corrosion prevention is small. Preventive maintenance is a powerful tool that can control even the most difficult corrosion problem.

Most operating activities increase their corrosion prevention programs to meet severe conditions aboard ship. Then, these programs are decreased in scope when the aircraft is returned to the relatively mild conditions ashore. When corrosion preventive maintenance is neglected because of tactical operating requirements, a period of intensive care should follow to bring the aircraft back up to standard.

The two most important factors in preventing corrosion, and the only factors that can be controlled by field personnel, are the removal of the electrolyte and the application of protective coatings. Since the extent of corrosion depends on the length of time electrolytes are in contact with metals, corrosion can be minimized by frequent washing. Prevention also involves the correct and timely use of covers and shrouds, periodic lubrication, and the application of preservatives. Years of experience have proven the need for such measures to keep the aircraft airworthy. When corrosion preventive maintenance is neglected, an aircraft soon becomes unsafe to fly. Squadrons with the best corrosion preventive programs tend to have the best safety records, maximum use of the aircraft, and the lowest operating costs.

SUPPORT EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

The Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2, requires SE shops to establish a maintenance schedule for each item of equipment. The SE Custody and Maintenance History Record, OPNAV 4790/51, is used to schedule and record all corrosion maintenance actions.

SURFACE MAINTENANCE

Surface maintenance includes regular cleaning of the aircraft as well as touch-up of protective paint coatings. Since paint touch-up is done after removal of corrosion, it is discussed later in this chapter. Touch-up of new damage to paint finishes prevents corrosion from starting.

Aircraft must be washed and cleaned at least every 14 days, unless otherwise directed by NAVAIR. Aircraft must be kept in a clean condition, and repeated cleaning should be done as often as necessary. More frequent cleaning may be needed when the following conditions exist:

- An excessive amount of soil or exhaust gases accumulation within impingement areas
- Exposure to salt spray, salt water, or other corrosive materials
- Evidence of paint surface decay, such as softening, flaking, or peeling
- The presence of fluid leakage (excessive oil, coolant, hydraulic fluid, etc.)

Immediate cleaning of affected areas is always mandatory if:

- Aircraft is exposed to corrosive fire-extinguishing materials
- Spilled electrolyte and corrosive deposits are found around battery terminals and battery area
- The aircraft has been exposed to significant amounts of salt water
- Salt deposits, relief tube waste, or other contaminants are apparent
- Fungus growth is apparent
- Chemical, biological, or radiological contaminants are detected

A daily cleaning or wipe-down is required on all exposed, unpainted surfaces, such as struts and actuating cylinder rods.

Aircraft must be thoroughly cleaned before they are stored. They should also be thoroughly cleaned when they are depreserved. Unpainted aircraft are cleaned and polished at frequent intervals. Aboard ship, cleaning and removal of salt deposits are needed to prevent possible corrosion. Components that are critically loaded (designed with minimum safety margins to conserve size and weight) are cleaned as often as possible to minimize exposure to corrosive

agents. These components include helicopter rotor parts and parts that are exposed to corrosive environments (such as engine exhaust gas, acid, or rocket blast).

NOTE: Postcleaning lubrication and preservation of exposed components are necessary to displace any of the cleaning solution entrapped during the cleaning operation.

- Q14. What should happen to a good corrosion preventive program when carrier-based aircraft return to a shore activity after a deployment?*
- Q15. Operating units that have the best safety records, maximum use of aircraft, and lowest operating costs will also have what program?*
- Q16. At a minimum, how often must aircraft be cleaned?*
- Q17. List the conditions that require the affected areas of an aircraft to be cleaned immediately.*
- Q18. What must be done on a daily basis with unpainted aircraft surfaces and actuating rods?*

AVIONICS MAINTENANCE

A successful avionics cleaning and corrosion prevention and control program depends upon a successful preventive maintenance program. The nature of corrosion requires that everyone involved in the repair and operation of electrical, electromechanical, and electronic systems be concerned with the corrosion control of avionic equipment. You should recognize the difference between the prevention of corrosion and the repair of damage caused by corrosion. Preventive maintenance programs at organizational- and intermediate-level maintenance activities accomplish the following:

- Reduce the maintenance time spent repairing corrosion damage
- Ensure the military avionics community is aware of the extent of the corrosion problem
- Improve avionics system reliability, durability, and service life
- Report any and every deficiency with material or process involving corrosion control

CLEANING MATERIALS

LEARNING OBJECTIVE: Identify the hazards of handling and storing aircraft cleaning materials.

When cleaning or performing corrosion control on aircraft and nonavionics aircraft components, you should use the materials listed in *Aircraft Cleaning and Corrosion Control for Organizational and Intermediate Maintenance Levels*, NAVAIR 01-1A-509. You may use materials that do not conflict with the 509, as listed in the MIM and maintenance requirements cards (MRCs) that apply. For avionics and electrical systems, you should refer to the *Avionic Cleaning and Corrosion Prevention/Control*, NAVAIR 16-1-540. Cleaning agents commonly used by O- and I-level maintenance activities are described in the following text

HAZARDOUS CHEMICAL WARNING LABEL					
1. CHEMICAL / COMMON NAME					
2. HAZARD CODE		3. NSN / LSN			
4. PART NUMBER					
5. ITEM NAME					
6. HAZARDS (x all that apply)	(1) Acute (Immediate)				(2) Chronic (Delayed)
	NONE	SLIGHT	MODERATE	SEVERE	
	a. HEALTH				
	b. CONTACT				
	c. FIRE				
d. REACTIVITY					
7. SPECIFIC HAZARDS AND PRECAUTIONS (including Target Organ Effects)					
(See MSDS for further information)					
8. PROTECT (x all that apply)	a. EYES		b. SKIN		c. RESPIRATORY
9. CONTACT: a. COMPANY NAME					
b. ADDRESS (Street, P.O. Box, City, State, Zip Code and Country)					
c. EMERGENCY TELEPHONE NUMBER (include Area Code)					
10. PROCUREMENT YEAR FOR HAZARDOUS CHEMICAL					

DD Form 2522 (1C), DEC 88 S/N 8182-LP-813-1100
★ GPO: 1991-507-427

AMR0053

Figure 4-3.—DoD Hazardous Chemical Warning Label.

CAUTION

You must read the Material Safety Data Sheet (MSDS) before you use any hazardous material.

Hazardous Materials

Hazardous material is any material presenting hazards to personnel, property or the environment by handling, storing, and using such materials. Hazardous materials can be used safely if you take extra precautions when handling and storing these materials.

Hazardous material, such as chemicals, require a hazardous chemical or material identification label. Figure 4-3 shows a DoD Hazardous Chemical Warning Label. DoD personnel must use this label on DoD manufactured hazardous materials, repackaged containers, tanks of hazardous chemicals, and unlabeled materials already in the DoD system.

Manufacturers use various symbols and DOT shipping labels with the required Occupational Health and Safety Administration (OSHA) labeling. Used alone, these DOT symbols or labels **do not** meet the OSHA labeling requirements. Navy personnel should not place any labels on containers that already have proper labels. If you buy or receive a hazardous material with the minimum required labeling, do not add any additional labeling. If you have an unlabeled container or one with a damaged label, you can print a label from the HMIS CD-ROM or use DD Form 2522.

Flammable and Combustible Liquids

Combustible liquids are any liquids that have a flash point at or above 100°F, but below 200°F. Flammable liquids are any liquids that have a flash point below 100°F. Fire is a very serious hazard. An equal hazard to personnel is breathing poisonous (toxic) fumes in unventilated spaces.

NOTE: Flash point is defined as the minimum temperature at which a liquid gives off an ignitable vapor within a test vessel.

Solvents

Solvents are liquids that dissolve other substances. They are used in many products, such as paints, degreasing fluids, and aircraft cleaning compounds (an organic solvent). Aside from posing a fire hazard, inhaling the vapors can seriously affect the brain and

the central nervous system. Therefore, you should use solvents only in well-ventilated spaces. You should wear gloves, an apron, and a face shield to protect your skin and eyes. You should also don an approved respirator to prevent breathing of the toxic vapors. Without protection, skin lesions, much like acne, may develop. If you do not use rubber gloves, your hands will lose their fatty protection and the skin will dry, crack, and become infected.

Some solvents are chlorinated. When solvents contain more than 24 percent by volume of chlorinated materials, they must be kept in specially marked containers. You must ensure the equipment in which the solvent is used is designed and operated to prevent escape of the solvent. All personnel who work near chlorinated solvents should be careful to avoid breathing the vapors. While the vapors from some solvents are more toxic than others, prolonged breathing of any fumes presents a serious health hazard.

Keep all containers holding paints, lacquers, removers, thinners, cleaners, or any volatile or flammable liquids tightly closed when not in use. Store all flammable and volatile liquids in a separate building or a flammable liquids storeroom. The approved flammable storage locker should be well ventilated. It should be located where its contents will not be exposed to excessive heat, sparks, flame, or direct rays of the sun. Storage areas must also have a fixed CO₂ or Halon extinguishing system. All electrical fixtures, outlets, and other wiring must be of the explosionproof class. Place wiping rags and other flammable waste material in tightly closed containers. You must empty these containers at the end of the work shift.

You should keep in mind that the temperature inside the paint locker could become very high, especially during the summer months. As the temperature increases, liquids expand. Maintenance personnel have received serious chemical burns on the face, hands, and arms from opening a hot can of solvent. This hazard increases many times when personnel work with the more volatile liquids, such as paint strippers. Before opening a container of solvent that has been stored in a high-temperature area, you should cool it down. You can do this by using a stream of water. Use common sense around flammable and volatile liquids.

When storing containers, you must handle them carefully to avoid breakage and spillage. If you stack the containers, the lower containers may be

overloaded, causing leaks to develop along seams. This results in a loss of material. To prevent an accumulation of water and debris in their upper ends, store the containers on their sides or cover them with a tarpaulin. Before you store containers, you should inspect them for leaks and ensure complete closure of all plugs, caps, and covers. Inspect stored containers frequently for leakage, rust, or any other condition that may cause a problem. Correct deficiencies immediately.

When storing materials outdoors, you should protect the containers from the weather with tarpaulins or sheds. This reduces the likelihood of water contamination. When you use tarpaulins, lash them in place securely and position them so that air is free to circulate around the containers.

Another hazard associated with solvents (and to a certain extent with all cleaning materials) is their effect on the material being cleaned. Some solvents, such as methyl ethyl ketone and toluene, will damage rubber, synthetic rubber, and asphalt coverings. You should always consider this damaging effect when selecting cleaning materials. Most cleaning materials may do a good job in removing dirt, grease, oil, and exhaust gas deposits. However, they may also soften and ruin an otherwise good paint coating. For specific information on solvents, you should check NAVAIR 01-1 A-509. Some solvents, consumable materials and their characteristics are described in the following text.

Solvent, Dry-cleaning. This material is a petroleum distillate commonly used in aircraft cleaning. It is a general all-purpose cleaner available in three types and is used for metals, painted surfaces, and fabrics. It is applied by spraying, brushing, dipping, or wiping.

Aliphatic Naphtha. Aliphatic naphtha is an aliphatic hydrocarbon product used as an alternate compound for cleaning acrylics. You may also use it for general cleaning purposes when you want fast evaporation and no film residue. Apply by dipping and wiping. DO NOT rub saturated surfaces vigorously. DO NOT use aliphatic naphtha with a synthetic wiping cloth, because it is a highly volatile and flammable solvent. Because it has a flash point below 80°F, use only in well-ventilated areas.

Safety Solvent. Methyl chloroform is for use where a high flash point is required. Use it for general cleaning and grease removal from assembled and disassembled engine components in addition to spot

cleaning. Do not use it on painted surfaces. Safety solvent is not suitable for oxygen systems. It can be used for other cleaning in ultrasonic cleaning devices. Apply it by wiping, scrubbing, or booth spraying. The term *safety solvent* is derived from its high flash point. Many later-issue maintenance manuals refer to safety solvent as 1,1,1-trichloroethane.

Methyl Ethyl Ketone (MEK). Methyl ethyl ketone (MEK) is a cleaner for bare-metal surfaces and areas where MIL-S-8802 sealant is to be removed. Normally, you apply MEK over small areas with wiping cloths or soft bristle brushes.

CAUTION

Avoid prolonged breathing and skin contact of MEK. Use MEK only in well-ventilated spaces. Use extreme care when working around transparent plastics because MEK will damage them upon contact.

Trichloroethane. This is a nonflammable degreasing agent for cleaning oxygen systems equipment. It can be harmful to paint and plastic materials and since its vapors are heavier than air, it will displace oxygen in poorly ventilated areas.

Ammonium Hydroxide. Normally, you use ammonium hydroxide in the lavatories of aircraft to neutralize urine and waste products. Use a sponge to apply it, and then flush the area with fresh water.

Sodium Bicarbonate. Sodium bicarbonate also neutralizes urine deposits. You apply it with a sponge, and then flush the area with fresh water. Sodium bicarbonate is also a neutralizing agent for sulfuric acid battery electrolyte deposits.

Sodium Phosphate. Sodium phosphate neutralizes electrolyte spills from nickel-cadmium batteries. Remove spilled electrolyte immediately by flushing with fresh water. Neutralize the area by sponging generously with sodium phosphate solution and then flush with fresh water. Dry with clean wiping cloths.

Aqueous Film-forming Foam. Aqueous film-forming foam is commonly known as AFFF. Use it for removing fire-extinguishing agent MIL-F-24385 from aircraft surfaces. Complete details for the use of AFFF as a cleaning agent are in *Aircraft Weapons System Cleaning and Corrosion Control*. NAVAIR 01-1A-509.

Aircraft Surface Cleaning Compound

Maintenance personnel use water emulsion cleaners to clean aircraft. These cleaners disperse contaminants into tiny droplets that are held in suspension. The droplets of this cleaner are then flushed from the surface. MIL-C-43616 water emulsion compounds contain emulsifying agents, coupling agents, detergents, solvents, corrosion inhibitors, and water. Use these compounds on painted and unpainted surfaces in heavy-duty cleaning operations, when materials of lower detergency are not effective. Use these compounds in varying concentrations, depending upon the condition of the surface.

Apply water emulsion cleaner by starting at the bottom of the area being cleaned. You may apply the mixed solution by spraying or brushing to avoid streaking. Loosen surface soils by mild brushing or mopping. Then, give the surface a thorough fresh water rinse by using an automatic shutoff-type water spray nozzle. This type of nozzle gives hand control from a light mist or fogging spray to a full spray with high-pressure water.

Aircraft cleaning compound MIL-C-85570 is the primary cleaning compound used on naval aircraft. The five types of MIL-C-85570 are discussed in the following text.

TYPE I is for cleaning painted and unpainted aircraft outdoors or where enough ventilation is available. It may be used to clean either high-gloss or tactical paint systems.

TYPE II is for cleaning painted and unpainted aircraft indoors and in areas of limited ventilation. It is for cleaning either high-gloss or tactical paint systems. Type II is not as good as type I for these purposes. It may also be used outdoors.

TYPE III is a mild abrasive cleaner. It is used undiluted for spot cleaning high-gloss paint systems, such as exhaust tracks, shoe scuff marks, and other areas where types I and II are not effective.

TYPE IV is a spot cleaner for Tactical Paint Scheme (TPS). For spot cleaning embedded soils on TPS systems without changing the paint finish.

TYPE V is for cleaning heavy soils, such as carbonized oil, aged preservatives, grease, and gun blast and exhaust deposits. This cleaner clings to

vertical oily or greasy surfaces where water rinsing can be tolerated.

AVIONIC CLEANING MATERIALS

The materials discussed in this section are the ones used most often when avionics and electrical equipment are cleaned. For a complete list, description, and application of avionic cleaning materials, you should refer to NAVAIR 16-1-540.

MIL-D-16791, type 1 detergent, is used to clean transparent plastics and glass. Also, it is used at I-level maintenance activities as a water-based solvent spray in cleaning booths and aqueous ultrasonic cleaners. For cleaning by hand, you should apply it to the area to be cleaned with a flannel cloth, let it dry, and then remove it with a flannel cloth.

Trichlorotrifluoroethane is commonly known as Freon (MIL-C-81302 cleaning compound). It is a general cleaner for avionic and electrical systems. You can use MIL-C-81302 Freon as type I (ultraclean) or type II cleaner. The uses for these types of cleaners are discussed in the following text.

TYPE I, MIL-C-81302, is used on precision equipment where an ultraclean solvent is required. It is used in clean room applications in intermediate-level maintenance activities.

TYPE II: MIL-C-81302, is used on all internal areas of avionics equipment. Normally, type II should be filtered before it is used. It can be used to clean dirt and dust from areas before soldering.

The application procedures and restrictions applying to MIL-C-81302, types I and II, are the same. They are as follows:

- Apply by wiping or scrubbing the affected area with an acid brush or toothbrush.
- Air dry or oven dry, as applicable.
- Do not use on acrylic plastics or acrylic conformal coatings.
- Do not use on unsealed aluminum electrolytic capacitors. Damage may result to end caps and cause leakage.

Isopropyl alcohol (TT-I-735) is a general-purpose cleaner and solvent. Use it to remove salt residue and contaminants from internal avionics and electrical equipment. Use an acid brush or pipe cleaner to apply

a solution of isopropyl alcohol and water. Then, wipe clean and air dry.

NOTE: Isopropyl alcohol is highly flammable and requires the same handling and storage procedures as other solvents.

MECHANICAL CLEANING MATERIALS

Mechanical cleaning materials consist of items such as abrasive papers: polishing compounds, polishing cloths, steel wool, and wadding. These materials are available in the supply system. However, use them as outlined in the cleaning procedures section of NAVAIR 01-1A-509 and the specific MIM. These procedures prevent damage to finishes and surfaces. In cases of conflicting information, NAVAIR 01-1A-509 always takes precedence.

Aluminum oxide abrasive cloth is available in several forms. It is safe to use on most surfaces because it does not contain sharp or needlelike abrasives. Avoid the use of silicon carbide papers as a substitute for aluminum oxide. The grain structure of silicon carbide is sharp. It is so hard that individual grains can penetrate steel surfaces.

Impregnated cotton wadding is used to remove exhaust gas stains and to polish corroded aluminum surfaces. It is also used on other metal surfaces to produce a high reflection.

Aluminum metal polish is used to produce a high-luster, long-lasting polish on unpainted aluminum-clad surfaces. It is not used on anodized surfaces because it will remove the oxide coat.

- Q19. *What are the most serious hazards in handling, using, and storing aircraft cleaning materials?*
- Q20. *Why is there a requirement to use a respirator when working with solvents?*
- Q21. *What must be done specifically when storing solvents that contain more than 24% chlorinated materials?*
- Q22. *Where must flammable liquids be stored when not in use?*
- Q23. *By what means is dry-cleaning solvent applied?*
- Q24. *Safety solvent is currently referred to by what name?*
- Q25. *List the application procedures and restrictions that apply to ML-C-81302, types I and II.*

Q26. What material must be avoided as a substitute to aluminum oxide abrasive cloth and why?

CLEANING EQUIPMENT

LEARNING OBJECTIVE: Identify the cleaning compounds used in aircraft cleaning and the procedures for washing aircraft.

Cleaning aircraft surfaces requires the correct cleaning materials and the use of properly maintained equipment. The choice of equipment depends upon several factors. Some of these are the amount of cleaning regularly performed, the type of aircraft, location of the activity, and the availability of air pressure, water, and electricity. Several types of specialized equipment are available for cleaning aircraft. These include pressure-type tank sprayers, a variety of spray guns and nozzles, high-pressure cleaning machines, and industrial-type vacuum cleaners. One piece of specialized equipment, the automatic water spray nozzle, is shown in figure 4-4.

A device used for the fast, economical cleaning of aircraft is a swivel-type, conformable applicator cleaning kit (fig. 4-5). Its design allows you to clean

aircraft exteriors faster than with cotton mops or bristle brushes. Its official designation is the Aircraft Cleaning Kit No. 251. The swivel and applicator head is attached to a standard brush handle. Because it conforms to the surface, the applicator allows easier application of a constant scrubbing pressure on curved skin panels. It does this by keeping the brushes in maximum contact with the surface. When you use these brushes, you must make sure they do not cause a FOD problem.

CLASSIFICATION AND REMOVAL OF SOILS

Soils may be classified and removed as described below:

- Lightly soiled surfaces (dirt, dust, mud, salt, and soot). Use the proper mixture of MIL-C-85570 and fresh water.
- Moderately soiled surfaces (hydraulic oils, lubricating oils, and light preservatives). Use a proper mixture of MIL-C-85570 and fresh water.
- Heavily soiled surfaces (carbonized oils, aged preservatives, grease, gun blast deposits, and exhaust

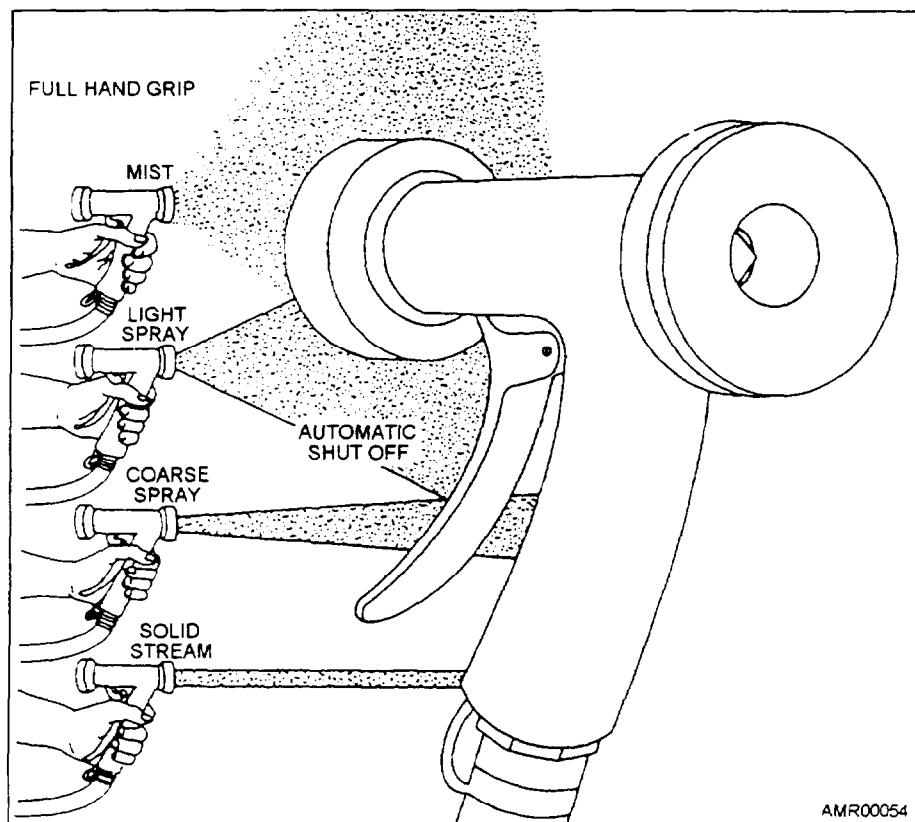


Figure 4-4.—Automatic water spray nozzle.

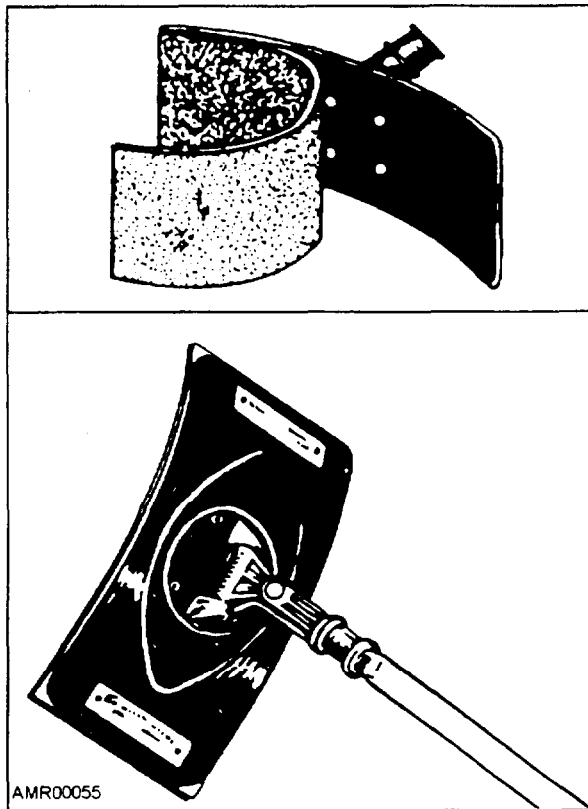


Figure 4-5.—Aircraft washing applicator.

trails). Pretreat with P-D-680, followed by cleaning with the proper mixture of MIL-C-85570 and fresh water or MIL-C-43616.

- Soiled surfaces on the tactical paint scheme (low visibility flat paint scheme). Use MIL-C-85570, types I, II, or IV for cleaning tactical paint systems according to mixture directions.

CLEANING PREPARATION

The first step in cleaning an aircraft is to select the proper cleaning agent for the method of cleaning you will use. Next, the aircraft must be prepared for cleaning.

Ground the aircraft to the deck. Static electricity generated by the cleaning operation will be dissipated through the ground wire.

If the aircraft surface is hot, cool it with fresh water before starting any cleaning operation. Many cleaning materials will clean faster at elevated temperatures. However, the risk of damage to paint, rubber, and plastic surfaces is increased. This damage is caused by the cleaners, which are concentrated by the solvent evaporating quicker at high temperatures.

Secure openings, such as canopies, doors, and access panels. Some equipment and components, such as air-sensing probes (pitot tubes), can be damaged by moisture and cleaning agents. To prevent the entrance of moisture, cover these and similar openings with either the proper aircraft cover or with masking tape, as specified in NAVAIR 01-1A-509, Appendix A.

CLEANING METHODS

There are several different methods for cleaning naval aircraft. These methods vary, depending upon the availability of fresh water.

Water-Detergent Cleaning

The water-detergent cleaning method is the preferred method for cleaning naval aircraft. Use this method when enough fresh water is available for rinsing.




After preparation, wet down the aircraft surface to be cleaned with fresh water. Then, apply a concentrated solution of cleaning compound and water to heavily soiled areas. Scrub these areas and allow the concentrated solution to remain on the surface. Limit the size of the area you are cleaning to an area that can be cleaned while it is still wet.

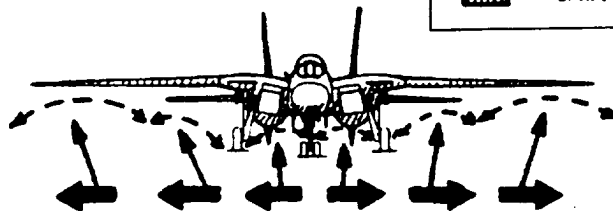
Next, apply a diluted solution of cleaning compound and water. The solution should be in a ratio suitable for the type of soil present in accordance with NAVAIR 01-1A-509. Apply this solution to the entire surface to be cleaned (upward and outward), including those areas previously covered with concentrated solution. The proper washing procedure is shown and described in figure 4-6.

- Scrub the surfaces thoroughly, and allow the solution to remain on the surface for 5 to 10 minutes before rinsing.

- Rinse the lower surfaces and work upward. Then rinse from the top down, starting with the vertical stabilizer, upper fuselage, upper wing surfaces, and horizontal stabilizers. Rinse lower areas in the same order and manner as the upper surfaces. If a high-pressure stream of water is used for rinsing, hold the nozzle at an angle and at a reasonable distance from the surface being sprayed. If any areas are still not clean, repeat the operation in those areas only. Thorough rinsing minimizes streaking.

LEGEND

 DIRECTION OF STEPS
 DIRECTION OF SPRAY
 SPRAYED AREA

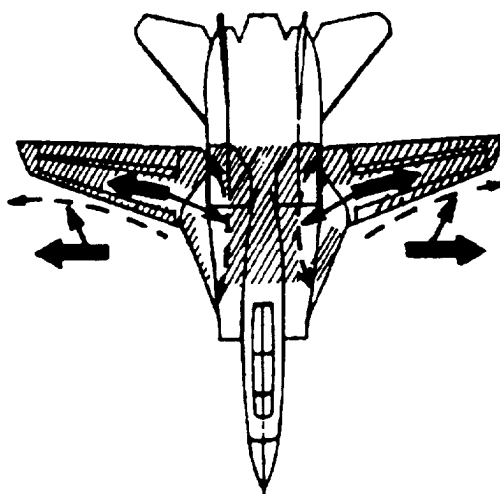
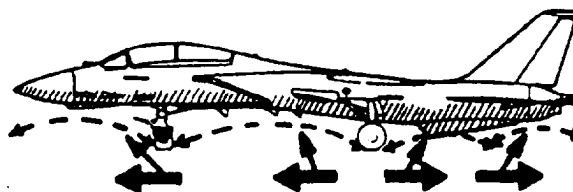


STEP 1

WASH THE UNDERSIDE OF WING, SPRAYING FROM THE CENTER SECTION TOWARDS THE WING TIPS.
 NOTE: OPEN DOORS AND FLAPS TO FLAPWELLS, INTERCOOLERS, OIL COOLERS, DIVE BRAKES, SPOILERS, CONTROLLABLE LEADING EDGES, ETC. TO PERMIT CLEANING OF HIDDEN AREAS.

STEP 2

WASH THE UNDER SURFACE OF FUSELAGE AND TAIL SECTIONS FROM LANDING GEAR TOWARDS BOTH ENDS AND SPRAYING IN THE DIRECTION OF MOVEMENT.

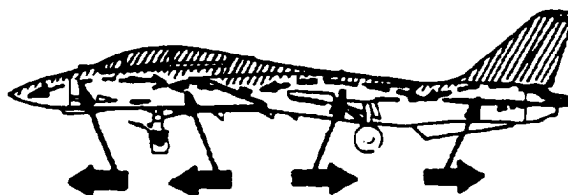


STEP 3

WASH THE UPPER SIDE OF WINGS AND CENTER SECTION OF FUSELAGE. DIRECT SPRAY INWARD WHILE MOVING OUTWARD TOWARDS WING TIPS.
 NOTE: OPEN COWL FLAPS WHILE CLEANING

STEP 4

SPRAY THE REMAINING PARTS OF THE UPPER SIDE OF FUSELAGE AND TAIL SECTIONS MOVING FROM CENTER TO ENDS. ALL AREAS OF THE AIRCRAFT MUST BE COMPLETELY COVERED BY THE CLEANING SOLUTION.



AMR00056

Figure 4-6.—Aircraft washing procedures.

Detergent Cleaning With Limited Water

Use this method only when water is limited.

- Prepare the aircraft for cleaning. Then mix the proper amounts of aircraft cleaning compound and water in a bucket.

- Apply the cleaner with a scrub brush, sponge, rag, or cleaning and polishing pad. Apply to one small area at a time.

- Scrub the area. Then remove the cleaner and loosened soils with a cloth.

- For soils that are resistant to the limited water procedure, clean with dry cleaning solvent (P-D-680, Type II or III) then repeat with the cleaning compound and water mixture.

- Apply water displacing, ultrathin, film corrosion preventive compound MIL-C-81309, type II, and wipe with a clean, dry cloth.

Waterless Wipedown Cleaning

Use waterless wipedown procedures only when water is not available for rinsing or when cold weather prevents the use of water. Using a plastic spray bottle, apply MIL-C-85570, Type I or II (mixed IAW NAVAIR 01-1A-509). Alternatively, spray the cleaner from an aerosol can and wipe off contaminants from the surface.

Spot Cleaning

Spot clean light, oily, soiled surfaces by wiping with dry-cleaning solvent. Apply the solvent by using a saturated wiping cloth. Brush or wipe the surface as necessary; then wipe clean with a dry cloth. The solvent wipe may leave a light residue. Remove this residue with soap and water, followed by a fresh water rinse.

NOTE: After cleaning an aircraft, relubricate it as specified by the MRCs. Ensure that all low-point drains are open, covers and shrouds are removed, and that aircraft preservatives are applied to clean, exposed, unpainted surfaces. Also make sure that the felt wiper washers on all hydraulic cylinders are moistened, and wipe down actuating cylinder rods with a clean rag saturated with hydraulic fluid. Remove and replace damaged or loosened sealant as specified by the applicable MIM.

Q27. *Why is the conformable applicator cleaning pad better than a mop or bristle brush when cleaning aircraft surfaces?*

Q28. *Types I, II, and IV of what cleaning compound are to be used on tactical paint schemes?*

Q29. *What is the first step in efficiently cleaning an aircraft?*

Q30. *When cleaning an aircraft what are the two directions in which cleaning compound and rinsing are applied?*

Q31. *What substance may be used to spot-clean lightly soiled areas?*

AVIONICS EQUIPMENT CLEANING

Dust and contamination cause corrosion problems in avionics equipment. Cleaning prevents many of these problems. Therefore, cleaning is the first logical step after an inspection. Cleanliness is very important in maintaining the functional integrity and reliability of avionic systems. Dirt may be either conductive or insulating. As a conductor, it may provide an undesired electrical path. As an insulator, it may interfere with proper operation. Dust, fingerprints, surface oxides, contaminants, or other foreign material on a surface can undo all the good provided by protective coatings.

A good maintenance practice is to use the mildest cleaning method that will properly decontaminate the equipment. It is also important to use the correct cleaning solutions and cleaning materials to avoid damage to avionics equipment. Some of the hazards associated with the cleaning of electronic and electrical equipment are as follows:

- Cleaning solvents or materials can be trapped in crevices or seams. This interferes with later applications of preservative coatings and causes corrosion as well.
- Vigorous or prolonged scrubbing of laminated circuit boards can damage the boards.
- Certain cleaning solvents soften conformal coatings, wire coverings, acrylic panels, and some circuit components.

WARNING

Dry-cleaning solvent should not be used in oxygen areas or around oxygen equipment. Dry-cleaning solvent is NOT oxygen compatible and will cause explosion and/or fire.

When dust, contaminants, or corrosion are detected, action is required. If the corrosion is within repairable limits specified in the applicable MIM or local directive, initiate corrective action. Corrective action includes cleaning, corrosion removal, treatment, and preservation.

The nature of some surfaces, such as chrome-, nickel-, gold-, and silver-plated contacts, limits the use of highly abrasive cleaning methods. You can remove tarnish and light corrosion from these surfaces by rubbing with one of the following materials:

- An eraser (conforming to specification ZZ-E-661) known as magic rub, ruby red, wood, or paper encased (pencil-type) or typewriter eraser
- A nonabrasive cleaning pad (MIL-C-83957) for laminated circuit boards, waveguides, relay contacts, etc.
- A brush (toothbrush H-T-560 or typewriter brush H-B-681) for general scrubbing of dirt, soil, and corrosive products on circuit components

Remove light to heavy corrosion from surfaces, such as covers, connectors, receptacles, antenna mounts, equipment racks, and chassis, by hand rubbing and by using aluminum oxide abrasive cloth. You may use either MIL-A-9962, type I, grade A (very fine), grade B (fine), or aluminum oxide abrasive cloth P-C-451, 320 grit, to do this task.

USE OF COVERS AND SHROUDS

When an aircraft is delivered by the manufacturer, it has a complete set of tailored dust and protective covers. Figure 4-7 shows a typical set of covers.

Install all covers so free drainage will occur. Do NOT create a bathtub that will trap and hold water. In warm weather, shrouds and covers cause a greenhouse effect, and cause condensation of moisture. Therefore, loosen and remove shrouds and covers and ventilate the aircraft on warm sunny days. However, where protection from salt spray is required, leave the covers in place, and ventilate the aircraft in good weather

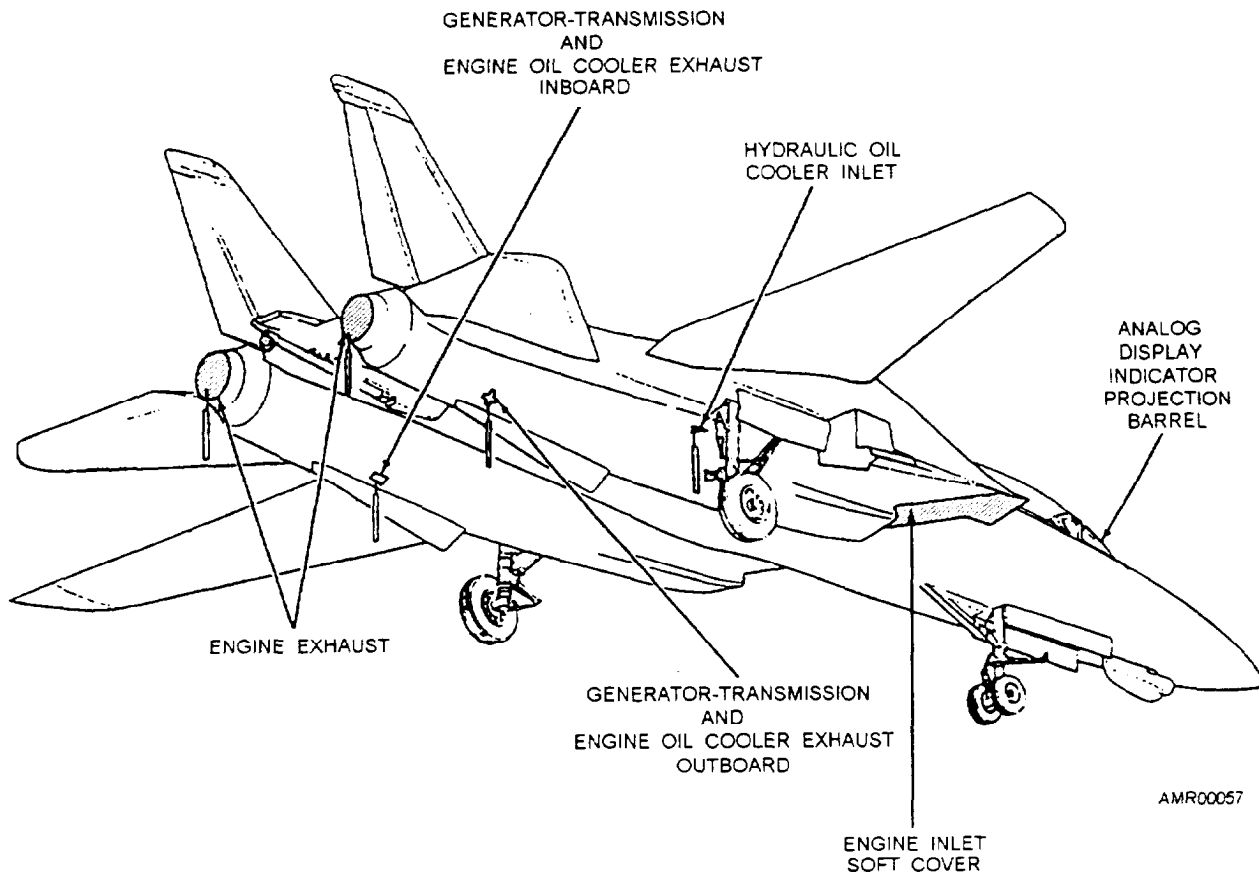


Figure 4-7.—Dust and protective covers.

only. Fresh water condensation does far less damage than entrapped salt spray.

In emergencies where regular waterproof canvas covers are not available, use a polyethylene sheet, polyethylene-coated cloth, or metal foil barrier materials as covers and shrouds. Hold these covers in place with adhesive tape that is designed specifically for severe outdoor applications.

GROUND HANDLING REQUIREMENTS

The MIM for an aircraft usually describe brief and simple ground-handling procedures. When followed, these procedures reduce corrosive attack. These procedures keep water, salt, and dirt out of areas that are difficult to get at and easy to overlook. As you can see, they also save a tremendous amount of maintenance work later.

Many practices, when followed, lessen paint damage and the loss of built-in protective systems during normal ground handling of the aircraft. Some of these practices are listed below.

- Use the tie-down points provided. Much damage is done to aircraft paint films by failure to use the tie-down points or by passing tie-down cables and lines over or around supporting structures so the paint finish is worn, chipped, or broken.

- Take time to wipe or brush sand or gravel from shoe soles before climbing on the aircraft. Painted aircraft surfaces will withstand a normal amount of foot traffic and abrasion by fuel hoses and air lines. However, shoe soles and fuel hoses pick up bits of sand, gravel, and metal chips. These become a coarse abrasive that scratches and scuffs the protective finish so it is completely ineffective under shipboard operating conditions.

- Do not place removed hardware on the deck. When you remove cowling and access plates during inspections and you cannot provide pads or cushions for them, secure them to prevent their movement.

- Avoid scratching the paint when you use hand tools to remove screws and quick-opening fasteners on aircraft exteriors. As little as 5 minutes of extra time spent carefully using tools might save hours of paint touch-up and corrosion removal.

Q32. Why should dry-cleaning solvent not be used in oxygen areas or around oxygen equipment?

Q33. In emergencies when regular waterproof canvas covers are not available, what materials can you use as covers and shrouds?

Q34. The ground handling requirements for an aircraft can be found in what publication?

RECOVERY AND RECLAMATION OF CRASH DAMAGED AIRCRAFT

LEARNING OBJECTIVE: Identify publications used to describe emergency reclamation procedures.

General procedures are required anytime an aircraft is exposed to gross amounts of saltwater or fire-extinguishing agents. Each activity that is assigned custody of aircraft has a recovery and reclamation team. The size and composition of the team depend upon the urgency of the situation. As a maintenance crew member, you may be called upon to assist with reclamation of an aircraft. Recovery and reclamation procedures are covered in detail in NAVAIR 01-1A-509.

Methods for cleaning support equipment (SE) are different from those used to clean aircraft. Authorized SE cleaning materials and procedures are identified in *Ground Support Equipment Cleaning and Corrosion Control*, NAVAIR 17-1-125.

Q35. What technical publication covers emergency reclamation procedures for naval aircraft?

LEVELS OF AIRCRAFT PRESERVATION

LEARNING OBJECTIVES: Describe the levels of aircraft and engine preservation. Identify the preservatives and sealants used in the preservation of aircraft and support equipment.

The exposure of an aircraft to corrosion damage is greatest when the aircraft is dirty, inactive, or being shipped. Aircraft spend more time on the ground than in the air, even in an active squadron. Therefore, they must be effectively protected. The method of preservation is based on complexity of the aircraft. A variety of methods are used to preserve aircraft. Preservation applies to all types of naval aircraft. There are three different levels of preservation used on naval aircraft:

Level	Use
I	Short-term preservation of flyable and nonflyable aircraft for periods up to 60 days
II	Preservation of aircraft for shipment and for periods of 60 days to 1 year
III	Preservation for long-term aircraft storage for periods of 1 to 8 years

NOTE: Level I preservation will have special MRCs for each aircraft/engine.

As a maintenance crew member, you will be involved with level I preservation. Anytime an aircraft is out of service or will remain idle for 14 or more days, maintenance will put the aircraft in level I preservation. You will use special MRCs to preserve, maintain preservation, and depreserve an aircraft.

Protection against corrosive attack on aircraft is achieved by placing a barrier between the surface and any possible source of moisture. During overhaul or manufacture, protective barriers, such as electroplate, paint, or chemical surface treatment, are provided. Surfaces that cannot be so treated (in some instances, the treated surfaces themselves) are covered with special corrosion-preventive compounds. These compounds are effective only if no moisture, dirt, or active corrosion is present on the treated surface. Therefore, you must thoroughly clean and dry the aircraft before applying a preservative compound. Also, you must apply an unbroken film of preservative in as moisture-free an atmosphere as possible.

Complete protection is not provided by compounds alone. Tapes, barrier paper, and sealing devices are used to seal off the many openings on aircraft. If these openings were to remain open during long-term storage, moisture and dirt would enter and accumulate.

To provide additional protection against corrosion, a complete moisture barrier is sometimes used on aircraft. Unless the cavity is protected by a vapor corrosion inhibitor, use desiccants to dehydrate internal areas that have been sealed. When an area cannot be sealed adequately, provide ventilation and moisture drainage.

When installed equipment in an aircraft is not being regularly used, its components must be preserved. For example, the guns of an aircraft must

be cleaned after each firing. The type of oil or other protective treatment used depends upon the anticipated period of idleness for the guns.

In the maintenance of aircraft surfaces under operating conditions, preservation adds to the protection already present. Also, protection coating and barrier materials provide temporary protection to damaged areas. A brief description of some of the more common materials used in aircraft preservation that are readily available in Navy stock is given in the following text.

Corrosion-Preventive Compound, Solvent Cutback

Corrosion-preventive compound, solvent cutback, comes in grades for specific applications. There are five grades of this compound, three of which are commonly used and do not displace water, grades 1, 2, and 4. All grades can be removed with dry-cleaning solvent. These materials are designed for cold application.

Grade 1 preservative forms a dark, hard-film, opaque cover. Its general use is limited because of the difficulty in removing aged coatings. Also, it hides what corrosion is present when it is applied over corroded areas. This material is used where maximum protection against salt spray is required. The military specification is MIL-C-16173, grade 1.

Grade 2 is a thick soft, greaselike compound which is used primarily to protect metal surfaces against corrosion during rework or storage periods. The military specification is MIL-C-16173, grade 2.

Grade 4 preservative forms a thin, semitransparent film through which identification dates can be read. It sets up dry enough to the touch, so preserved parts may be handled easily. This grade is effective in protecting wheel well areas and other exposed surfaces where film transparency is required and moderate protective characteristics can be tolerated. Its main disadvantage is that it is easily removed by water spray and requires replacement at 1-month intervals under severe exposure conditions. The military specification is MIL-C-16173, grade 4.

Coating Compounds

Activities based outside the Continental United States sometimes receive aircraft via ocean surface shipment. This is especially true of helicopter and limited-range fighter aircraft. These aircraft are

protected during shipment with a sprayable, strippable coating system that conforms to MIL-C-6799, type II. Normally, type II coatings are safe on metal, plastic, or painted surfaces. Also, they are useful for protecting clear acrylic surfaces, such as canopies, against abrasion during maintenance or extended periods of downtime.

The type II system consists of a black base coat and a white topcoat that provides heat reflection during outside exposure. Nylon ripcords with finger-size loops are placed about the aircraft before the aircraft is sprayed with this coating. This allows manual stripping of coatings. When properly applied, the coatings can be removed easily. If coatings are sprayed too thin for easy removal, they can be recoated and allowed to dry. The top layer will bond to previous layers, and all layers may be manually stripped in one operation.

Corrosion-Preventive Petroleum (MIL-C-11796)

MIL-C-11796 is designed for hot application. It is available in two classes, class 1 (hard film) and class 3 (soft film). Both classes consist of corrosion inhibitors in petroleum. They are removed with Stoddard solvent or mineral spirits. Where a hard film is not necessary, you should use class 3. Class 3 is easier to apply and remove, yet it gives the same degree of protection as class 1. Class 1 is for long-time, indoor protection of highly finished metal surfaces and aircraft control cables. Class 3 provides protection for metal surfaces, such as antifriction bearings, shock-strut pistons, and other bright metal surfaces. Class 1 must be heated to 170°F to 200°F before it is applied by brush or dip. For brushing, class 3 material must be between 60°F and 120°F, and for dipping, between 150°F and 180°F.

Oil, Preservative, Hydraulic Equipment (MIL-H-46170)

Use hydraulic fluid MIL-H-46170 as a preservative fluid to store hydraulic systems and components. It is also used as a testing medium in stationary test stands within a temperature range of -40°F to +275°F. Hydraulic fluid MIL-H-46170 is NOT to be used in portable test stands that are connected to the aircraft.

This hydraulic fluid is a fire-resistant, synthetic, hydrocarbon, hydraulic fluid similar to MIL-H-83282.

MIL-H-46170 is used as a preservative fluid in systems operating on MIL-H-83282.

Lubrication Oil, General-Purpose, Preservative

There are several types of lubricating oils, some of which contain preservatives. Each oil is identified by a specification number. Use the correct oil for each situation. The specification number for the oil described in this section is VV-L-800.

VV-L-800 oil is used to lubricate and protect piano-wire hinges and other critical surfaces. It is also used when a water-displacing, low-temperature, lubricating oil is required. You may apply VV-L-800 as received by brush, spray, or dip. It is readily removed with dry-cleaning solvent or mineral spirits.

Corrosion-Preventive Compound (MIL-C-81309)

MIL-C-81309 corrosion-preventive compound is a water-displacing compound and lubricant that must be reapplied frequently. On exposed surfaces, protection lasts about 7 days at best. On internal areas, protection lasts about 30 days. MIL-C-81309 is available in two types—type II and type III.

Type II is used for external areas. It forms an effective barrier against moisture when used on B-nuts, linkages, bolts, nuts, ejection seat mechanisms, and canopy locks. When you lubricate an area where there are no pressure lubricating fittings (zerk fittings), such as the piano hinges on access doors and control surfaces, spray with type II preservative compound to clean the area before you apply VV-L-800 preservative oil to remove moisture and contaminants.

Type III corrosion-preventive compound is for avionics and electrical equipment usage. It is not for use on exterior areas that will be exposed to the environment. Type III is used primarily on electrical connectors (cannon plugs) and microswitches to remove moisture and contaminants and to prevent corrosion.

Packaging and Barrier Materials

A minimum of packaging is necessary at the operating activity level. However, critical aircraft and engine areas require shrouding against contamination during maintenance and repair. The fuselage must be sealed when cleaning and stripping materials are used

on the aircraft. There are several barrier materials available in the Navy stock for sealing and shrouding large aircraft openings. The stock numbers for these materials can be found in NAVAIR 01-1A-509.

Water-vaporproof Barrier Material. This material is a laminated metal foil barrier that has good water-vapor resistance. It is used for closing intake openings, protecting acrylics during cleaning, and for the packaging of removed components and accessories that are returned for overhaul. It is heat sealable with a soldering or clothes iron.

Polyethylene Plastic Film. This barrier material is used for the same purpose as the metal foil barrier material, but it is less expensive. However, it is not puncture resistant. This plastic film is heat sealable only with special equipment.

Polyethylene Coating Cloth. This cloth is used in support equipment covers. Its use is preferred over plastic film material for general shrouding because of its greater tear and puncture resistance.

Tape, Federal Specification PPPT-60, Class 1. This pressure-sensitive tape is used to close small aircraft openings and for direct contact use on noncritical metallic surfaces. It has moderate water-vapor resistance that is adequate for maintenance use.

Pressure-sensitive Adhesive Tape. This tape was developed specifically for exterior preservation and sealing. It can be applied at temperatures as low as 0°F. It should perform satisfactorily over a temperature range of -65°F to +140°F. It is an excellent general-purpose tape for exterior preservation and sealing operations.

- Q36. *State the levels and terms of preservation used for naval aircraft.*
- Q37. *What level of preservation is required if an aircraft is scheduled to remain idle for more than 14 days but less than 28 days?*
- Q38. *MIL-C-16173, corrosion preventive compound, is available in three grades. Which grade(s) is/are easily removed with dry-cleaning solvent?*
- Q39. *Corrosion-preventive petroleum, class 3, provides protection for what type of surfaces?*
- Q40. *When is general-purpose lubrication oil VV-L-800 used?*
- Q41. *What type of corrosion-preventive compound MIL-C-81309 is used on avionics and electrical equipment?*

ENGINE PRESERVATION

NAVAIR 15-01-500, *Preservation of Naval Aircraft*, addresses specific requirements for the cleaning, inspection, protection, maintenance, and depreservation of auxiliary power units, gas turbine engines, and reciprocating engines. This section only highlights some important factors in engine preservation. Refer to the *Preservation Manual* for specific details.

Level I preservation of engines requires the fuel system to remain at least 95% full of fuel for a period not to exceed 60 days. Any fuel system that has been drained of fuel for more than 3 days or is expected to remain inactive for more than 60 days is to be preserved with MIL-L-6081 Grade 1010. and be dehumidified.

Level II and III preservation requirements are also outlined in the *Preservation Manual*. All requirements are listed by type engine and level of preservation desired.

NOTE: In any case of preservation, ensure all logbook entries and preservation tag requirements have been met.

SUPPORT EQUIPMENT PRESERVATION

WARNING

Do NOT use oil-based preservatives around oxygen fittings or oxygen regulators since fire or explosion may result.

The preservation of clean, corrosion-free surfaces is the final step of the preventive maintenance process of SE. The act of preservation helps to protect nonmoving parts by filling air spaces, displacing water, and providing a barrier to corrosion.

Preservatives For SE

Preservatives are used after SE cleaning before ocean assignment when an extended period of SE storage is anticipated. Preservatives are also used wherever paint films require additional preservative (for example, in metal joints, tightly fitting surfaces, and on sump areas). The technical corrosion manual to be used for support equipment is *Ground Support Equipment Cleaning And Corrosion Control*,

NAVAIR 17-1-125. This publication takes precedence over any and all MIMs and service instruction manuals (SIMs) at both O- and I-level maintenance activities. This manual spells out specifically which materials and procedures you are to use to clean up corrosion and restore the protective surface. You still follow the maintenance and service manuals in conjunction with matters not pertaining to corrosion control. The four primary preservative compounds recommended for use on SE are listed in table 4-1.

Apply corrosion-preventive compound to all exposed SE hardware items (around light brackets, hand brakes, levers, dissimilar metal joints, and tightly fitting surfaces and so forth). Preserve areas and components according to the following general procedures:

1. After removing corrosion products, clean the surface and spray the area with water-displacing agent, MIL-C-81309, type II.
2. Apply an even, thin coating of corrosion-preventive compound, MIL-C-16173, grade 4, or MIL-C-85054 to all nonmoving, difficult-to-protect areas. Use only MIL-C-16173, grade 4, for fasteners.
3. Dip removable screws and fasteners in corrosion-preventive compound before installation.
4. Remove excess compound from the metal surface with solvent, P-D-680, and clean cloth, DDD-R-30.

Sealants For SE

Sealants are brush- or spatula-applied compounds for SE corrosion prevention. These compounds are used primarily to repair damaged door and cover

weather seals, fill depressions resulting from corrosion repair, protect heavy bolts and fasteners, and seal corrosion-prone crevices and lap seals. Two sealants recommended for SE are

- Silicone Sealant MIL-A-46146, type I, and
- Polysulfide Sealant MIL-S-81733 (inhibited) or MIL-S-8802 (uninhibited).

When properly applied, the sealant forms as a barrier to the penetration of moisture. Prepare metal surfaces carefully before the application of a sealant. Do NOT apply sealant over visible moisture. Ensure that the sealant forms a continuous film at all seams, especially where dissimilar metals are in contact. When applying sealants on SE, you should use the following steps:

1. Mix the sealant according to the manufacturer's direction.
2. Dip bolts or fasteners into the sealant so that the threads and shanks are completely covered. Immediately install the bolt in tapped holes.
3. Brush or swab sealant on mating surfaces that form a crevice when assembling parts. Immediately assemble these parts.
4. Pour, spoon, or trowel sealant into crevices that cannot be disassembled for treatment.

- Q42. *What level of engine preservation requires the fuel system to remain at least 95 percent full of fuel for a period not to exceed 60 days?*
- Q43. *What technical corrosion manual should you use for support equipment?*
- Q44. *What are the two sealants recommended for use on support equipment?*

Table 4-1.—SE Preservatives

Preservative compound	Use
Corrosion-Preventive Compound, Water-displacing, Ultrathin Film, MIL-C-81309, type II, class 2	For all exposed metal and hardware not exposed to the elements
Corrosion-Preventive Compound, Water- Displacing, Clear, MIL-C-85054, type I (AMLGUARD)	A general exterior surface preservative to produce an even, thin, nontacky, and clear film
Corrosion-Preventive Compound, Solvent Cutback, Cold Application, MIL-C-16173, grade 4	A general external preservative, which produces a semitransparent film
Corrosion-Preventive Compound, Ultrathin Film, Avionics Grade, MIL-C-81309, type III	A general preservative for internal areas of electric components

CORROSION DETECTION

LEARNING OBJECTIVE: Identify the types, forms, and characteristics of corrosion.

Timely detection of corrosion is essential to any corrosion control program. Of course, corrosion can be detected after a part fails (if the equipment can be recovered). However, then it is too late to do anything about it other than to intensify inspections of other similar aircraft and SE. Inspection for corrosion should be a part of all routine inspections. On every aircraft and piece of SE, there are certain areas that are more corrosion prone than others. You should check these areas carefully. For the corrosion inspection to be thorough, you must know the types of corrosion likely to be found and the symptoms or appearance of each type of corrosion. Sometimes corrosion is hidden, and special detection methods are used to find it. Various aspects of corrosion detection are discussed in the following text.

FORMS OF CORROSION

Corrosion may occur in several forms, depending upon the specific function, size, shape and type of metal involved. Atmospheric conditions and the presence of corrosion-producing agents are also factors in the development of corrosion. The types of corrosion described in this section are the more common forms found on aircraft structures and SE. This text uses the most commonly accepted terms that describe the various types of corrosion.

Uniform (Direct) Surface Attack

The surface effect produced by the direct reaction of a metal surface with oxygen in the air is a uniform etching of the metal. The rusting of iron and steel, the tarnishing of silver, and the general dulling of aluminum surfaces are common examples of surface attack. On aluminum surfaces, if the surface attack is allowed to continue, the surface will become rough and eventually frosted in appearance. Figure 4-8 shows direct surface corrosion on an A-6 landing gear linkage system.

Pitting Corrosion

The most common effect of corrosion on aluminum and magnesium alloys is called "pitting." The primary cause of pitting is the variation in structure or quality between areas on the metal surface

in contact with a corrosive environment. Pitting corrosion is first noticeable as a white or gray powdery deposit, similar to dust, which blotches the surface. When the superficial deposit is cleaned away, tiny pits or holes can be seen in the surface. They may appear as shallow indentations or deep cavities of small diameter. Pitting may occur in any metal, but it is particularly characteristic of aluminum and magnesium. Figure 4-9 is an illustration of pitting corrosion.

Crevice Attack or Concentration Cell

Concentration cell corrosion is actually a form of pitting corrosion. Concentration cell corrosion is caused by the difference in concentration of the electrolyte or the active metal at the anode and cathode. When there are concentration differences at two different points in an entrapped pool of water or cleaning solution, anodic and cathodic areas may result. This results in the anodic area being attacked. Figure 4-10 shows the theory of concentration cell corrosion. Areas where there are crevices, scale, surface deposits, and stagnant water traps are prone to this type of attack. Concentration cell corrosion is controlled and prevented by avoiding the creation of crevices during repair work. It is also controlled with sealants and caulking compounds that eliminate voids that trap water.

Intergranular Attack, Including Exfoliation

All metals consist of many tiny building blocks called "crystals" (sometimes called grains). The boundaries between these crystals are commonly called "grain boundaries." Intergranular corrosion is an attack on the grain boundaries of some alloys under specific conditions. During heat treatment, these alloys are heated to a temperature that dissolves the alloying elements. As the metal cools, these elements combine to form compounds. If the cooling rate is slow, they form at the grain boundaries. These compounds differ electrochemically from the material adjacent to the grain boundaries, and they can be either anodic or cathodic to the adjoining areas, depending upon their composition. The presence of an electrolyte results in attack of the anodic area. This attack can be rapid and exist without visible evidence.

As the intergranular corrosion progresses to the more advanced stages, it lifts the surface grain of the

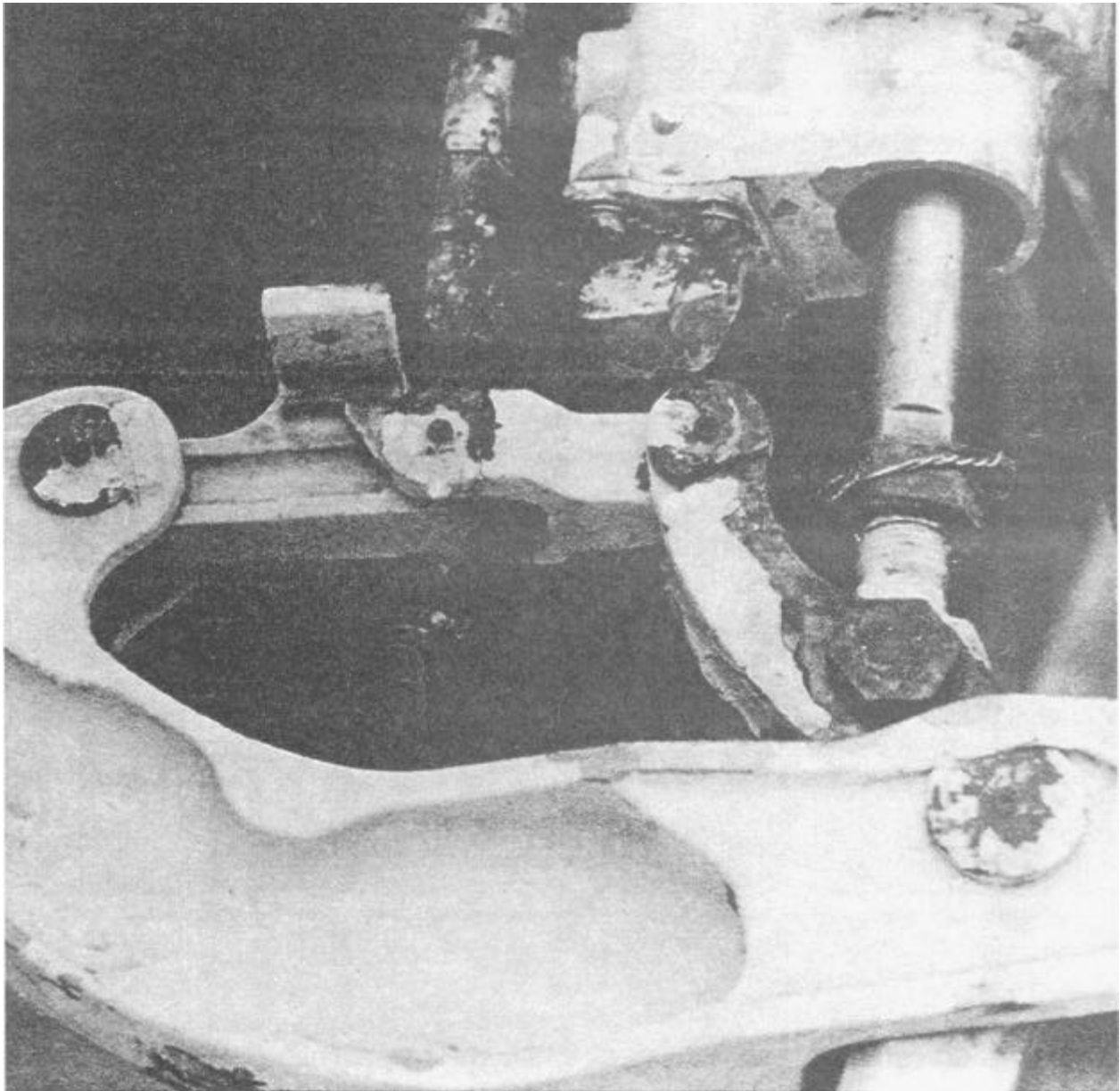


Figure 4-8.—Surface corrosion on hydraulic linkage.

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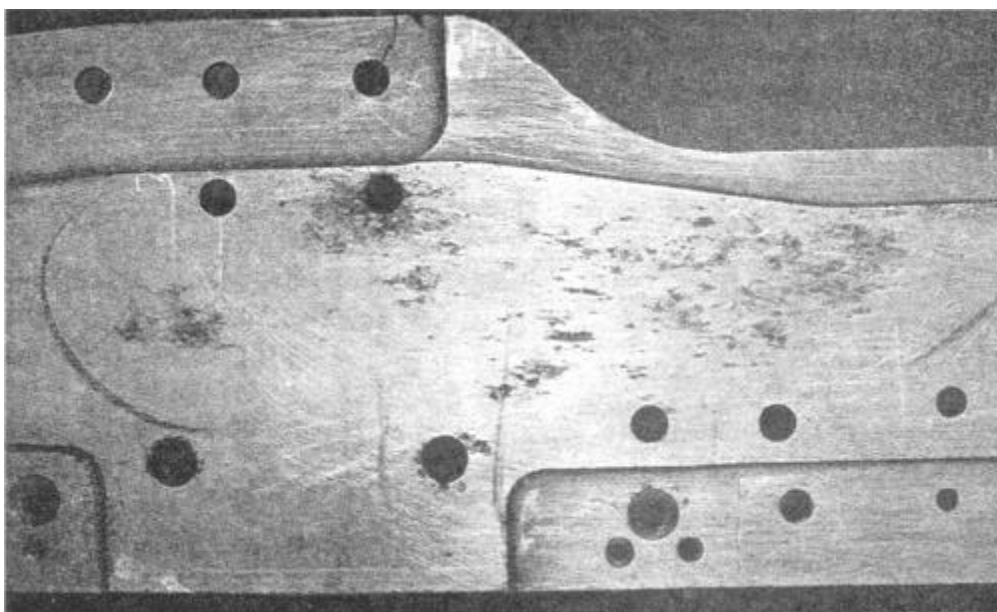
metal. This is caused by the force of expanding corrosion products at the grain boundaries just below the surface. This advanced attack is called exfoliation (fig. 4-11). At this point, it can be seen by maintenance personnel. Correction of such serious corrosion is vital to aircraft safety. The insidious (sneaky) nature of such an attack can seriously weaken structural members before the volume of corrosion products accumulate on the surface and the damage becomes apparent.

Metal that has been properly heat-treated is not readily prone to intergranular attack. However, localized overheating, such as could occur from

welding and fire damage, can make metal prone to attack. If the intergranular attack has not penetrated so far as to impair structural strength, correction as outlined in the applicable structural repair manual (SRM) can restore an aircraft to flight status.

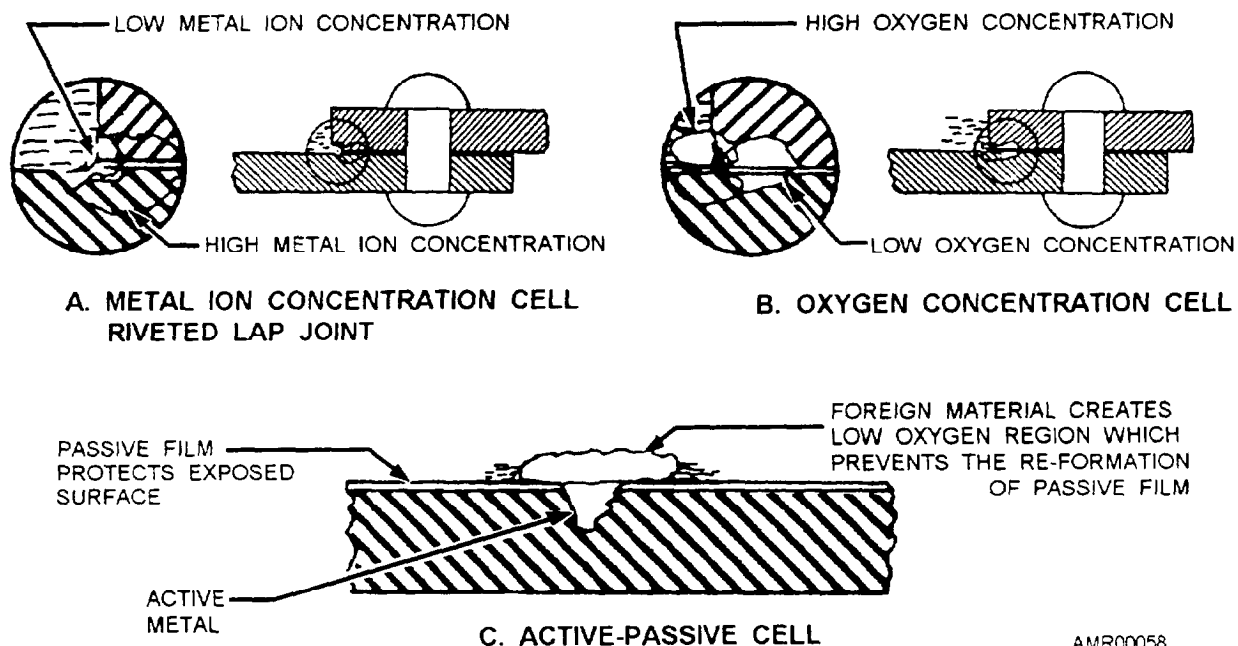
Dissimilar Metal Corrosion

The terms *galvanic* or *dissimilar* metal corrosion are applied when accelerated corrosion of metal is caused by dissimilar metals being in contact in a corrosive medium, such as salt spray or water. Dissimilar metal corrosion is usually the result of a



205.154

Figure 4-9.—Pitting of an aluminum wing assembly.



AMR00058

Figure 4-10.—Concentration cell corrosion.

faulty design or improper maintenance practices. You can usually recognize it by the presence of a buildup of corrosion at the joint between the metals. For example, aluminum and steel materials riveted together in an aircraft wing form a galvanic couple if moisture or contamination is present. When aluminum pieces are attached with steel bolts or screws, galvanic corrosion can occur around the fasteners (fig. 4-12).

To keep these metals from coming in direct contact with each other, aircraft and support equipment manufacturers use a variety of separating materials. Such materials include plastic tape, sealant, primer, washers, and lubricants. These materials keep corrosion to a minimum. These separating materials must remain intact and be replaced, restored, or repaired as needed.

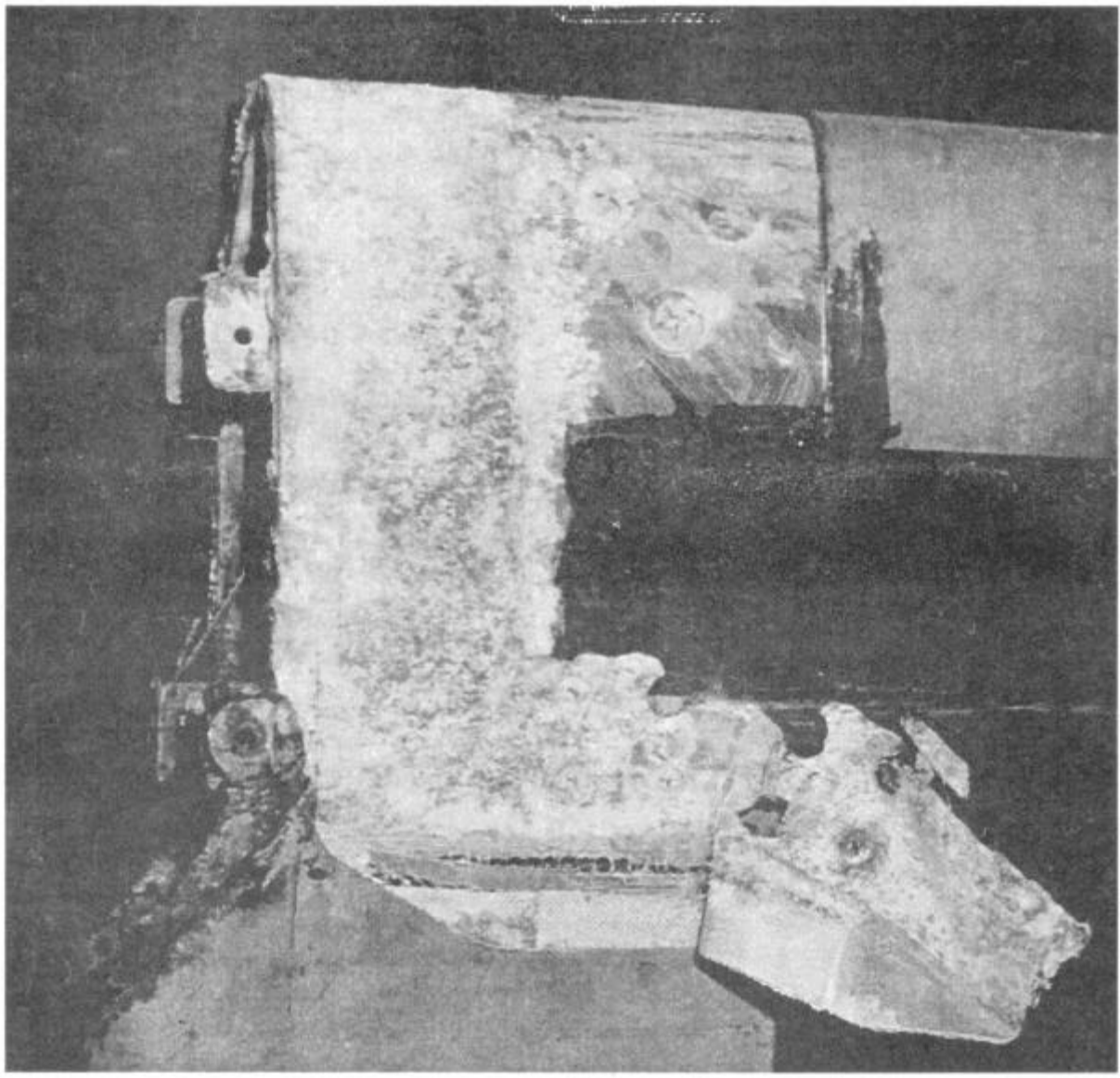


Figure 4-11.—Intergranular corrosion.

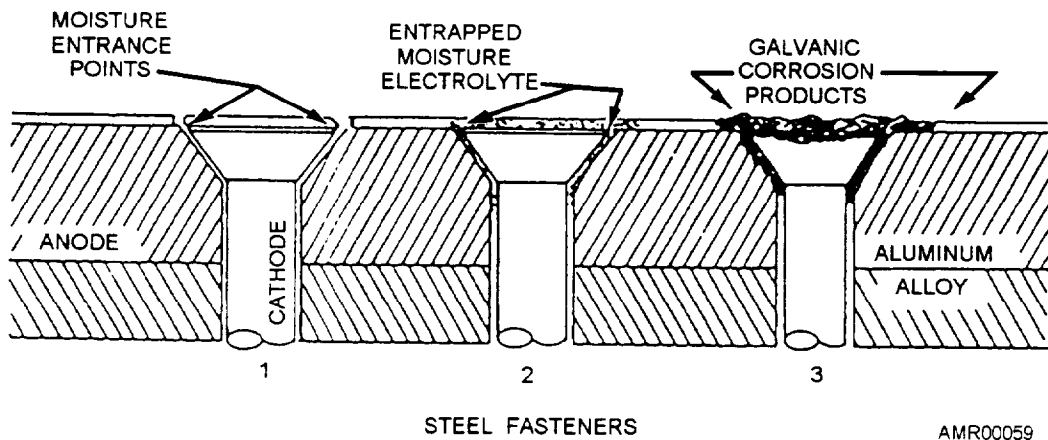


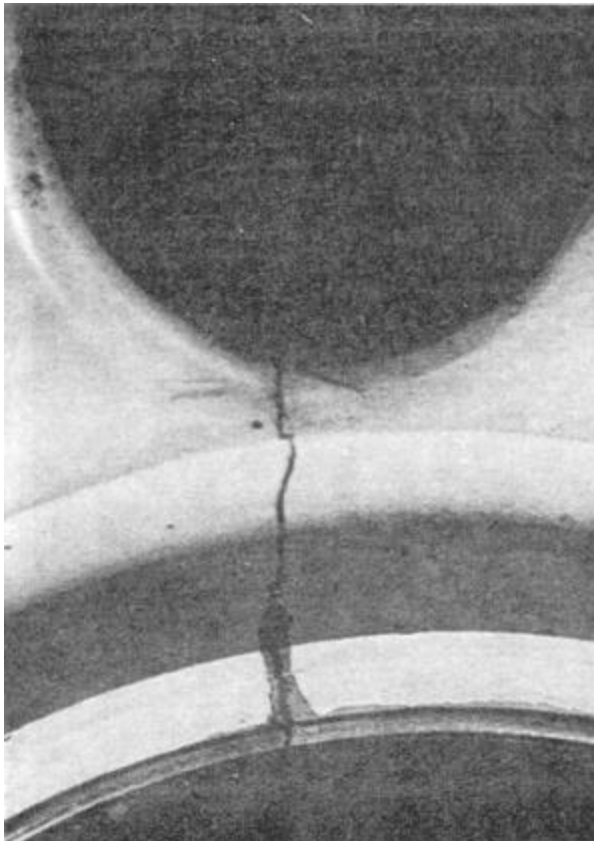
Figure 4-12.—Galvanic corrosion.

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Some metals are more active than others. The degree of attack depends upon the relative activity of the two surfaces in contact. The more active or easily oxidized surface becomes the anode and corrodes. In plated metal, the possibility of dissimilar metal corrosion becomes a factor only if there are defects in the plating. Moisture penetrates and galvanic cells form because of these defects.

Stress Corrosion

Stress corrosion is caused by the combined effects of tensile stress and corrosion. Stress may be internal or applied. Internal stresses are produced by nonuniform deformation during cold working, by unequal cooling from high temperatures during heat treatment, and by internal structural rearrangement involving volume changes. Stresses set up when a piece is formed. Stress induced by press-and-shrink fits and those in rivets and bolts are examples of internal stresses. Concealed stress is more important than design stress because it is difficult to recognize before it exceeds the design safety factor. The magnitude of the stress varies from point to point



205.157

Figure 4-13.—Stress corrosion cracking.

within the metal. Stresses that approach the yield strength of the metal promote stress cracking (visible at this point), but failure can occur at lower stresses (fig. 4-13). Most often, stress cracks are not visible to the naked eye and are discovered in the nondestructive inspection (NDI) process.

Fatigue Corrosion

Fatigue corrosion is a special kind of stress corrosion. It is caused by the combined effect of corrosion and stress applied in cycles to a component. An example of cyclic stress is the alternating loads to which the reciprocating rod on the piston of a hydraulic, double-acting, actuating cylinder is subjected. During the extension stroke, a compression load is applied. During the retracting or pulling stroke, a tensile or stretching load is applied. Fracture of a metal part due to fatigue corrosion commonly occurs at a stress far below the fatigue limit in a laboratory environment, even though the amount of corrosion is unbelievably small. This is why protection of parts subject to alternating stress is particularly important in any environment. Figure 4-14 shows an oil cooler blower that disintegrated because of fatigue corrosion of a blade (shown by arrow).

Fretting Corrosion

Fretting corrosion is a limited but highly damaging type of corrosion. It is caused by a slight vibration, friction, or slippage between two contacting surfaces that are under stress and heavily loaded. It is usually associated with machined parts. Examples of these parts are the area of contact of bearing surfaces, two mating surfaces, and bolted or riveted assemblies. At least one of the surfaces must be metal. In fretting corrosion, the slipping movement on the contacting surface destroys the protective films that are present on the metallic surface. This action removes fine particles of the basic metal. The particles oxidize and form abrasive materials, which further agitate within a confined area to produce deep pits. Such pits are usually located in an area that increases the fatigue failure potential of the metal. Early signs of fretting corrosion are surface discoloration and the presence of corrosion products in lubrication. Lubrication and securing the parts so that they are rigid are effective measures to prevent this type of corrosion.

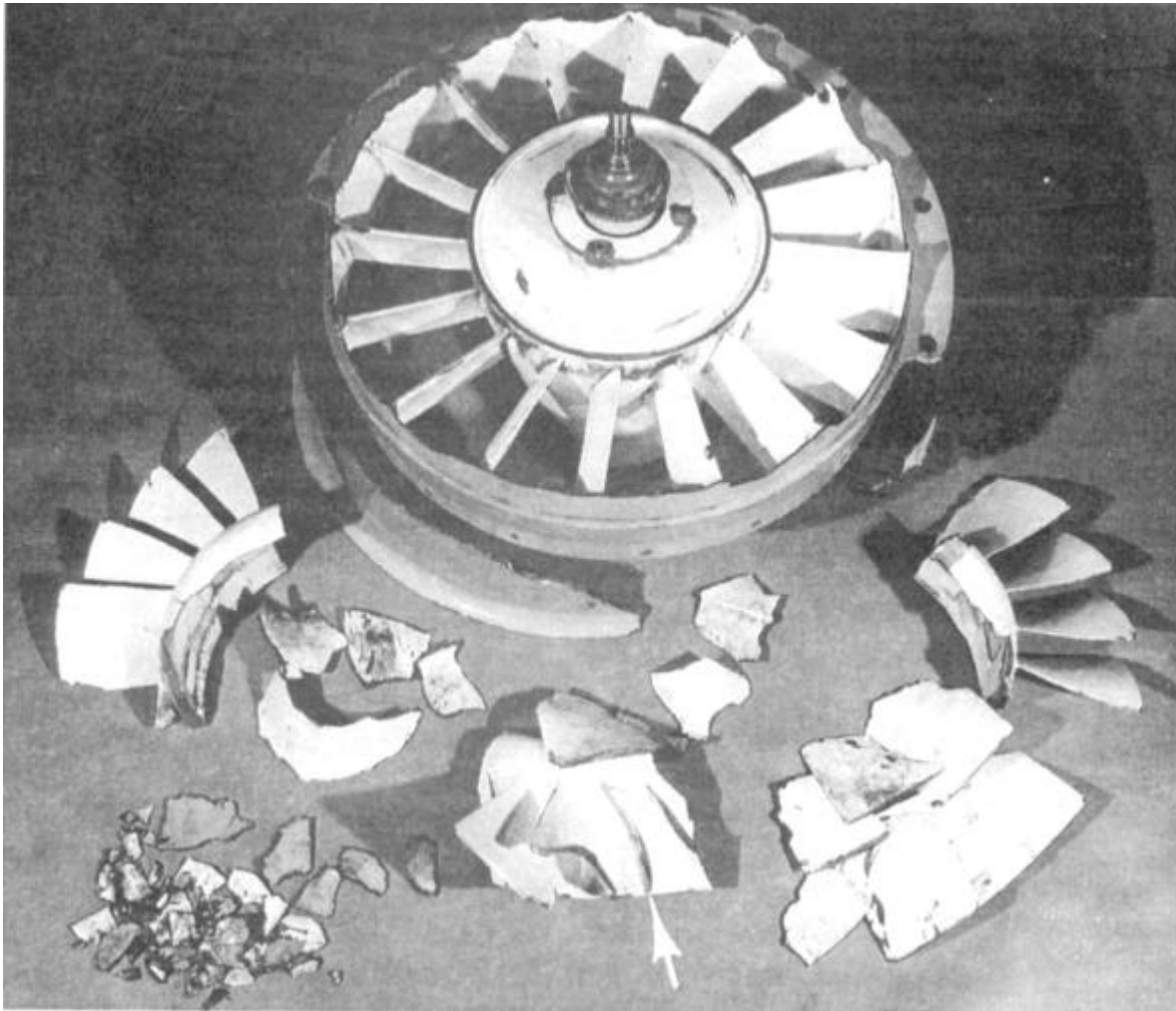


Figure 4-14.—Oil cooler blower disintegration.

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Filiform Corrosion

Filiform corrosion (fig. 4-15) consists of threadlike filaments of corrosion known as underfilm. Metals coated with organic substances, such as paint films, may undergo this type of corrosion.

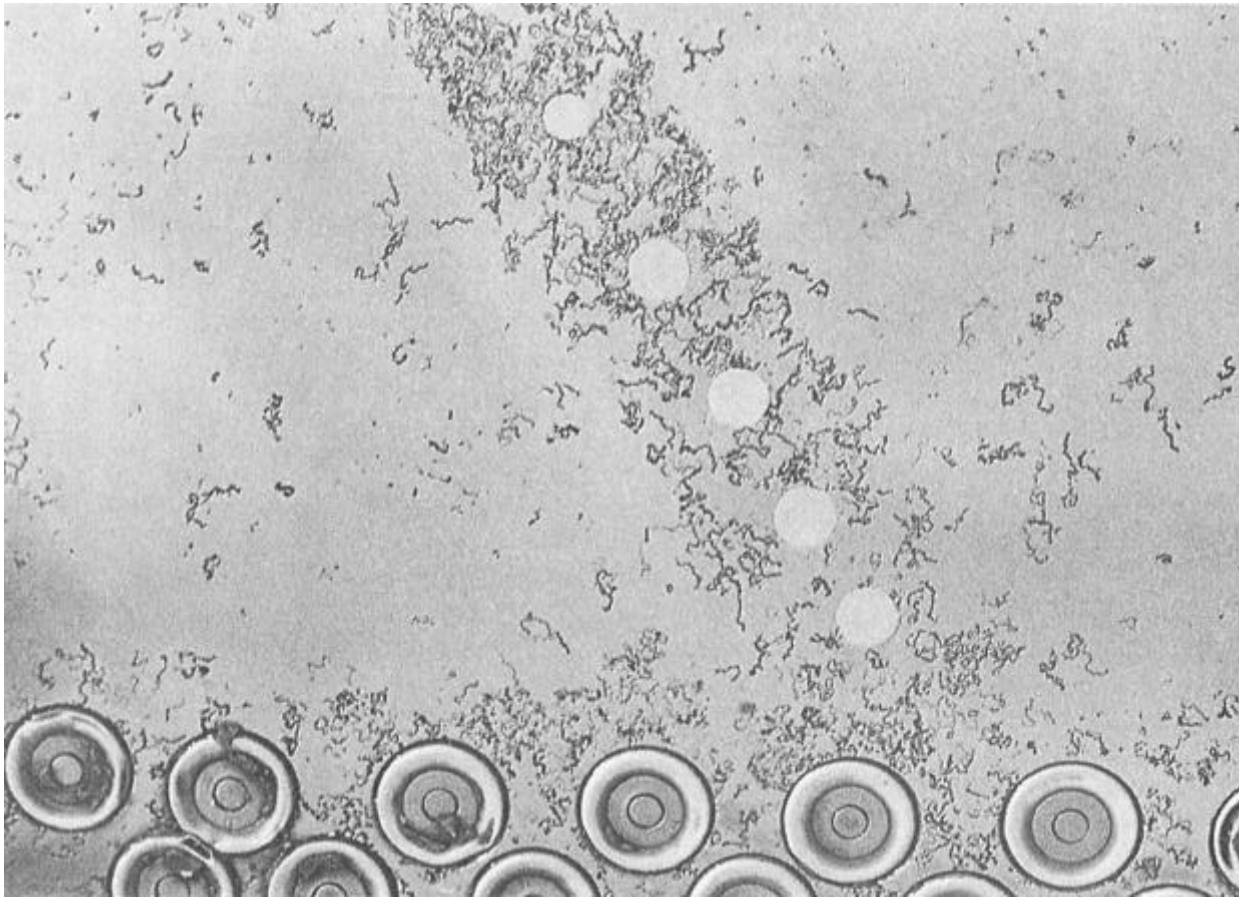
Filiform corrosion occurs independently of light, metallurgical factors, and microorganisms present. It takes place when the relative humidity of the air is 78 to 90 percent and when the surface is slightly acidic. Although the threadlike filaments are visible only under clear lacquers or varnishes, they also occur under opaque paint film. Filiform corrosion can attack steel, aluminum, and magnesium.

Microbiological Corrosion

Microorganisms contained in seawater can be introduced into fuel systems by contaminated fuel.

These fungus growths attack the sealing material used on integral fuel tanks. They can cause corrosion of aluminum, probably by aiding in the formation of concentration cells. Residues from biological growth tend to clog fuel filters and coat fuel quantity probes. Fuel quantity probes thus coated give erroneous readings. Also, moisture aids in the growth of fungi and microorganisms in avionic equipment.

- Q45. *The tarnishing of silver is a common example of what type of corrosion?*
- Q46. *Pitting is the most common effect of corrosion on what alloys?*
- Q47. *Pitting corrosion is first noticeable as what color deposit on a metal surface?*
- Q48. *How can concentration cell corrosion be controlled or even prevented?*
- Q49. *Define intergranular corrosion.*



205.159

Figure 4-15.—Filiform corrosion found under paint coating.

- Q50. *What is usually the cause of dissimilar metal corrosion?*
- Q51. *What are some examples of internal stress corrosion?*
- Q52. *What causes fatigue corrosion?*
- Q53. *What is the cause of fretting corrosion?*
- Q54. *Filiform corrosion occurs on what types of metals?*

behind lavatories, sinks, and ranges where spilled food and waste products may accumulate. Even when contaminants are noncorrosive: they may attract and hold moisture. This, in turn, causes corrosive attack. Maintenance personnel should pay attention to bilge areas located under galleys and lavatories and to personnel relief and waste disposal vents or openings on the aircraft exteriors. Human waste products can corrode common aircraft metals.

Avionic Systems

The control of corrosion in avionic systems is not unlike that in airframes. Procedures useful for airframes apply to avionics, with appropriate modifications. Avionics systems are more prone to corrosion than aircraft because avionics have the following characteristics:

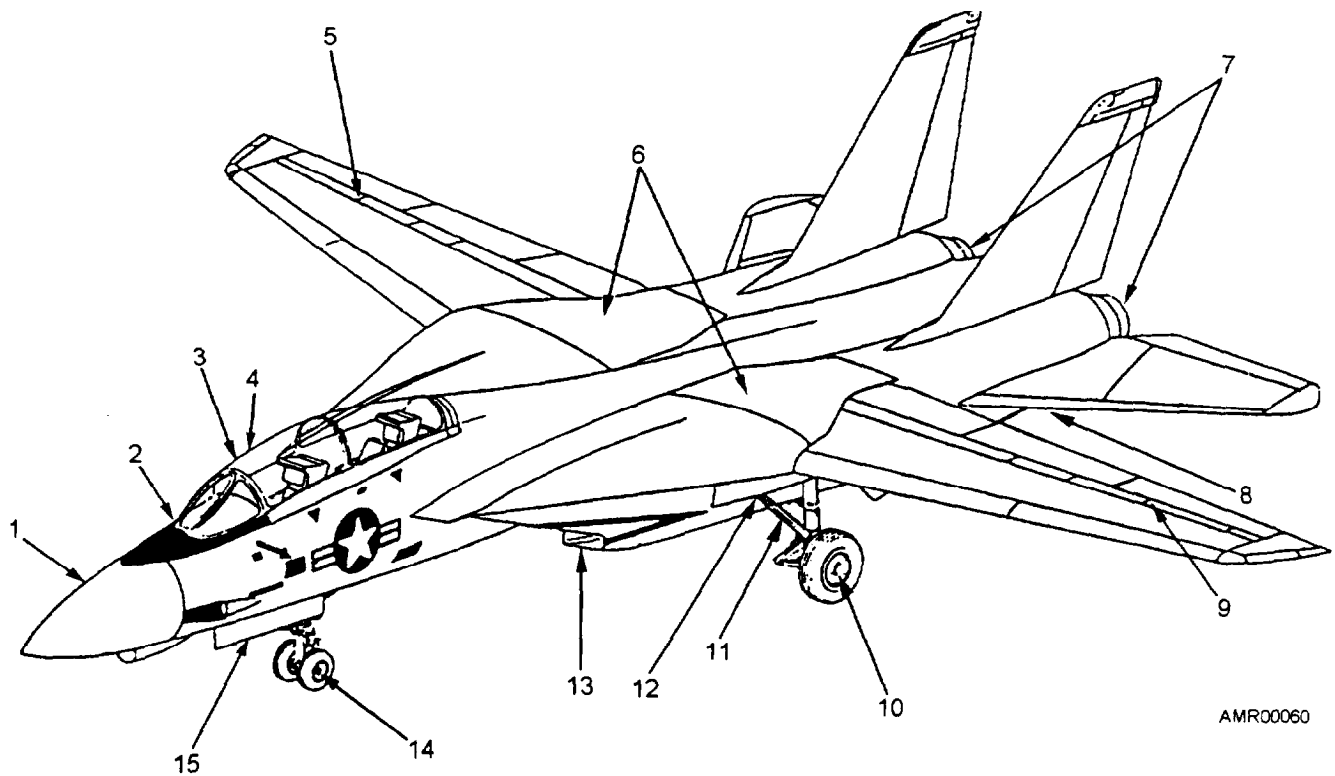
- Less durable protection systems,
- Very small amounts of corrosion can make equipment inoperative.
- Dissimilar metals are often in electrical contact.
- Stray currents are present that can cause corrosion.

LOCATION OF CORROSION-PRONE AREAS

LEARNING OBJECTIVE: Describe the areas on an aircraft prone to corrosion.

This section discusses corrosion-prone areas common to all aircraft. For specific aircraft, you should refer to the periodic maintenance information cards (PMICs) to locate corrosion-prone areas for that aircraft. Figure 4-16 is an example of possible trouble spots on jet engine aircraft.

Lavatories and galleys are likely trouble spots if they are not kept clean. These areas include the deck



- | | |
|--------------------------|--|
| 1. Radome area | 8. Missile rocket blast area |
| 2. Rudder pedal | 9. Flap carriage area |
| 3. Cockpit floor | 10. Magnesium wheels |
| 4. Battery compartment | 11. Exposed rigid tubing |
| 5. Piano hinges | 12. Main wheel well |
| 6. Flight control cables | 13. Air inlet ducts and engine frontal areas |
| 7. Exhaust areas | 14. Nose wheel well |

Figure 4-16.—Typical corrosion-prone areas on jet engine aircraft.

- Active metals and dissimilar metals in contact are often unprotected.

- Closed boxes can produce condensation during normal temperature changes during flight.

- Avionic systems have many areas to trap moisture.

- Hidden corrosion is difficult to detect in many avionic systems.

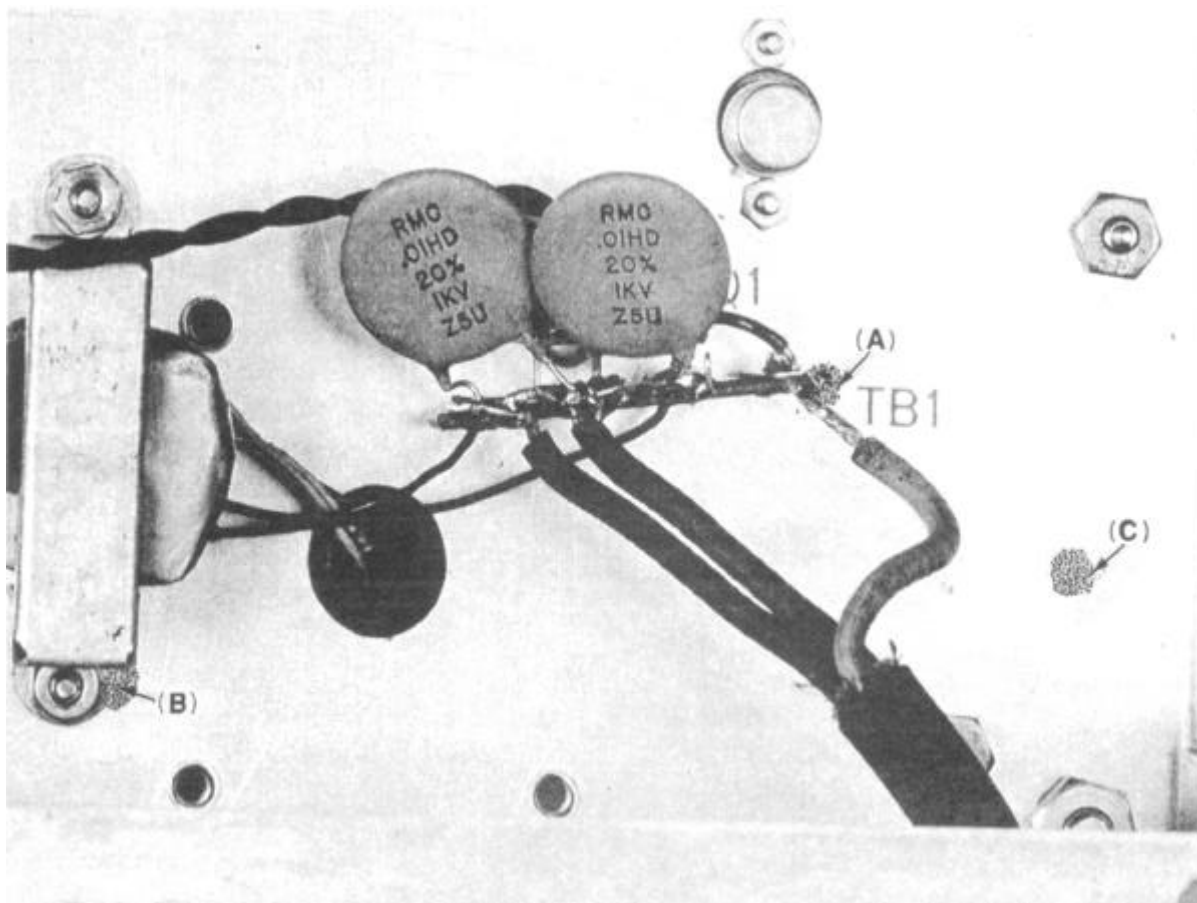
- Many materials used in avionic systems are subject to attack by bacteria and fungi.

- Organic materials are often used that, when overheated or improperly or incompletely cured, can produce vapors. These vapors are corrosive to electronic components and damaging to coatings and insulators.

The only requirements for a corrosion cell are a cathode, an anode, and an electrolyte. The size of a cell

depends upon the size of its components. A cell can form where a resistor lead is soldered to a terminal, or where two sheets of metal join. It can also form around a rivet head and the adjacent metal. (See figure 4-17, views A and B.) Even two metallic crystals in the same alloy can form a cell. All that is needed is for crystals to be of different composition and in electrical contact with each other in the presence of an electrolyte (fig. 4-17, view C).

Battery Compartments and Battery Vent Openings. Fumes from battery electrolyte are difficult to contain. They will spread throughout the battery compartment, vents, and even adjacent internal cavities. Battery electrolyte fumes cause rapid corrosive attack on unprotected surfaces. Maintenance personnel should check the external skin area around the vent openings regularly for this type of corrosion. Corrosion from this source is a serious problem



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Figure 4-17.—Electrochemical corrosion.

whenever batteries are used. The battery compartment shown in figure 4-18 needs immediate attention.

WARNING

Before performing any cleaning, inspection, or maintenance on electrical systems, maintenance personnel should make sure that all electrical power is secured from the aircraft. If the electrical power is NOT secured from the aircraft, it could result in serious injury to maintenance personnel.

Multiple Electrical Connectors (Cannon Plugs). Connectors mounted in avionic and electrical systems are prone to the same corrosive environment as airframe structural components (fig. 4-19). Normally, connectors and mounting plates contain a gasket that acts as a watertight seal. When maintenance personnel dismantle (take apart) a connector for cleaning or repair, they should inspect the gasket. They should

give special attention to connectors that use replaceable pins. These connectors use a self-sealing gasket water seal or dog bones (plastic inserts) that automatically seal the connectors against water intrusion. The repeated removal and replacement of the pins or forgetting the dog bones may cause the watertight seal to lose its effectiveness. In extreme cases where the connector cannot be replaced, potting compounds must be used to prevent water intrusion. You can find the stock numbers for dog bones in the applicable IPB.

Coaxial Connectors. Look at figure 4-20. It shows corrosion on a coaxial connector. Coaxial connectors require special steps to avoid water intrusion. Usually, moisture, contaminants, and corrosion in fuel quantity, oil quantity, and similar capacitive-type indicating system connectors cause erroneous (wrong) quantity indications in the cockpit indicating systems. Antenna coaxial connectors have similar problems with moisture.

Wire Harnesses and Cables. When corrosion is discovered at the pin-to-wire connection on electrical connectors, plugs, and receptacles, the wire harness



Figure 4-18.—Battery compartment.

205.160

and cables should be inspected for corrosion attack and cracking of the wire insulation. Cable shielding is particularly prone to corrosion.

Ram Air Turbine (Rat) Compartments. Maintenance personnel should inspect RAT compartments for moisture traps. They should inspect all mounting hardware, electrical connectors, terminal boards, junction boxes, and the RAT itself for signs of corrosion that may have been caused by moisture spray.

Electrical Bonding and Grounding Straps. The bonding and grounding straps used on aircraft and electrical equipment are major sources of galvanic corrosion. Usually, this strap is made of a metal that is dissimilar to the areas to which it is attached. Thus, a galvanic couple is created. Unless maintenance personnel take proper preservation action, this couple, in the presence of moisture, corrodes at a rapid rate.

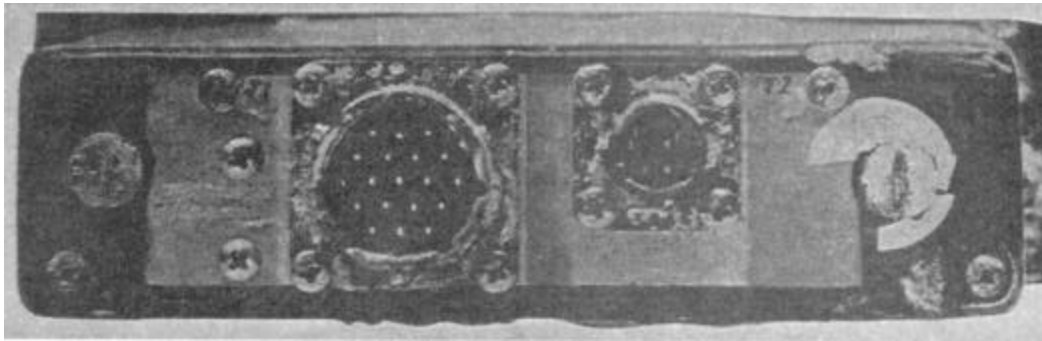


Figure 4-19.—Corrosion on control box electrical connectors.

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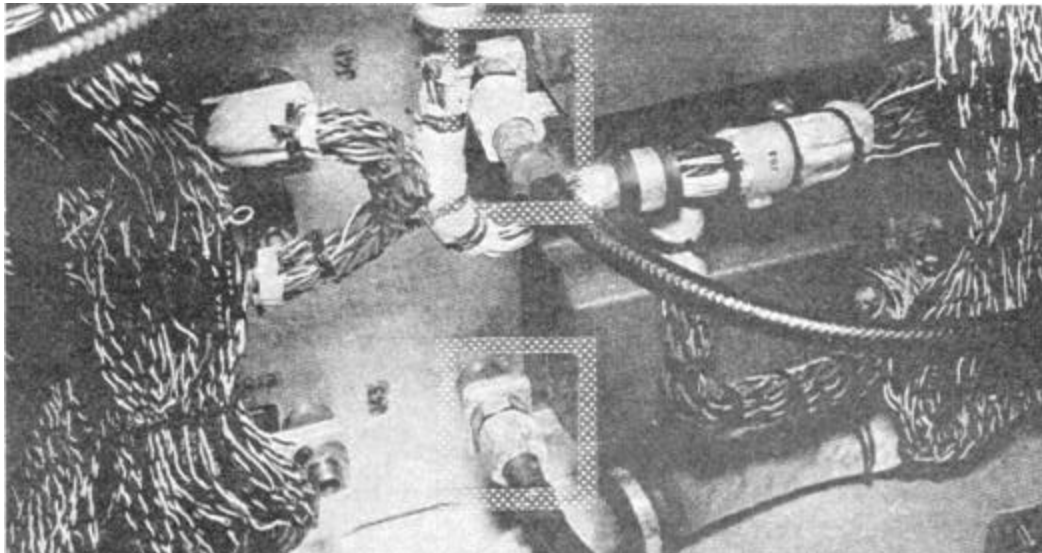


Figure 4-20.—Corrosion on coaxial connector.

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Light Assemblies. External formation lights, wing tip lights, rotating beacons, and lower fuselage anticollision lights are highly prone to corrosion. These lights are prone to corrosion because of poor seals, exposure to the elements in flight, or water intrusion during aircraft washdown. Usually, corrosion is heavy at the bases of the bulbs because of dissimilar metal contact between bulbs and sockets. Seals and preservation actions reduce the likelihood of corrosion in light assemblies.

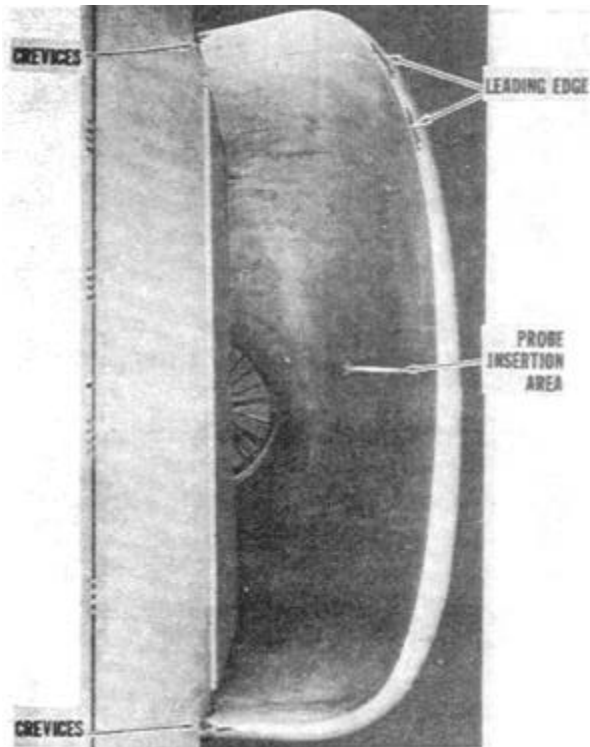
Q55. The corrosion-prone areas for each specific aircraft are detailed in what publication?

Q56. What are the three requirements for a corrosion cell to form?

Ejection Seats

Aboard ship, salt spray enters most aircraft cockpit areas when the canopies are opened for respotting of aircraft maintenance or to accommodate the manning of ready alert aircraft. While the cockpit and ejection seats are not as corrosion prone as some other areas, they are still in a corrosive environment. Therefore, the cockpit and ejection seats require constant attention, along with other parts of the aircraft.

Because of their construction and location, ejection seats are difficult to inspect and clean thoroughly while they are installed in the aircraft. Also, there is a lengthy period of time between aircraft inspections that require seat removal. Therefore,



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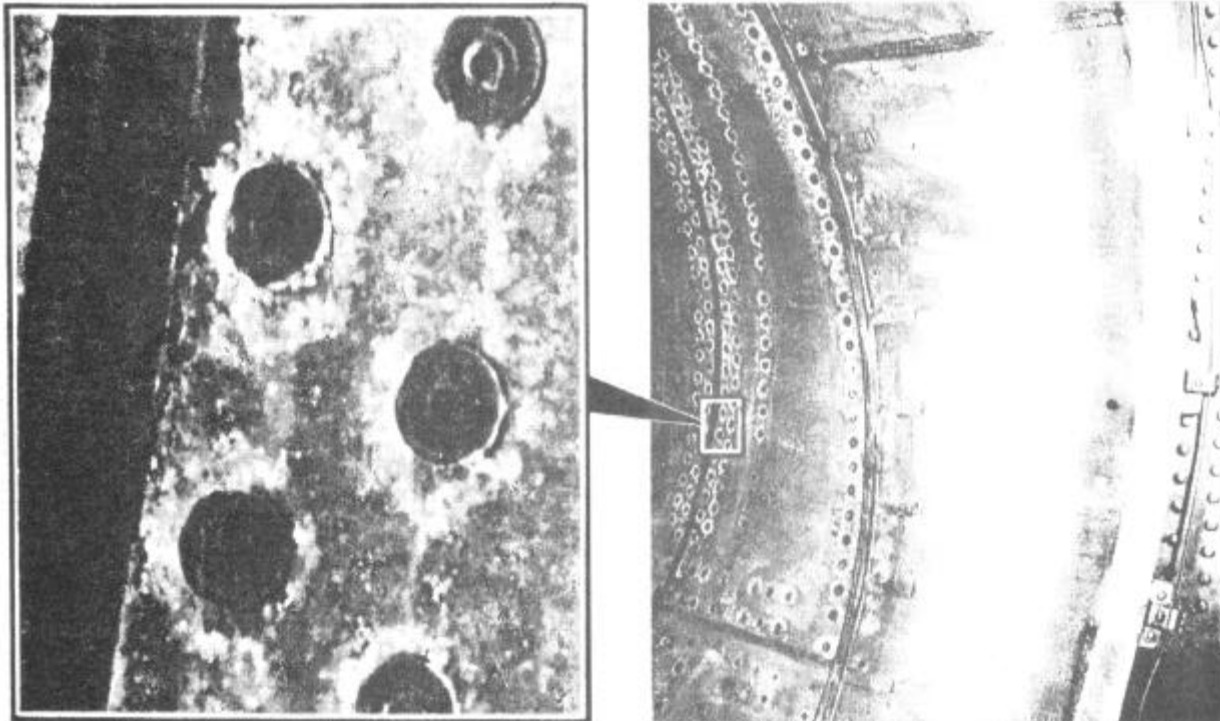
Figure 4-21.—Corrosion-prone point of air inlet duct.

ejection seats could become severely corroded if not given adequate attention.

The likelihood that slight corrosion could make an ejection seat inoperable must not be overlooked. The MRCs for these seats require that every portion of the seats be checked thoroughly for corrosion when they are removed from the aircraft. Additional emphasis is usually given to the ultrahigh-strength steel parts of seats. As with all aircraft parts, corrosion could weaken the structural soundness of a seat. Maintenance personnel should give worn paint finishes and those showing signs of superficial corrosion immediate attention, as specified in the applicable MIM, because other problems not yet visible may be present. They should touch up cockpit fasteners with dull, black paint to prevent cockpit glare. Refer to NAVAIR 01-1 A-509 for more information.

Intake and Exhaust Trail Areas

Airborne dirt and dust and bits of gravel from runways constantly erode engine frontal areas and cooling air vents. Rain erosion removes the protective finish on intake and exhaust areas (fig. 4-21). In addition, areas such as air intake ducts and cooler radiator cores are not painted. Engine accessory mounting bases usually have small areas of unpainted magnesium or aluminum on the machined mounting surfaces. With moist, salt-laden air constantly flowing over these surfaces, they are prime sources of a corrosive attack (fig. 4-22). When maintenance



205.165

Figure 4-22.—Corrosion in air intake duct.

personnel inspect such areas, they should also inspect all sections in the cooling air path, giving special attention to obstructions and crevices where salt deposits may build up during marine operations. Corrosion must be checked in its early stages and paint touch-up and hard-film, preservative coatings must be maintained intact.

Jet exhaust deposits are very corrosive. These deposits are particularly troublesome where gaps, seams, hinges, and fairings are located down the exhaust path, and where the deposits may be trapped and not reached by normal cleaning methods. When inspecting these surfaces, maintenance personnel should give special attention to the areas indicated in figure 4-23. Maintenance personnel should also include in their inspection procedures the removal of fairings and access panels located in the exhaust path.

JATO, Rocket, and Gun Blast Areas

Surfaces located in the path of JATO, rocket, and gun blasts are particularly subject to corrosive attack and decay (fig. 4-24). In addition to the corrosive effect of the gases and exhaust deposits, protective finishes are often blistered by heat and blasted away by high-velocity gases. Also, spent shell casings or solid particles from gun and rocket exhausts abrade

finishes. Maintenance personnel should watch these areas for corrosion and clean the finishes carefully after firing operations.

Bilge Areas

Bilge areas are common trouble spots on all aircraft. One example of a bilge area is the engine bay area. Bilge areas are natural collection points for waste, hydraulic fluids, water, dirt, loose fasteners, drill shavings, and other debris. Oil puddles often mask small quantities of water, which settle to the bottom and set up hidden corrosion cells. Keeping bilge areas free of extraneous material, including oil, is the best insurance against corrosion.

Wheel Wells and Landing Gear

The wheel well area probably receives more punishment than any other area on the aircraft. It is exposed to mud, water, salt, gravel, and other flying debris from runways during flight operations. It is open to salt water and salt spray when the aircraft is parked aboard ship. Because of the many complicated shapes, assemblies, and fittings in the area, complete coverage with a protective paint film is difficult to attain. Because of the heat generated from braking,

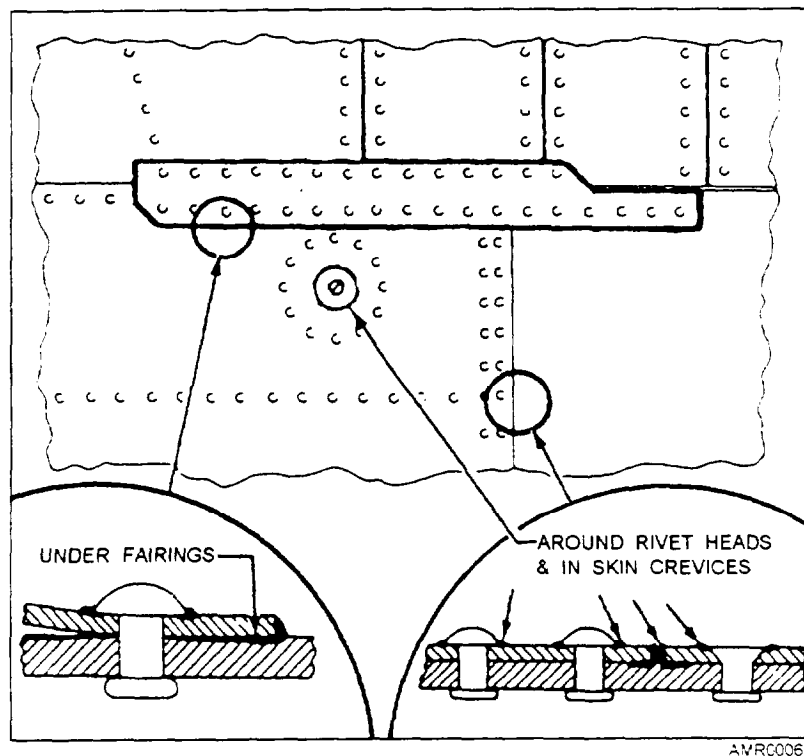


Figure 4-23.—Exhaust trail corrosion points.

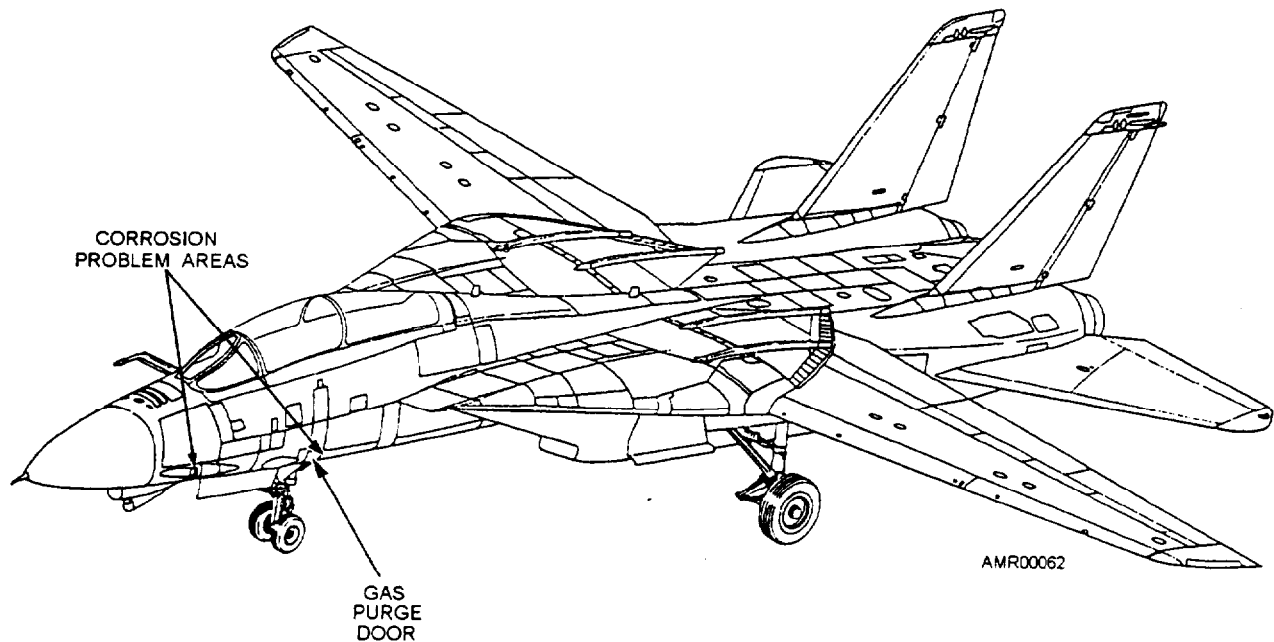


Figure 4-24.—Gun blast area corrosion points.

preservative coatings are not used on jet aircraft landing gear wheels. During inspections, maintenance personnel should pay particular attention to the following areas:

- Magnesium wheels, especially around bolt heads, lugs, and wheel well areas
- Exposed metal tubing, especially at nuts and ferrules, and under clamps and identification tapes
- Exposed connectors, such as indicator switches and other electrical equipment
- Crevices between stiffeners, ribs, and lower skin surfaces, which are typical water and debris traps

Water Entrapment Areas

Aircraft have drains installed in areas where water may collect. However, these drains may not be effective either because of improper location or because they are plugged by sealants, fasteners, dirt, grease, and debris. Daily inspection of drains is a standard requirement, especially aboard ship.

- Q57. *Cockpit fasteners should be touched up with what color paint?*
- Q58. *In water entrapment areas of an aircraft, drains are required to be inspected how often?*

Wing Fold, Flap, and Speed Brake Recesses

Flap and speed brake recesses are potential corrosion problem areas because they are normally closed when on the ground. Dirt and water may collect and go unnoticed. Wing fold areas contain complicated shapes and assemblies that are difficult to cover with a protective paint coating or preservative film; thus, corrosion is present. Wing fold areas are extra vulnerable to salt spray when wings are folded aboard ship. To thoroughly inspect this area, maintenance personnel should use a mirror to check the back sides of tubing and fittings. Also, they should pay particular attention to aluminum alloy, wing lock fittings (such as those used in some current aircraft models).

External Skin Areas

Most external aircraft surfaces are ordinarily covered with protective paint coatings and are readily visible or available for inspection and maintenance. Even here, certain types of configurations or combinations of materials can cause trouble under shipboard operating conditions and require special attention.

Magnesium skin, when painted over, is not visibly different from any other painted metal surface. Magnesium surfaces are identified in the applicable structural repair manual. When an aircraft contains

magnesium skin panels, maintenance personnel must give special attention to these panels during inspections for corrosion. Some aircraft have steel fasteners installed through magnesium skin with only protective finishes under the fastener heads or tapes over the surface for insulation. In addition, paint coatings are thin at trimmed edges and comers. These conditions, coupled with magnesium's sensitivity to saltwater attack, present a potential corrosion problem whenever magnesium is used. Therefore, maintenance personnel must inspect all magnesium skin surfaces for corrosion, giving special attention to edges, areas around fasteners, and cracked, chipped, or missing paint.

The entrance and entrapment of corrosive agents between the layers of metal cause corrosion of spot-welded skins. (See figure 4-25.) Some of the corrosion may be caused originally by fabrication processes, but its progress to the point of skin bulging and spot-weld fracture is the direct result of moisture or salt water working its way in through open gaps and seams. The first indication of this type of corrosion is the appearance of corrosion products at the crevices where the corrosive agents entered. Corrosion may appear at the external or internal faying (closely joined) surfaces, but it is usually more prevalent on external areas. More advanced corrosive attack causes skin buckling and eventual spot-weld fracture. Maintenance personnel should detect skin buckling in its early stages by sighting along spot-welded seams or by using a straightedge.

Piano-Type Hinges

Figure 4-26 shows the effect of corrosion on the piano hinges used on aircraft. These are prime spots for corrosion to develop due to the dissimilar metal contact between the steel pin and aluminum hinge tangs. They also natural traps for dirt, salt, and moisture. When used on access doors and plates, these hinges tend to freeze in place because they are opened only during periodic inspections. While inspecting for corrosion of these hinges, maintenance personnel should lubricate the hinge and move the hinge back and forth several times to ensure complete penetration of the lubricant.

RECOGNIZING AND ELIMINATING CORROSION

One of the problems you will have as a maintenance crew member is recognizing and combating corrosion on different materials. The following paragraphs include brief descriptions of typical corrosion product characteristics that are normally found on the materials used in aircraft construction. Also included are the normal procedures for their elimination and prevention. Treating internal corrosion of equipment requires a trained technician, and is normally accomplished at the intermediate-maintenance level. The materials found in avionic equipment, such as gold, silver, tin, solder, and copper alloys, are prone to many forms of corrosion. The treatment for corrosion involving these materials can be found in NAVAIR 16-1-540. When in-depth information is needed about structural corrosion, refer to NAVAIR 01-1A-509. Table 4-2 identifies the

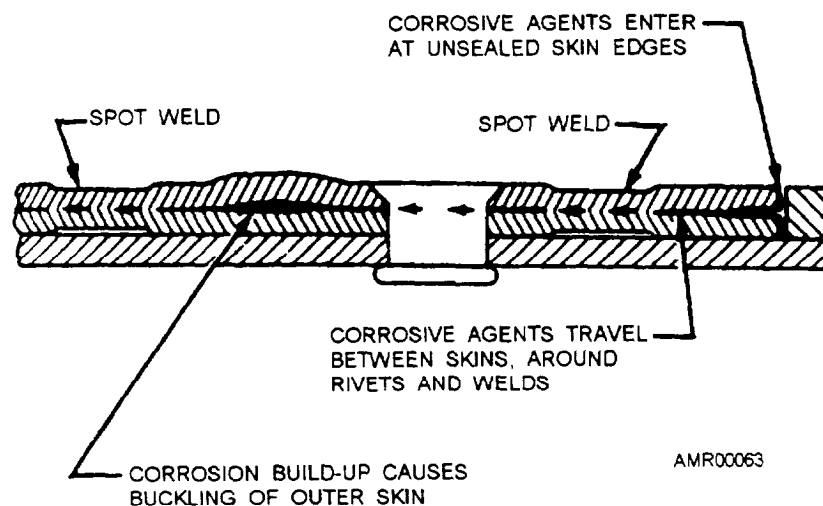


Figure 4-25.—Spot-welded skin corrosion points.

Table 4-2.—Corrosion of Metals—Nature and Appearance of Corrosion Products

ALLOY	TYPE OF ATTACK TO WHICH ALLOY IS SUSCEPTIBLE	APPEARANCE OF CORROSION PRODUCT
Aluminum Alloy	Surface pitting, intergranular, exfoliation, stress corrosion, fatigue cracking and fretting.	White to gray powder.
Titanium Alloy	Highly corrosion resistant. Extended or repeated contact with chlorinated solvents may result in degradation of the metal's structural properties.	No visible corrosion products at low temperature. Colored surface oxides develop above 700°F.
Magnesium Alloy	Highly susceptible to pitting.	White powder snowlike mounds and white spots on the surface.
Carbon and Low-Alloy Steel	Surface oxidation and pitting, surface and intergranular.	Reddish-brown oxide (Rust).
Stainless Steel (300-400 series)	Crevice/concentration cell corrosion; some pitting in marine environments; corrosion cracking; intergranular corrosion (300 series) and surface corrosion (400 series).	Rough surface; sometimes a red, brown, or black stain.
Nickel-base Alloy (Inconel, Monel)	Generally has good corrosion-resistant qualities; susceptible to pitting in seawater.	Green powdery deposit.
Copper-base Alloy Brass, Bronze	Surface and intergranular corrosion.	Blue or blue-green powdery deposit.
Cadmium (protective plating for steel)	Good corrosion resistance. Will cause embrittlement if not properly applied.	White powdery deposit to brown/black mottling of the surface.
Chromium (wear-resistant plating for steel)	Subject to pitting in chloride environments.	Chromium being cathodic to steel, does not corrode itself, but promotes rusting of steel where pits occur in the coating.
Silver	Will tarnish in presence of sulfur.	Brown to black film.
Gold	Highly corrosion resistant.	Deposits cause darkening of reflective surfaces.
Tin	Subject to whisker growth.	Whiskerlike deposits.

nature and appearance of corrosion products found on the metals used in aircraft construction.

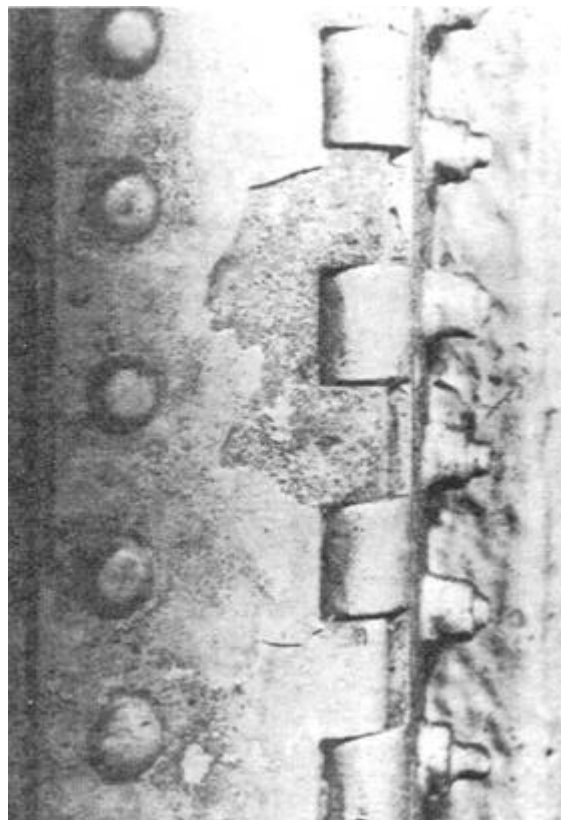
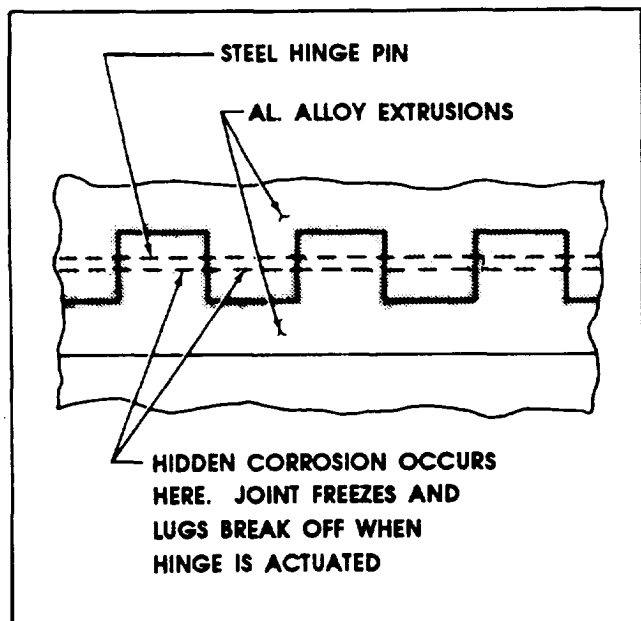
Iron and Steel

Possibly the best known and the most easily recognized form of metals corrosion is the familiar reddish-colored iron rust. When iron and its alloys corrode, dark iron oxide coatings usually form first. These coatings, such as heat scale on steel sheet stock, may protect iron surfaces. However, if enough oxygen

and moisture are present, the iron oxide is soon converted to hydrated ferric oxide, commonly known as iron rust. Iron and steel are used in avionic equipment as component leads, magnetic shields, transformer cores, racks, and general hardware. Steel and iron hardware used in aircraft construction is usually plated with nickel, tin, or cadmium.

Aluminum

Aluminum and its alloys are used many places in aircraft construction, including ejection seats, chassis



205.200

Figure 4-26.—Hinge corrosion points.

structures in avionic equipment, and the skin of the aircraft. Because of its wide use, you must be able to recognize and take the proper corrective action whenever corrosion is detected or suspected.

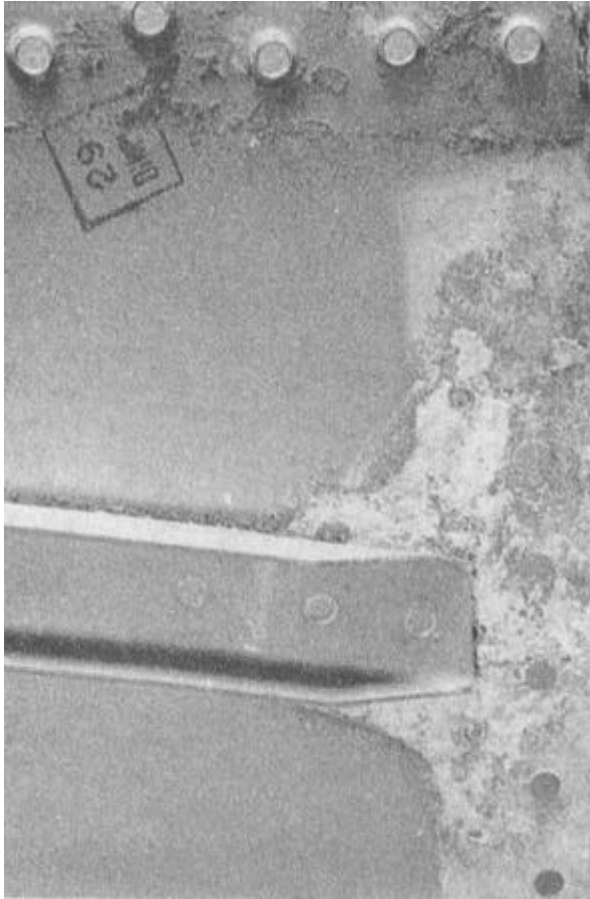
Aluminum and its alloys are subject to a wide range of corrosive attack, varying from general etching of the surfaces to penetrating attacks along the internal grain boundaries of the metal. The corrosion products (fig. 4-27) appear as white-to-gray powdery deposits that have greater volume than the original metal. In its early stages, aluminum corrosion is evident as a general etching, pitting, or roughness of the surface. The surface attack progresses quite slowly at first; however, the attack will accelerate if the corroding material is not given immediate attention.

Paint coatings mask evidence of corrosion, but because the corrosion products have a greater volume, corrosion will show up as blisters, flakes, chips, lumps, or other irregularities in the paint coating. Often, white or gray streaks of corrosion products become readily apparent at breaks in the paint film. Maintenance personnel should investigate such signs further to determine the extent that corrosion has progressed.

There are three types of aluminum surfaces insofar as corrosion removal is concerned. They are clad, anodized, and exfoliated aluminum surfaces.

Clad Aluminum Surfaces. Pure aluminum has considerable corrosion resistance compared to aluminum alloys, but it has little or no structural strength. An extremely thin sheet of pure aluminum laminated onto each side of an aluminum alloy sheet improves the corrosion resistance with little impairment of strength. The trade name of this aluminum laminate, as originated by the Aluminum Company of America, is Alcad. From this trade name the adjective clad and the verb cladding have been derived. An example of clad aluminum is the surface of unpainted aircraft. Not all aircraft sheet aluminum is clad, especially those alloy sheets from which small brackets, gussets, and fittings are made. The pure aluminum is very soft, and fabrication processes would severely damage or destroy the clad surfaces.

To remove corrosion from clad surfaces, the corroded areas should be hand polished with MIL-P-6888 metal polish. It effectively removes stains and produces a high-gloss, lasting polish on unpainted clad surfaces. During the polishing operation, you should take care to avoid mechanical



205.166

Figure 4-27.—Aluminum corrosion products.

removal of the protective clad layer and exposure of the more susceptible, but stronger, aluminum alloy base.

If there is any superficial corrosion present, you should treat it by wiping down the surface with an inhibitive material, such as the Chemical Surface Films for Aluminum Alloy, available under specification MIL-C-81706.

Anodized Aluminum Surfaces. Nonclad aluminum alloys are the primary type of aluminum used on naval aircraft. Anodizing is the most common surface treatment of nonclad aluminum alloy surfaces. In anodizing aluminum alloys, the alloy sheet or casting is the positive pole in an electrolytic bath in which an oxidizing agent produces an aluminum oxide film on the metal surface. This aluminum oxide is naturally protective, and anodizing merely increases the thickness and density of the natural oxide film. When this coating is damaged in service, it can only be partially restored by chemical surface treatments. Therefore, when processing anodized surfaces,

including corrosion removal, you should avoid destruction of the oxide film.

Aluminum wool (nylon webbing impregnated with aluminum oxide abrasive) or fiber bristle brushes are the approved tools for cleaning anodized surfaces. The use of steel wool, steel wire brushes, or harsh abrasive materials on aluminum surfaces is prohibited. A buffed or wire brush finish produced by any means is also prohibited. Otherwise, anodized surfaces are treated in much the same manner as other aluminum finishes.

Exfoliated Surfaces. As previously described, exfoliation is a separation along the grain boundaries of metal and is caused by intergranular corrosion. More severe procedures must be used when intergranular corrosion is present. All corrosion products and visible delaminated metal layers must be removed by mechanical means to determine the extent of destruction and to evaluate the remaining structural strength of the component. Maintenance personnel use metal scrapers, rotary tiles, and other tools to assure that all corrosion products are removed and that only structurally sound aluminum remains. Maintenance personnel should inspect the area with a 5- to 10-power magnifying glass or use a dye penetrant to determine if all unsound metal and corrosion products have been removed. When all corrosion products have been removed, maintenance personnel should blend or smooth out any rough edges, even if it involves the removal of more metal. Grinding, where required, is best done by using abrasive nylon wheels into which tiny particles of aluminum oxide abrasives have been impregnated. Chemical treatment of exposed surfaces is applied in the same manner as any other aluminum surface. An aeronautical engineer should evaluate any loss of structural strength in critical areas. This is particularly true if the damage exceeds the permissible limits established in the structural repair manual for the aircraft model involved.

Magnesium

Magnesium and its alloys have limited use in aircraft structural construction. However, they are used extensively throughout avionics systems as antennas, structures, chassis, supports, and frames. Magnesium, without a protective coating, is highly susceptible to corrosion when exposed to marine environments. Magnesium forms a strong anodic galvanic cell with every other metal and is ALWAYS the one attacked. Magnesium is subject to direct acid

attack, deep pitting, stress corrosion, intergranular, and galvanic corrosion.

Corrosion of magnesium or its alloys forms white, powdery, snowlike mounds. The deposits tend to raise slightly, and the corrosion spreads rapidly. When magnesium corrosion is detected, it requires immediate attention or the corrosion will spread throughout the entire structure. Magnesium corrosion re-protection involves the maximum removal of corrosion products, the partial restoration of surface coatings by chemical treatment, and a reapplication of protective coatings. After maintenance personnel clean the surface and strip the paint, (if any,) they break loose and remove as much of the corrosion products as possible. They do this by using a pneumatic drill with an abrasive wheel or a Vacu-Blast Dry Honing Machine with glass beads. Steel wire brushes, Carborundum™ abrasives, or steel-cutting tools should NOT be used. After corrosion removal, maintenance personnel treat the surface with specification MIL-M-3171 (type VI) chemical treatment solution, as outlined in the NAVAIR 01-1A-509. Then restore the protective paint film.

If extensive removal of corrosion products from a structural casting was involved, a decision from a structural engineer may be necessary to evaluate the adequacy of the structural strength remaining. Structural repair manuals for the aircraft models involved usually include tolerance limits for dimensions of critical structural members. They should be referred to if any question of safety of flight is involved.

Copper and Copper Alloys

Copper and its alloys are generally corrosion resistant, although the products of corrosive attack on copper are commonly known. Sometimes copper or copper-alloy surfaces will tarnish to a dull gray-green color, and the surface may still be smooth. This discoloration is the result of the formation of a fine-grained, copper oxide crust called "patina." The patina, in itself, offers good protection for the underlying metal in ordinary situations. However, exposure of copper and copper alloys to moisture or salt spray causes the formation of blue or green salts, indicating active corrosion. These salts form over the patina since this crust is not totally moistureproof. Copper alloys used in aircraft have a cadmium-plated finish to prevent surface straining and decay.

Copper and copper-based alloys are used in avionic systems as contacts, springs, connectors, printed circuit board runs, and wires. Copper and copper-based alloys (brass and bronze) are resistant to atmospheric corrosion. However, copper is cathodic to iron, steel, aluminum, and magnesium when in electrical contact with these metals.

Maintenance personnel can remove corrosion products by using a pneumatic drill with an abrasive wheel or, as an alternate method, a typewriter eraser (ZZ-E-661, type I or III), depending upon the situation. Copper and copper alloys used in avionic equipment are not usually painted.

Cadmium and Zinc

Cadmium is used as a coating to protect the part to which it is applied. It also provides a compatible surface when the part is in contact with other materials. The cadmium plate supplies sacrificial protection to the underlying metal because of its greater activity. That is, during the time it is protecting the base metal, the cadmium is intentionally being consumed. It functions in the same way that an active magnesium rod inserted in the water system protects the piping of a hot-water heater. The cadmium becomes anodic and is attacked first, leaving the base metal free of corrosion. Zinc coatings are used for the same purpose, but to a lesser extent in aircraft. Attack is evident by white-to-brown-to-black mottling of the cadmium surfaces. These indications DO NOT indicate decay of the base metal and should NEVER be removed for appearance sake alone. Until the characteristic colors peculiar to corrosion of the base metal appear, no steps should be taken,

Cadmium is usually used on bolts as a sacrificial metal to protect the base metal. Zinc is used in avionic/electronic equipment for the same general purpose.

Maintenance personnel remove corrosion products by rubbing lightly with stainless steel wool, abrasive impregnated webbing, or 320-grit or finer aluminum oxide abrasive paper. They do not remove the undamaged cadmium plate adjacent to the corroded area; this will reduce the amount of protection for the underlying base metal. Wire brushes are not used on cadmium-plated surfaces since they will remove more plating than corrosion. After removing corrosion products from cadmium-plated surfaces, maintenance personnel apply a protective coating to retard the corrosive attack.

Nickel and Chromium Alloys

Nickel and chromium alloys are also used as protective agents in the form of electroplated coatings. Also, they are used as alloying constituents with iron in stainless steels, such as the wear surfaces of aircraft struts. Nickel and chromium plates protect by forming a physical, noncorrosive barrier over the steel. Electroplated coatings, particularly chromium on steel, are slightly porous, and corrosion eventually starts at these pores or pin holes unless a supplementary coating is applied and maintained.

Titanium

Titanium is often used in engine exhaust areas. Titanium is a highly corrosion-resistant metal. However, it can greatly accelerate corrosion of dissimilar metal coupled to it. Insulation between titanium and other metals is necessary to prevent dissimilar metal attack on the other metal. Maintenance personnel must frequently inspect such areas to make sure that insulation failure has not allowed corrosion to begin.

- Q59. *What publication should you refer to for information about structural corrosion?*
- Q60. *Hydrated ferric oxide is commonly known as what kind of corrosion?*
- Q61. *What are the three types of aluminum surfaces insofar as corrosion removal is concerned?*
- Q62. *How should you remove corrosion from clad aluminum surfaces?*
- Q63. *What is the primary type of aluminum used on naval aircraft?*
- Q64. *What are the approved tools for cleaning anodized aluminum surfaces?*
- Q65. *Who should evaluate any loss of structural strength in critical areas of an aircraft?*
- Q66. *What manual should you refer to for tolerance limits for dimensions of critical structural members?*
- Q67. *Copper and copper-based alloys are used in avionic systems for what purpose?*
- Q68. *Where is titanium most often used on a aircraft?*

CORROSION REMOVAL AND TREATMENT

LEARNING OBJECTIVE: Describe the methods of removing and treating corrosion.

Once corrosion is detected, a specific and immediate program for corrective treatment is required. A complete treatment involves paint removal and cleaning of all corroded areas, removal of corrosion products, restoration of protective, surface-treatment films, and immediate application of protective coating and paint finishes. Each type of corrosion has its own peculiarities and requires special treatment. Corrosion should always be removed by the mildest means available.

CORROSION REMOVAL

Before starting any corrosion removal, you must conduct an inspection and evaluation of the suspected area. When you inspect an aircraft or a particular area of an aircraft for corrosion, you should follow the steps listed below.

1. Clean the area thoroughly.
2. If an area is suspected of having corrosion, visually inspect the area by using a magnifying glass.
3. To preclude metal damage, remove paint chemically from areas suspected of having underlying hidden corrosion. Use abrasive paint removal techniques only when corrosive products are observed.
4. After removing the paint, use a magnifying glass to determine the extent of the damage, especially if there is evidence of corrosion on critical parts. Corrosion cracks must be detected as early as possible.
5. Refer to the applicable structural repair manual (SRM) or MIM for damage limits. Metal loss damage is accumulative. When assessing corrosion damage, consider prior metal loss, including areas on the opposite side of the part. Propellers and helicopter blades have critical balance requirements. Refer to the propeller and blade manuals that apply for the evaluation and repair limits of corrosion, erosion, and abrasive damage.

After the aircraft or aircraft part has been inspected, the extent of the corrosion damage must be correctly evaluated. The severity of corrosion damage is grouped into the following categories:

Light corrosion. This type of damage is defined as a protective coating that is scarred or etched by light

surface corrosion. characterized by discolorization and pitting to a depth of approximately, 1-mil (0.001 inch) maximum. This type of damage can normally be removed by light hand sanding.

Moderate corrosion. This looks like light corrosion except that there may be some blisters or evidence of scaling and flaking of the coating or paint system. The pitting depths may be as deep as 10 mils (0.010 inch). This type of damage is normally removed by extensive hand sanding or light mechanical sanding.

Severe corrosion. This type of corrosion has a general appearance that may be similar to moderate corrosion with severe intergranular corrosion, blistering exfoliation, scaling, or flaking. The pitting depths are deeper than 10 mils (0.010 inch). This damage must be removed by extensive mechanical sanding and grinding.

Repairable damage. When corrosion damage exceeds the limits of the applicable MIM or SRM, it is classified as repairable damage. The use of the affected part may be continued after repair at a cognizant field activity (CFA).

Nonrepairable damage. When corrosion damage exceeds the established repair limits and requires replacement of the affected parts or special depot-level repair, it is classified as nonrepairable damage.

MECHANICAL CORROSION REMOVAL

The most effective mechanical methods of removing corrosion with the least removal of the metal are vapor blasting, soft-grit blasting, and dry, vacuum blasting. For use on assembled aircraft, a portable unit, such as the VACU-Blast Dry Honing Machine, is the most desirable.

VACU-Blast Dry Honer

The VACU-Blast Dry Honing Machine is a portable, air-operated, self-contained, lightweight unit that uses the dry vacuum return system. Dry honing is the only approved blasting method of removing corrosion on assembled aircraft. With this machine, the work is visible, and metal removal can be held to closer limits. The machine is air-operated, and can be used in shore-based or shipboard operations.

The dry honing machine (fig. 4-28) is composed of the following principal components mounted on a two-wheel carriage assembly:

A hose rack and storage compartment is provided on the front of the dry honing machine for storage of hoses, brushes, and accessories.

The dry honing machine can cause damage to aircraft components and systems if used improperly. Small quantities of abrasives will escape from the blast nozzle during normal use; therefore, the equipment must not be used where the abrasives may contaminate systems or components. The following are precautions you should use when working with this machine:

- Do not use on engines, gearboxes, or other oil lubricating systems.
- Do not use on fuel, hydraulic, or oxygen system components.
- Mask all vent susceptible systems when blasting near them to prevent possible contamination.
- Use only on exterior surfaces or parts that have been removed from the airframe to prevent possible contamination of interior areas.
- Do not use on airframe skins or structural parts that are exposed to more than 500°F in service.
- Do not blast Metallite or honeycomb panels.

Q69. What must you do before starting corrosion removal?

Q70. How should you remove moderate corrosion?

Q71. What is the most desirable method of mechanical corrosion removal?

Abrasive Wheel

An abrasive wheel can be used to remove severe corrosion (intergranular or exfoliation) on thick metal. The abrasive wheel is composed of nonwoven nylon, resin reinforced. The wheel is mounted on a mandrel assembly and driven by a pneumatic drill motor. Eye protection must be worn when an abrasive wheel is operated.

CAUTION

After removal of exfoliation corrosion by abrasive wheel, VACU-Blast area with glass beads to ensure removal of all corrosion. Failure to do so will result in the formation of tiny bubbles or flakes.

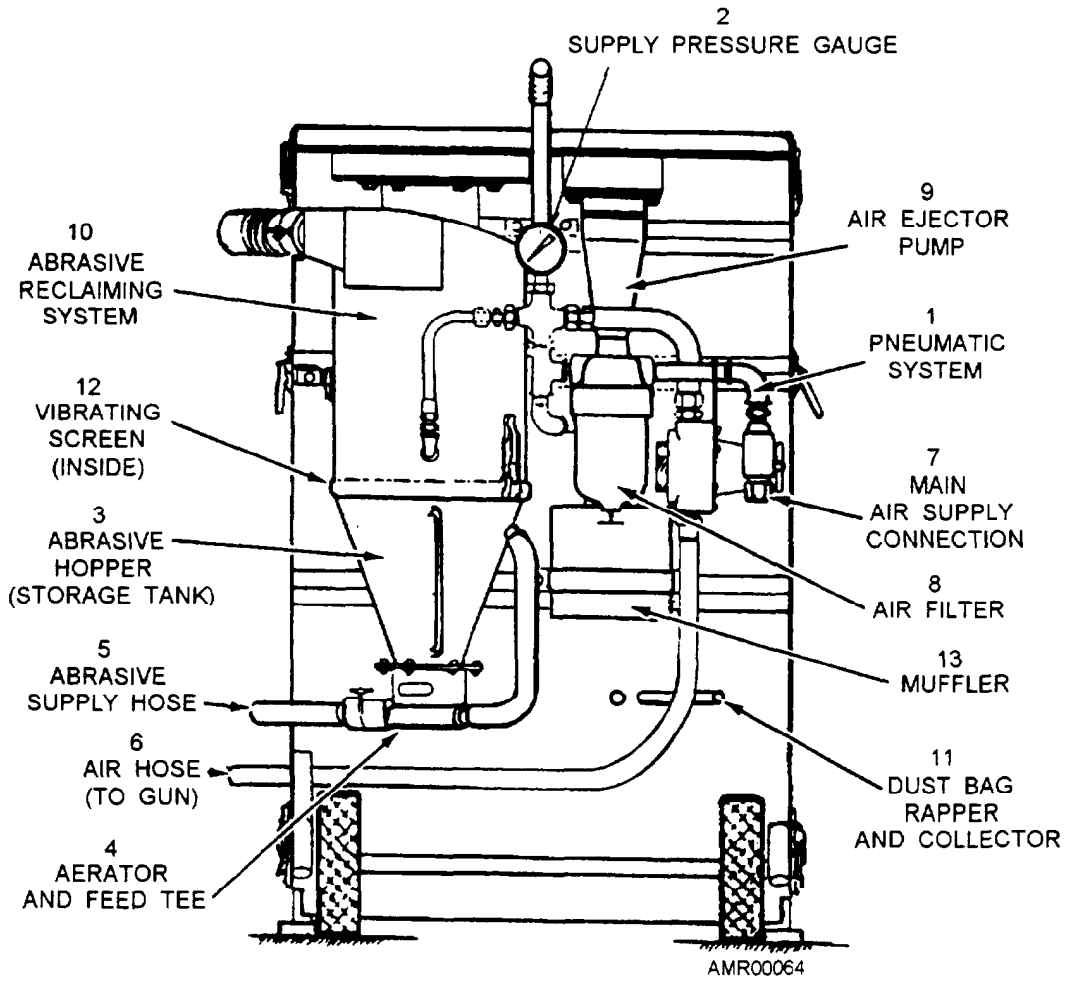
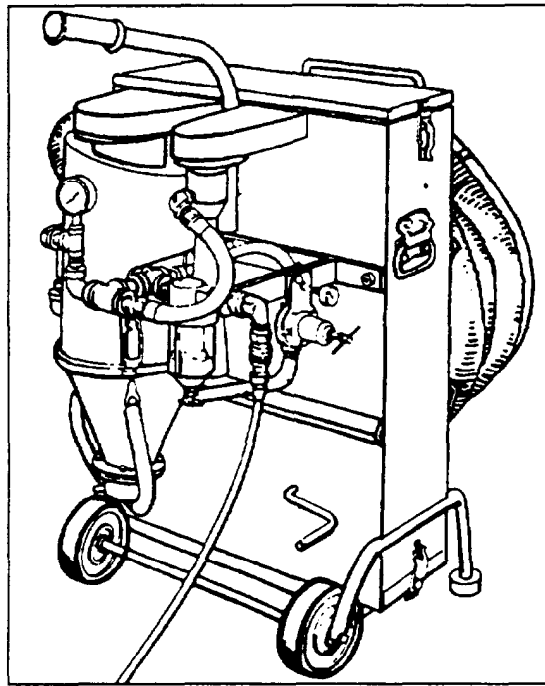


Figure 4-28.—VACU-Blast dry honing machine.

SUPPORT EQUIPMENT (SE) CORROSION REMOVAL AND SURFACE PREPARATION

The following text discusses surface preparation as well as mechanical and chemical paint and corrosion removal methods for SE. They are listed in order from the most effective or preferred to the least effective and not preferred. Each SE maintenance station develops the procedures for operating surface preparation equipment according to the applicable MIMs.

The key to achieving a successful, long-lasting coating system lies in good bonding between coating and metallic surfaces of SE. Paint will not bond to a surface that is poorly prepared. Dirt, oil, grease, corrosion by-products, moisture, and other contaminants prevent complete contact between paint and base metal. In addition, a metallic surface must be roughened to enable the paint system to bond to the surface. This roughened or anchor pattern can be produced by mechanical means or by chemical etchings.

You should remove corrosion, scale, and old paint from SE by the least destructive method. Where simple touch-up painting is required, feather the edges of existing sound paint with light sanding to provide an anchor for the touch-up paint.

You must apply the initial paint to SE as soon as possible following surface preparation. A prolonged lapse in time between surface preparation and painting allows corrosion to form on the prepared surface. This corrosion will cause later coating system failure.

REMOVING DIRT, OIL, AND GREASE

The first step in surface preparation is the removal of dirt, salt, lubricants, hydraulic oil, and other surface contaminants from SE. When grease and oil are present during abrasive blasting, grinding, or wire brushing, they will spread out over the treated surface and disrupt the coating bond. The cleaning method that you use depends on the type of soil, its extent, and the available cleaning equipment. Detergent cleaning, solvent cleaning, emulsifiable solvent cleaning, and acid cleaning are cleaning or degreasing methods.

Detergents and solvents are highly effective in attacking and dissolving grease and oil on metal surfaces of SE. Most solvents can be either applied by vapor degreasing equipment or by wiping. Solvents

are specially useful for cleaning small parts and spot-cleaning jobs. Disadvantages of degreasers lie in their toxicity and flammability. Many solvents are particularly dangerous when used on oxygen service equipment.

Emulsifiable solvent (solvents suspended in a gelatinlike medium) cleaning is an effective cleaning method for removing heavy oil, grease, wax, and other contaminants of SE.

Acid cleaning combines the forces of oil solvents and detergent cleaners in removing grease, oil, light rust, and other contaminants. The method is useful on the heavy steel structures of SE where surface etching is required. This cleaning method requires a thorough rinse with clean water.

MECHANICAL CORROSION REMOVAL ON SUPPORT EQUIPMENT (SE)

Abrasive or grit blasting is the preferred surface preparation method for many of the components of SE. Such blasting provides the clean anchor pattern needed by most coating systems. Wet abrasive blasting is preferred to dry blasting. Before blasting, disassemble the components according to the applicable technical manual. Mask all areas that should not be blasted, such as tapped holes, key ways, machined surfaces, reflectors, lights, and gauges.

When using abrasive blasting equipment, you must wear protective clothing, face shield or safety goggles, and a respirator.

Wet Abrasive Blasting

Water blasting is a technique that requires high-pressure producing equipment. It involves the propelling of water and blasting beads. The water blast method removes surface chemical contaminants, deteriorated paint, grease accumulations, oil, and mastic materials from SE.

NOTE: You must use Sodium Nitrite MIL-S-24521 during the abrasive process to prevent flash rusting.

The Hydroblaster or other water blast machines can be dangerous if not handled properly or with sufficient safeguards.

Dry Abrasive Blasting

Dry abrasive blasting involves propelling abrasive particles against the metallic surface by either high-pressure air or spinning paddle wheel. The striking of these particles against the metal abrades away deteriorated paint and scale. Many abrasive blast machines (portable dry-honing machines) reclaim used grit by cleaning and sifting out dirt, scale, and damaged grit. (See figure 4-28.) Grit that has been recycled after use on steel, brass, bronze, or copper-nickel should not be used on aluminum. Do not blast aluminum with steel or copper slag or chilled iron grit. Table 4-3 lists some common abrasive materials and grit sizes.

CLEANING SURFACES WITH POWER TOOLS

Power tool cleaning includes devices that impact the metallic surface with an abrasive substance or mechanical object. Impact tools, powered wire brushes, and disk sanders are common power tool cleaners for SE.

Impact tools, such as the needle gun (pneumatic descaler), provide a rapid means for removing rust and old paint from metal surfaces of SE. These tools must NEVER be used on aluminum.

A wire brush powered pneumatically or by electric motor is a method for removing small amounts of paint and rust from SE. Often, the overextended use of a wire brush results in a metal surface that is polished to a glossy appearance. A polished surface produces a poor anchor pattern for paint bonding.

Usually, electric or pneumatic disk sanders abrade the metal surface of SE with coarse to fine grit. When used with the needle gun, the disk sander can produce a uniform anchor pattern of very closely spaced scratches.

WARNING

When using abrasive power hand tools, you must wear eye protection to prevent serious injury.

- Q72. What is the preferred surface preparation method for many of the components of support equipment?
- Q73. What should you use during the abrasive process to prevent flash rusting?

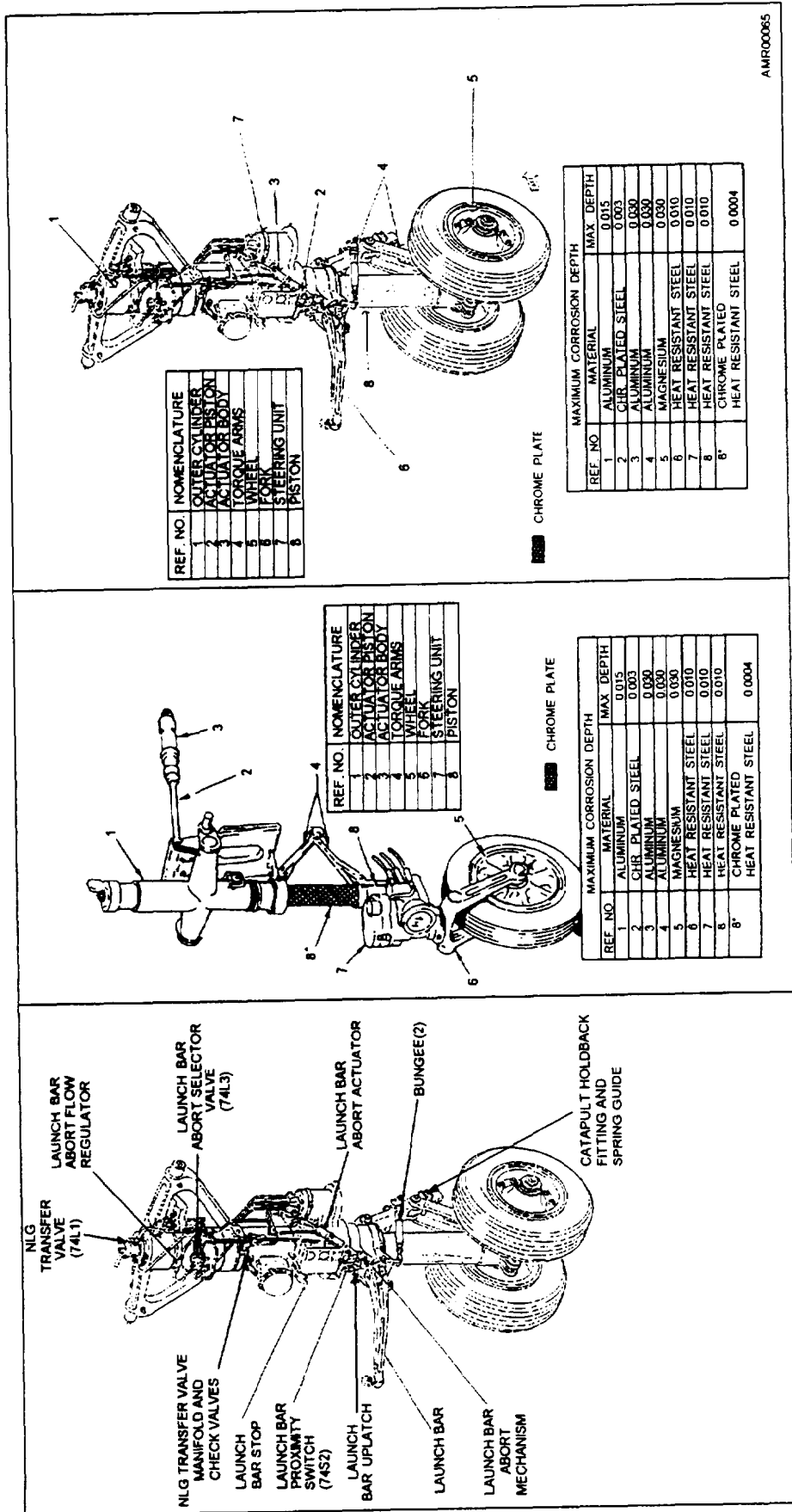
CORROSION DAMAGE LIMITS

LEARNING OBJECTIVE: Recognize the limits in removing corrosion damage.

Corrosion damage limits refer to the amount of metal that may be removed from a corroded part without impairing the strength and function of the part. When removing corrosion, maintenance personnel must be very careful not to remove more of the metal than is necessary to ensure complete removal of corrosion. Figure 4-29 shows the maximum corrosion depths allowed on the various components of the nose landing gear. When damage exceeds the limits specified in the SRM or the corrosion control section of the MIM, the affected part must be replaced if structural repair of the damage is not possible.

Table 4-3.—Recommended Grit for Steel and Aluminum

TYPE OF METAL BLASTED	RECYCLING			NON-RECYCLING		
	GRIT	SAE MESH	PRES PSI	GRIT	SAE MESH	PRES PSI
Steel	Angular silica	20/40	75	Silica sand	20/40	75
	Sand			Crushed garnet	20/40	75
	Crushed garnet	20/40	75			
Aluminum	Aluminum oxide	20/50	50			
	Silica sand	20/40	75	Silica sand	20/40	75
	Aluminum oxide	20/50	50	Crushed garnet	20/40	75
	Crushed garnet	20/40	75			



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Figure 4-29.—Nose gear maximum corrosion depths.

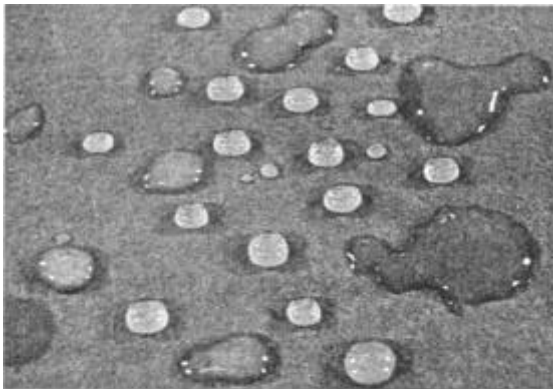
Q74. Information regarding corrosion removal limitations can be found in what publications?

CHEMICAL SURFACE TREATMENT

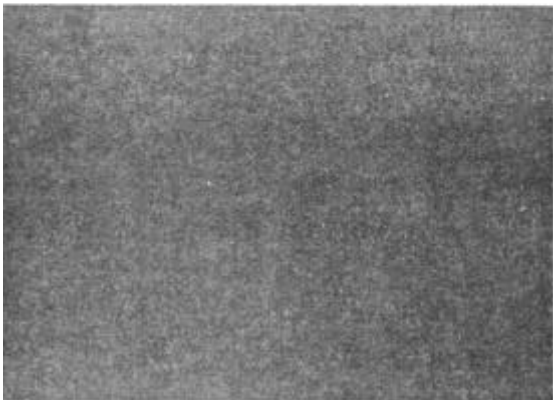
LEARNING OBJECTIVE: Define the purpose for chemically preparing a surface for priming and painting.

Chemical conversion coatings increase a surface's resistance to corrosion and improve paint bonding on the surface.

The metal to be treated must be cleaned to a water breakfree surface (fig. 4-30). Metal surfaces not free of water breaks must be recleaned with a solution of 1 part MIL-C-43616 or MIL-C-25769 aircraft cleaning compound to 16 parts of water, and then rinsed with water. Surfaces that have been waxed, particularly with silicone wax, may require special cleaning. After cleaning and removal of surface oxides, aluminum should be treated with MIL-C-81706 and magnesium with MIL-M-3171, type VI, chemical conversion coating material.



WITH WATER BREAKS



WATER BREAK FREE

Figure 4-30.—Water break comparison.

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CAUTION

Personnel must wear protective clothing, rubber gloves, and chemical goggles when using a solution of MIL-C-81706 and MIL-M-3171 or serious injury could result.

Apply these chemical conversion coatings immediately after cleaning the surface to a water breakfree surface and while the surface is still wet. Apply these coatings by brush, nonatomizing spray, or sponge stick moistener. The sponge stick moistener is particularly useful for small areas.

Soluble salt residues that remain on the surface after treatment accelerate corrosion and can cause blistering of paint finishes. Thus, complete rinsing with fresh water following the chemical treatment is very important. Flush the chemical with free-flowing water only. Allow the chemical conversion coated surface to dry (usually 30 minutes) before painting. Do NOT wipe the surface with a damp cloth or brush, as this will degrade or remove the chemical conversion coating.

Chemical conversion coatings are often damaged during aircraft maintenance, or they may be contaminated by grease, oil, or other foreign matter. Therefore, the treated surface should be painted soon after treating to obtain the best results.

CHEMICAL CONVERSION OF ALUMINUM ALLOYS

The procedure to be used for the chemical conversion of aluminum alloys is as follows: Apply the conversion coating material, MIL-C-81706 (Form V [powdered] is preferred, Form III [premixed] is an alternate), until you obtain a golden iridescent color. Immediately rinse the chemical from the surface with large amounts of fresh water when you obtain the proper color conversion. This rinsing stops the chemical action and minimizes solution entrapment. Failure to rinse may accelerate corrosion and reduce paint bonding. If a long period of contact before rinsing is allowed, a powdery, coated surface may be the result.

CHEMICAL CONVERSION OF MAGNESIUM ALLOYS

The procedure for the chemical conversion of magnesium alloys is as follows: Apply the conversion

coating material MIL-M-3171 until you obtain a greenish-brown or brass-colored yellow color. For a proper conversion coating, keep the surface wet with the specified solution until you obtain the desired color. Rinse with fresh water. Remove any excess conversion coating solution that collects into pools within the aircraft.

Some magnesium parts in later model aircraft were originally protected by a proprietary (held under patent) electrolytic process. One process is identified by the brown to mottled gray appearance of the unpainted surface. Another process will appear as a green to grayish-green color. These coatings are thicker than those applied by the immersion or brush method, such as MIL-M-3171. The electrolytic finish cannot be restored in the field. Therefore, when failure of the coating occurs, you should remove corrosion and touch up the bare magnesium with MIL-M-3171 chemical treatment solution. You should minimize removal of the electrolytic coatings, as they afford greater protection than the replacement coatings.

Q75. What is the purpose for chemically treating a surface for painting?

Q76. When failure of the coating occurs, you should remove corrosion and touch up the bare magnesium with what chemical treatment solution?

AIRCRAFT PAINTING AND COMPONENT TOUCH-UP

LEARNING OBJECTIVE: Identify the materials used and procedures for painting aircraft.

The amount of paint touch-up done at organizational- and intermediate-level maintenance varies widely. The amount depends upon the activity involved, the availability of facilities, and the area of operations.

The primary objective of any paint finish is the protection of the exposed surface against decay. There are secondary reasons for particular paint schemes. Glare is reduced by nonspecular (not mirrorlike) coatings. White or light-colored, high-gloss finishes reduce heat absorption. Camouflage, high visibility, or special identification marking requirements are met by various paint schemes. **REPAINTING SHOULD NOT BE DONE FOR APPEARANCE SAKE ONLY.** A faded or stained but well-bonded paint finish is

better than a fresh touch-up treatment applied over dirt, corrosion products, or other contaminants.

Complete refinishing (particularly under field conditions) should be restricted to those areas where existing paint finishes have degraded until they fail to perform their protective function. However, the organizational and intermediate levels of maintenance should evaluate maintenance and repair of paint finishes. This should be done at the time of aircraft receipt and through constant surveillance and maintenance of finishes during an aircraft's service tour. Maintenance also should make final recommendations for refinishing an aircraft when the aircraft is scheduled for standard depot-level maintenance (SDLM).

General safety precautions should be followed when you paint and when you use special types of paints. These precautions include the following:

- No eating, drinking, or smoking is allowed in areas where paint or solvent is being used.
- Prolonged breathing of vapors from organic solvent is dangerous. Prolonged skin contact with organic solvents or materials containing organic solvents can have a toxic effect on the affected skin area.

PAINT REMOVAL

Paint removal operations at the organizational and intermediate levels of maintenance are usually confined to small areas, or possibly a whole panel. In all cases, the procedures outlined in the MIM that applies should be observed. General stripping procedures are contained in NAVAIR 01-1A-509.

Materials

All paint removers are toxic and caustic; therefore, both personnel and material safety precautions must be observed in their use. Personnel should wear eye protection, gloves, and a rubber apron.

Paint remover, specification MIL-R-81294, is an epoxy paint remover for use in the field. This remover will strip acrylic and epoxy finishes. Acrylic windows, plastic surfaces, and rubber products are damaged by this material. This material should not be stocked in large quantities as it ages rapidly, degrading the results of stripping action. This paint remover must NOT be used to remove paint from composite materials.

Procedures and Precautions

The stripping procedures described below are general in nature. When stripping any aircraft surface, you should consult the applicable MIM for the specific procedures to be used. Stripping should be accomplished outside whenever possible. If you must strip aircraft surfaces in a hangar or other enclosure, you should make sure you have adequate ventilation. You should adhere to the following general procedures and precautions during stripping operations:

CAUTION

Before cleaning and stripping, make sure that the aircraft is properly grounded. This will dissipate any static electricity produced by the cleaning and stripping operations.

- Where the paint remover may contact adhesives, mask all seals, joints, skin laps, and bonded joints by using the approved tapes and papers.
- Apply the stripper liberally. Completely cover the surface with a thick layer of stripper with a paint or acid brush. The stripper should not be spread in a thin coat like paint because it will not loosen paint sufficiently for removal, and the remover may dry on the surface of the metal. This would require it to be reapplied.
- Allow the stripper to remain on the surface long enough for it to wrinkle and lift the paint. This may be from 10 to 40 minutes, depending upon temperature, humidity, and the condition of the paint coat being removed. Reapply paint remover as necessary in the areas where paint remains tight or where the material has dried.
- Remove loosened paint and residual paint remover by washing and scrubbing the surface with fresh water, fiber scrapers, bristle brushes, and rags. If water spray is available, you should use a low-to-medium pressure stream of water. Apply it directly to the surface while scrubbing the surface.
- After a thorough cleaning, you should remove masking materials and clean any residual paint from the surface.
- Rinse with water and clean the area with aircraft cleaning compound (1 part MIL-C-85570 to 9 parts water) to remove paint remover residue.

Flap Brush

Paint can be mechanically removed with a flap brush. The brush consists of many nonwoven, nonmetallic, nylon flaps bonded to a fiber core. The brush assembly (fig. 4-31) is made up of a flap brush, flanges, and mandrel. Use a NO LOAD 3200 rpm pneumatic drill motor to power the brush. Do not use a flap brush that is worn down to within 2 inches from the center of the hub. Continued use beyond this limit may cause gouging due to loss of flexibility of the fiber. When you use a flap brush, apply minimum pressure to remove the most paint and the least metal. Excessive pressure will cause some paints to melt, gum up, and streak around the area being worked. For safe and efficient operation, the direction of rotation is indicated by an arrow imprinted on the inside of the core. Wear eye protection when operating a flap brush, and consult your maintenance instruction manuals for limitations on corrosion removal.

- Q77. What is the primary purpose of any paint finish?
- Q78. When using paint removers, you should wear what type of protective clothing?
- Q79. What safety precaution must be taken before cleaning and stripping old finishes on aircraft?
- Q80. What type of motor should you use to power a flap brush?

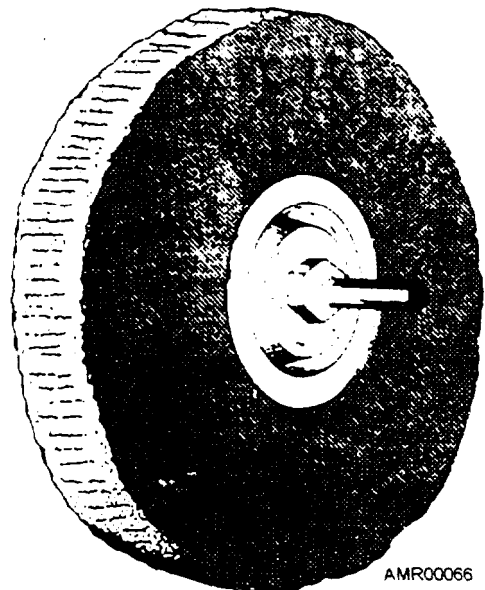


Figure 4-31.—Flap brush and mandrel.

SURFACE PREPARATION

The effectiveness of any paint finish and its bond to the surface depends upon the careful preparation of the damaged surface before touch-up. The touch-up paint should overlap onto the existing good paint finish. The touch-up materials will not bond to glossy finishes, so the finishes must be prepared. Also, any edges of the existing film will show through the overlap unless they are smoothed out.

To break the gloss of existing finishes and to feather (smooth out) the edges for overlap, you should scuff sand by using 240 or 320 grit aluminum oxide cloth. After sanding, use a water rinse to remove the abrasive residues.

You should remove any loosened seam sealants in the area to be touched up and replace them as necessary. Also, resecure any loose rubber seals by using the type of adhesive specified in the applicable MIM.

Then outline the area to be painted with tape and masking paper, as shown in figure 4-32. This protects the adjoining surfaces from overspraying and unwanted paint buildup.

TOUCH-UP PROCEDURES

A standardized paint system for O- and I-level painting and paint touch-up is presented in NAVAIR 01-1A-509.

Standardized exterior paint touch-up systems for organizational and intermediate levels of maintenance consist of an epoxy primer (MIL-P-23377, type I or type II, as applicable) overcoated with aliphatic polyurethane (MIL-C-85285). Paint systems are identified by a decal or stencil located on the right side of the aft fuselage.

Standardized interior paint touch-up systems for O- and I-level maintenance consist of zinc chromate primer (TT-P-1757). Paint materials that are within their original shelf life or within an extended shelf life are preferred. However, if materials are beyond shelf life date, test them by using a small sample of scrap aluminum.

The following paragraphs furnish the basic information for identifying and applying the standard touch-up paint systems. Complete information on the types and applications of aircraft paint systems is contained in NAVAIR 01-1A-509.

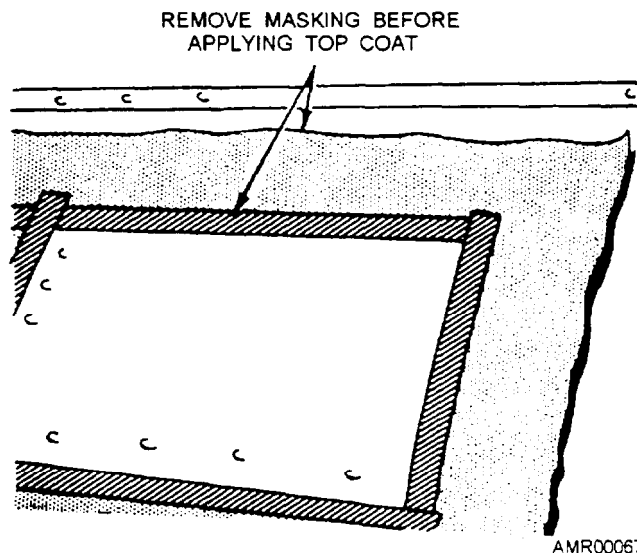


Figure 4-32.—Masking before paint touch-up.

Epoxy-Polyamide Primer (MIL-P-23377)

The epoxy-polyamide primer is supplied as a two-part kit. Each part must be stirred or shaken thoroughly and separately before they are mixed together. One part contains the pigment particles in an epoxy vehicle. The other part is composed of a clear polyamide solution that functions as a hardener for the epoxy solution. This primer is supplied by various manufacturers. You should mix only as much primer as needed. The storage life of the primer is limited after it is mixed to the amount that can be used in 4 hours. Refer to NAVAIR 01-1A-509 for specifics on mixing these two components.

Zinc Chromate Primer

Zinc chromate primer (TT-P-1757) is a general-purpose, interior, protective coating for metal surfaces. Depending upon the location, zinc chromate primer may or may not require a topcoat. Zinc chromate primer is easy to apply or remove as it is a single component. There is no thinning required for brush or roller application however, for spray application, thin this primer with MIL-T-81772. Do not use zinc chromate primer on exterior aircraft surfaces, including wheel wells and wing butts, and in areas that are exposed to temperatures exceeding 175°F (79.4°C).

Polyurethane Finish Systems

You must have a physical examination before you can work with polyurethane coatings. Also, you must

have periodic physicals during the time you are working with these coatings.

There are two types of polyurethane systems used on naval aircraft—the aliphatic type (used in MIL-C-85285 and TT-P-2756 polyurethane paints) and the aromatic type (used in polyurethane, rain erosion-resistant coatings, MIL-C-85322). These materials present no special hazard to health when cured (dried), but they require special precautions during preparation, application, and curing due to the isocyanate vapors produced. The isocyanate vapors can produce significant irritation to the skin, eyes, and respiratory tract even in very small concentrations. They also may induce allergic sensitization of personnel exposed to their vapors and mists produced during spray applications. Aliphatic polyurethane, MIL-C-85285, is the standard, general-purpose, exterior, protective coating for aircraft surfaces.

The polyurethane finish comes in kits that consist of a two-component material resin and a catalyst. The touch-up kits are prethinned and ready for use when they are mixed according to the instructions in the kit. Use aliphatic polyurethane over epoxy polyamide primer and for touch-up and insignia markings over polyurethane paint systems only.

Acrylic Lacquer

Acrylic lacquer (gloss and camouflage) MIL-L-81352 is the preferred topcoat material for aircraft markings that identify the reporting custodian and for propeller safety stripes.

Enamel Finishes

Most enamel finishes used on aircraft surfaces are baked finishes that cannot be touched up with the same materials in the field. Minor damage to conventional enamel finishes ordinarily used on engine housings is repaired by touching up with epoxy topcoat material or air-drying enamel.

Elastomeric Rain Erosion-Resistant Coating (MIL-C-85322)

Elastomeric coatings are used as a coating system to protect exterior laminated plastic parts of high-speed aircraft, missiles, and helicopter rotary blades from rain erosion in flight. They offer good resistance to weather and aromatic fuels in addition to rain erosion. Excellent bonding is obtained after a 7-day drying period.

Repair to these coatings in the field is not practical due to this long curing time. Kits are available for repair of coatings where limited touch-up is required. These kits contain a primer, neoprene topcoat, and antistatic coating. If the radome or leading edge coatings are in bad condition, they should be stripped completely and recoated with epoxy primer and acrylic topcoat as a temporary measure. If schedules and conditions permit adequate curing of elastomeric coatings, the original coatings may be replaced.

The repair kits are normally bought as an open purchase to ensure that fresh materials are available. Since heat accelerates aging, repair kits should be stored in a cool place or refrigerated. Stripping of fiber glass surfaces should be done according to current maintenance instructions. Elastomeric coatings are toxic and flammable, and must be used with care.

PAINTING EQUIPMENT (SPRAY GUNS)

The spray gun atomizes the material to be sprayed, and the operator directs and controls the spray pattern through manipulation and minor adjustments of the spray gun. Spray guns are usually classed as either a suction-feed or pressure-feed type. The type of spray gun can be determined by two methods—by the type of container used to hold the paint material and by the method in which the paint is drawn through the air cap assembly. For information on the types of spray guns, refer to NAVAIR 01-1A-509.

Suction-Feed Type

The suction-feed spray gun is designed for small jobs. The container for the paint is connected to the spray gun by a quick-disconnect fitting, as shown in figure 4-33. The capacity of this container is approximately 1 quart. The fluid tip of this spray gun protrudes through the air cap, as shown in figure 4-34. The air pressure rushing by the fluid tip causes a low-pressure area in front of the tip. This causes paint to be drawn up through the fluid tip, where it is atomized outside the cap by the air pressure.

Pressure-Feed Type

The pressure-feed spray gun is designed for use on large jobs where a large amount of spray material is to be used. With this type of spray gun, the material is supplied to the gun through a hose from a pressurized tank. This spray gun produces a high volume of spray material metered at a low air pressure. This type of

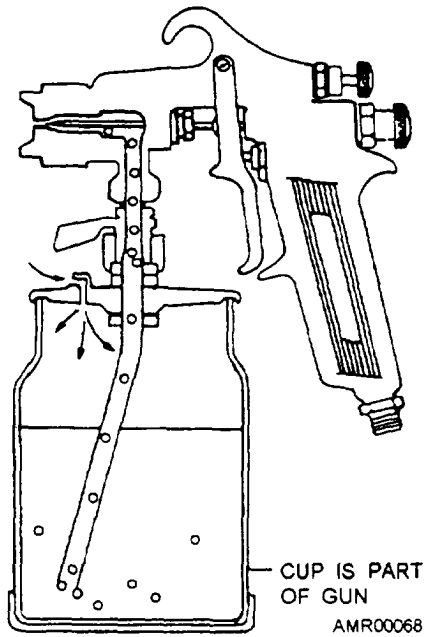


Figure 4-33.—Suction-feed type of spray gun.

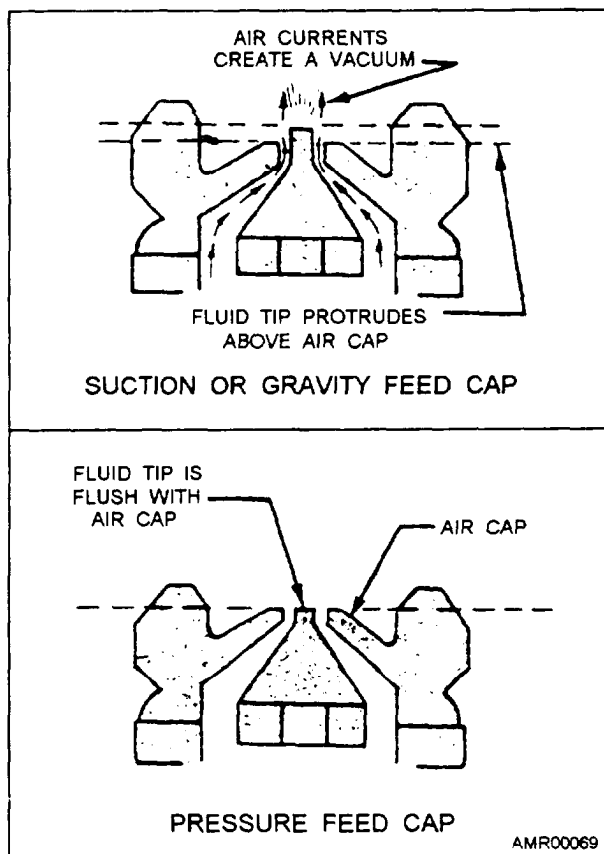


Figure 4-34.—Suction and pressure fluid tips and air caps.

spray equipment eliminates evaporation of the volatile substances of the mixture before they strike the surface because the paint and air are mixed internally. Thus, a wetter coating is applied.

SEALANTS

CAUTION

Many of the sealants discussed in this section may be flammable or produce toxic vapors. When materials designated as flammable are used, all sources of ignition must be at least 50 feet away from the work location. Toxic vapors are produced by the evaporation of solvents or the chemical reaction that takes place in the curing sealants. When sealants are used in a confined space, such as a fuel cell, fuselage, wing section, or table or bench operation, adequate local exhaust ventilation must be used. This will reduce the vapors below the maximum allowable concentration and keep them at that level until repairs have been completed. Personnel must NOT eat or smoke when they work with sealants.

Sealants are used to prevent the movement of liquid or gas from one point to another. They are used in an aircraft to maintain pressurization in cabin areas, to retain fuel in storage areas, to achieve exterior surface aerodynamic smoothness, and to weatherproof the airframe. Sealants are used in general repair work in the field and for maintenance and restoration of seam integrity in critical areas if structural damage or the use of paint removers has loosened existing sealants.

Conditions surrounding the requirements for use of sealants govern the type of sealants to be used. Some sealants are exposed to extremely high or low temperatures. Other sealants are in contact with fuels, lubricants, and so forth. Therefore, sealants are supplied in different consistencies and rates of cure. The basic types of sealants are classified in three general categories—pliable sealants, drying sealants, and curing sealants.

Pliable sealants are called “one-part” sealants and are ready for use as packaged. They are solids and change little, if any, during or after application. Solvent is not used in this type of sealant. Therefore, drying is not necessary; and except for normal aging, they remain virtually the same as when first packaged, neither hardening nor shrinking. They bond well to metal, glass, and plastic surfaces. Pliable sealants are used around high-usage access panels and doors, and

in areas where pressurized cavities must be maintained.

Drying sealants set and cure by evaporation of the solvent. The solvents in these sealants provide the desired consistency for application. Consistency or hardness may change when this type of sealant dries, depending upon the amount of solvent it contains. Shrinkage is a consideration when these sealants are used. Shrinkage occurs upon drying. The degree of shrinkage depends on the proportion of solvents.

Catalyst-cured sealants have advantages over drying sealants. They are transformed from a fluid or semifluid state into a solid mass by chemical reaction of physical change rather than by evaporation of a solvent. A chemical catalyst or accelerator is added and thoroughly mixed just before sealant applications. Heat may or may not be used to speed up the curing process. When a catalyst is used, accurate proportioning and thorough mixing of the two components are very important to assure a complete and even cure.

Application of Sealants

Application of sealants varies according to time element, tools required, and the method of application. However, the following restrictions apply to all sealant applications:

- Sealants should be used within the approximate application time limits specified by the sealant manufacturer.
- Sealants should not be applied to metal that is colder than 70°F. Better bonding is obtained and the applied sealant will have less tendency to flow out of place while curing if the metal is warmed to a temperature of 90°F to 100°F before the sealant is applied.
- Sealants should be discarded immediately when they become too stiff to apply or work readily. Stiff or partially cured sealants do not wet the surface to which they are applied as well as fresh material. This causes uneven bonding.
- Sealants should not be used for close-fitting (faying) surface applications unless they have just been removed from refrigerated storage or freshly mixed.

Brushes, dipping, injection guns, spatulas, and spray guns are the methods used to apply sealants. Figure 4-35 shows (black areas) where sealant is applied to protect some of the most corrosion-prone

areas on an F-14 aircraft. The sealant is applied by using the spray, spatula, and brush methods.

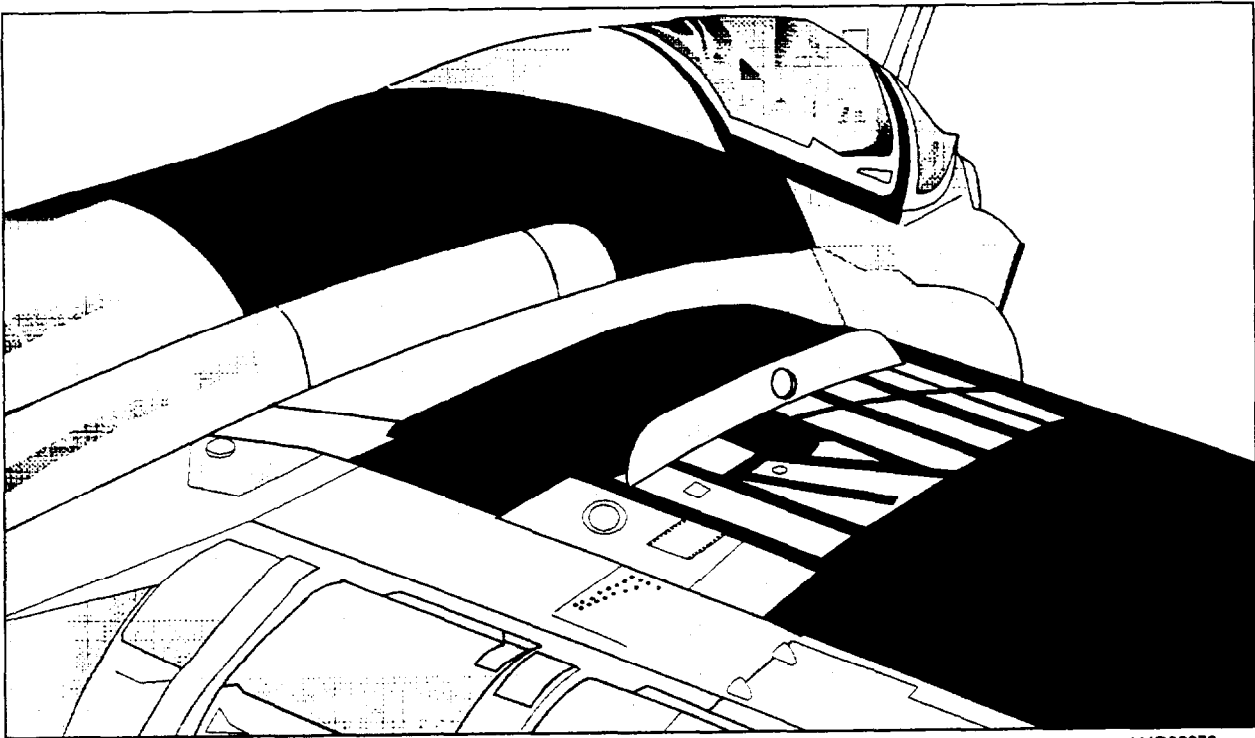
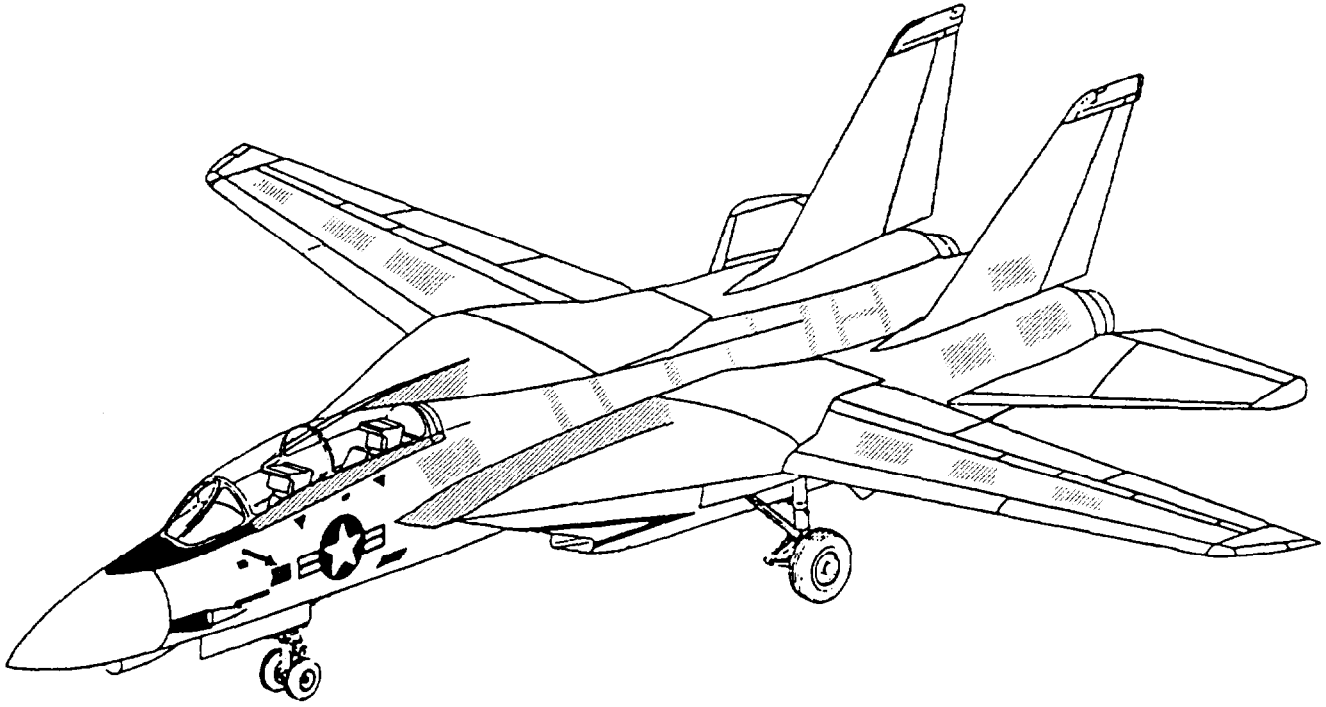
Sealant MIL-S-81733, type III, is the sealant used most extensively for spray application. If type III sealant cannot be procured, sealant MIL-S-8802, class A, may be used by thinning it to a sprayable consistency by the addition of the correct solvent.

When an aircraft is pressure sealed, the sealing materials should be applied as a continuous bead, film, or fillet over the sealed area. Air bubbles, voids, metal chips, or oily contamination prevent an effective seal. Therefore, the success of the sealing operation depends upon the cleanliness of the area and the careful application of the sealant materials. There are various methods of pressure-sealing joints and seams in aircraft. The applicable SRM will specify the method to be used in each application.

The sealing of a faying surface is done by brush. The contacting surfaces are coated with the specified sealant. Application of the sealant should be made immediately before the parts are fastened together. Careful planning of work and equipment are necessary so faying surface seals on large assemblies may be closed within the application time limit of the sealant. Once the sealant has been applied, the parts must be joined, the bolts torqued, and the rivets driven all within the application time limit.

When insulating tape has been installed between the faying surfaces to prevent contact of dissimilar metals, pressure sealing should be done by fillet sealing. In fillet sealing, the sealant is spread along the seam with a sealant injection gun in about 3-foot increments. Before proceeding to the next increment, the applied portion of the fillet is worked in with a sealant spatula or tool (fig. 4-36). This working of the sealant is done to fill in all voids in the seam and to eliminate most air bubbles. The care used in working out the air bubbles determines the leakfree service life of the sealant. After the sealant has cured to a tackfree condition, the fillet should be inspected for remaining air bubbles. These air bubbles should be opened and filled with sealant. When a heavy fillet is required, the fillet should be applied in layers. The top layer should fair with the metal.

Injection sealing is the pressure filling of openings or voids with a sealant injection gun. The sealant is forced into the opening until it emerges from the opposite side. Voids and cavities are filled by starting with the nozzle of the sealant injection gun at the bottom of the space and tilling as the nozzle is



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Figure 4-35.—Sealant applied to aircraft exterior surfaces.

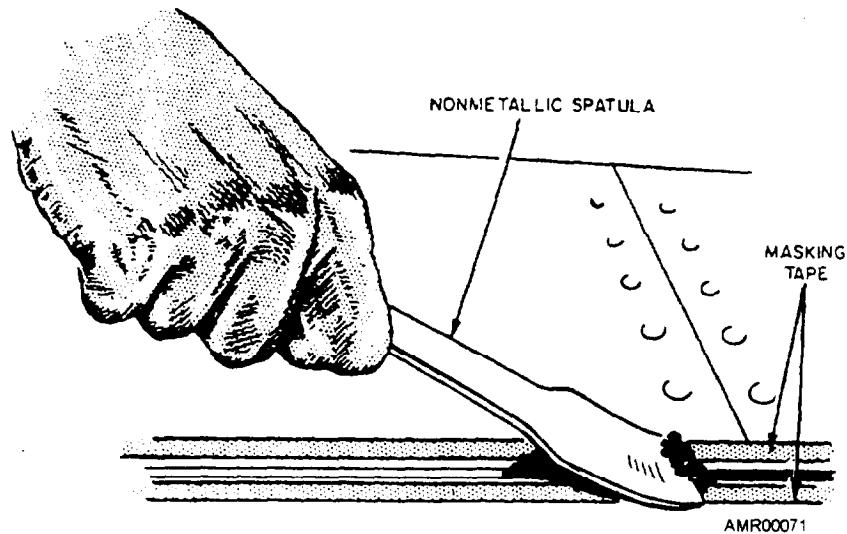


Figure 4-36.—Applying sealant.

withdrawn. An example of injection sealing is the caulking of a leaking fuel cell.

Fasteners, such as rivets, Rivnuts, screws, and small bolts, should have a brush coat of sealant over the protruding portion on the pressure side. Washers should have a brush coat of sealant on both sides. Split-type grommets should have sealant brushed into the split before installation. After installation, fillets should be applied to both the base of the grommet and the protruding tube on the pressure side.

Sealing Compound (MIL-S-8802). MIL-S-8802 is a temperature-resistant (-65°F to +250°F), two-component, synthetic rubber compound used for sealing and repairing fuel tanks and fuel-cell cavities. It is produced in three classifications.

Type	Applied by	Maximum application time in hours
I	Brush	1/2
	Dip	2
II	Extrusion	1/2
	Gun	2
	Spatula	4
III	Spray gun	1
IV	Brush or Spatula	12 to 48

Class	Use
A	For brushing application
B	For extrusion gun and spatula application
C	For faying surface sealing

Sealing Compound (MIL-S-81733). MIL-S-81733 is an accelerated, room-temperature curing, synthetic rubber compound. It is used in sealing metal components on weapons and aircraft systems for protection against corrosion. This sealant contains a corrosion inhibitor. Figure 4-37 shows MIL-S-81733 sealing compound used to seal an antenna. It comes in four types.

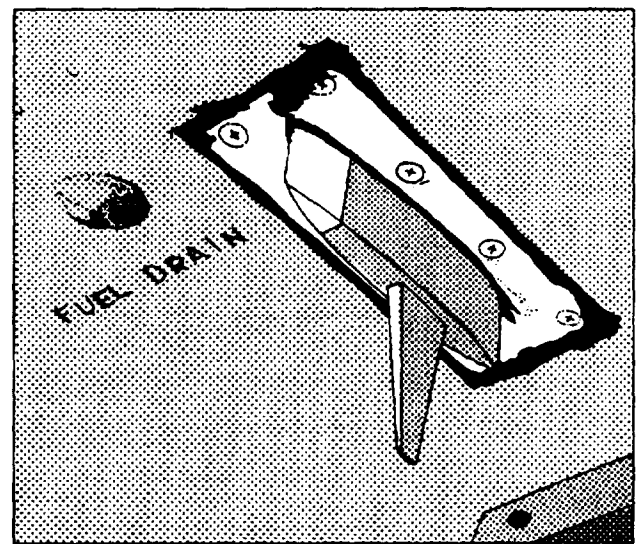


Figure 4-37.—Typical fleet antenna sealing application.

Sealing Compound (MIL-S-8516). MIL-S-8516 is an accelerated, synthetic, rubber sealing compound used for sealing low-voltage electrical connectors, wiring, and other electrical equipment against moisture and corrosion where temperatures do not exceed 200°F. This sealant has very good resistance to fuels, oils, grease, water, and humidity. However, it is NOT authorized for use in engine bays, keel areas, or areas adjacent to bleed-air ducts. It is manufactured in kit form and comes in sizes from 2.5 ounces to 1 quart. MIL-S-8516 is available in three classes with different curing times.

Class	Curing time in hours
1	24
2	48
3	72

Silicone Rubber Sealant (MIL-S-23586). Room temperature vulcanizing (RTV), silicone rubber sealant is used for sealing small electrical connectors and electrical components that are located in areas where the temperatures are between 200°F and 450°F. This sealant has good resistance to weathering, moisture, and withstands ozone. RTV silicone rubber sealant is available in two types, both used for the same purposes. The two types are type II, class 2, grade A, and type I, class 1, grade B-1. Type II, class 2, grade A contains cure volatiles and should be used only in well-ventilated areas.

Adhesive Silicon Sealant (MIL-A-46146). Also known as 3145 RTV. A noncorrosive sealant for use on sensitive metals and avionics equipment in areas that are exposed to temperatures between 250°F and 350°F. This sealant comes in 3-, 8-, and 12-ounce tubes.

CAUTION

Many RTV silicone sealants contain an acetic acid curing agent. These sealants, when in contact with metal, cause rapid corrosion. RTV sealants that contain acetic acid are NOT authorized for use on electronic or electrical circuits. They may be identified by the emission of a vinegar odor while in a liquid or curing state.

- Q81. Complete information on the types and applications of aircraft paint systems is contained in what publication?*
- Q82. After it is mixed, the storage life of epoxy-polyamide primer is limited to the amount that can be used in how many hours?*
- Q83. What is the standard, general-purpose, exterior protective coating for aircraft surfaces?*
- Q84. What are the two classes of spray guns?*
- Q85. When flammable materials are used, all sources of ignition must be at least how far away from the work location?*

SUMMARY

This chapter identifies the manuals and procedures used to detect and combat corrosion on naval aircraft and support equipment. It identifies the types and causes of corrosion. Familiarize yourself with types and uses of cleaning materials and the procedures and materials for preservation and depreservation. This is vital information.

ANSWERS TO REVIEW QUESTIONS

- A1. *Corrosion reduces the strength and changes the mechanical characteristics of the material.*
- A2. *Corrosion control.*
- A3. *Weight-to-strength ratio.*
- A4. *Metal corrosion,*
- A5. *Protection from corrosive environments.*
- A6. *Electron flow is established from the cathode to the anode.*
- A7. *They speed the corrosion process.*
- A8. *Thick sections are more likely to have variations in their composition, particularly if heat-treated during fabrication.*
- A9. *Moisture is the single largest contributor to avionics corrosion.*
- A10. *NAVAIR 01-1A-509.*
- A11. *NAVAIR 16-1-540 provides information on cleaning and corrosion prevention and control of avionics equipment.*
- A12. *NAVAIR 15-01-500, Preservation Of Naval Aircraft.*
- A13. *General uses for cements, sealants, and coatings.*
- A14. *A period of intensive care should follow the deployment cycle to bring the aircraft back up to standard.*
- A15. *A good corrosion prevention program.*
- A16. *Every 14 days.*
- A17.
 - a. *Aircraft is exposed to corrosive fire-extinguishing materials.*
 - b. *Spilled electrolyte and corrosive deposits are found around battery terminals and battery area.*
 - c. *The aircraft has been exposed to significant amounts of salt water.*
 - d. *Salt deposits, relief tube waste, or other contaminants are apparent.*
 - e. *Fungus growth is apparent.*
 - f. *Chemical, biological, or radiological contaminants are detected.*
- A18. *They must be cleaned or wiped down.*
- A19. *Flammability and toxicity*
- A20. *Inhaling toxic vapors can seriously affect the brain and central nervous system.*
- A21. *They must be kept in specially marked containers.*
- A22. *In a separate building or-flammable liquids storeroom.*
- A23. *It is applied by spraying, dipping, brushing, or wiping.*
- A24. *1,1,1-trichloroethane.*

- A25.
 - a. *Apply by wiping or scrubbing the affected area with an acid brush or toothbrush.*
 - b. *Air dry or oven dry as applicable.*
 - c. *Do not use on acrylic plastics or acrylic conformal coatings.*
 - d. *Do not use on unsealed aluminum electrolytic capacitors. Damage may result to end caps and cause leakage.*
- A26. *Silicon carbide paper because it is sharp and the individual grains can penetrate steel surfaces.*
- A27. *Because it conforms to the surface, the applicator allows easier application of a constant scrubbing pressure on curved skin panels.*
- A28. *MIL-C-85570.*
- A29. *Select the proper cleaning agent for the method of cleaning chosen.*
- A30. *Upward and outward.*
- A31. *Dry-cleaning solvent.*
- A32. *It is not oxygen compatible and will cause explosion or fire.*
- A33. *A polyethylene sheet, polyethylene-coated cloth, or metal foil barrier materials.*
- A34. *The maintenance instructions manual (MIM).*
- A35. *NAVAIR 01-1A-509.*
- A36. *Level I—Short term, up to 60 days.*
Level II—60 days to 1 year.
Level III—Long term, 1 to 8 years.
- A37. *Level I preservation.*
- A38. *All three. Grades I, II and IV.*
- A39. *Antifriction bearings, shock-strut pistons, and other bright metal surfaces.*
- A40. *It is used when a water-displacing, low temperature, lubricating oil is required.*
- A41. *Type III.*
- A42. *Level I.*
- A43. *Ground Support Equipment Cleaning and Corrosion Control, NAVAIR 17-1-125.*
- A44. *Silicone sealant MIL-A-46146, type I, and polysulfide sealant MIL-S-81733 or MIL-S-8802.*
- A45. *Uniform or direct surface attack*
- A46. *Aluminum and magnesium alloys.*
- A47. *White or gray powdery deposit.*
- A48. *Avoid the creation of crevices during repair work.*
- A49. *Intergranular corrosion is an attack on the grain boundaries of alloys under specific conditions.*

- A50. *It is usually the result of faulty design or improper maintenance practices.*
- A51. *Stress induced by press-and-shrink fits and those in rivets and bolts.*
- A52. *Fatigue corrosion is caused by the combined effect of corrosion and stress applied in cycles to a component.*
- A53. *A slight vibration, friction, or slippage between two contacting surfaces that are under stress or heavy load.*
- A54. *Steel, aluminum, and magnesium.*
- A55. *Applicable periodic maintenance information cards (PMICs).*
- A56. *A cathode, an anode, and an electrolyte.*
- A57. *Black paint to prevent glare.*
- A58. *Daily.*
- A59. *NAVAIR 01-1A-509.*
- A60. *Iron rust.*
- A61. *Clad, anodized, and exfoliated.*
- A62. *Hand polish the corroded areas with MIL-P-6888 metal polish.*
- A63. *Nonclad aluminum alloys.*
- A64. *Aluminum wool or fiber bristle brushes.*
- A65. *An aeronautical engineer.*
- A66. *Structural repair manuals for the specific aircraft model.*
- A67. *Contacts, springs, connectors, printed circuit board runs, and wires.*
- A68. *In the engine exhaust areas.*
- A69. *Conduct an inspection and evaluation of the suspected area,*
- A70. *Extensive hand sanding or light mechanical sanding.*
- A71. *VACU-Blast dry honing portable machine.*
- A72. *Abrasive or grit blasting.*
- A73. *Sodium Nitrite MIL-S-24521.*
- A74. *The applicable aircraft Structural Repair Manual (SRM) or the "Corrosion" section of the Maintenance Instruction Manual (MIM)*
- A75. *Chemical conversion coatings increase a surfaces resistance to corrosion and improve paint bonding to the surface.*
- A76. *MIL-M-3171.*
- A77. *The protection of the exposed surfaces against decay.*
- A78. *You should wear eye protection, gloves, and a rubber apron.*
- A79. *Ensure the aircraft is properly grounded.*
- A80. *Use a NO LOAD 3200 rpm pneumatic drill motor.*

A81. NAVAIR 01-1A-509.

A82. 4 hours.

A83. Aliphatic polyurethane, MIL-C-85285.

A84. Suction feed and pressure-feed spray guns.

A85. 50 feet.

CHAPTER 5

LINE OPERATIONS AND SPECIAL PROGRAMS

One of the busiest, most important and dangerous divisions in a squadron is the line division. Upon reporting to a squadron, no matter your rate or paygrade, you may be assigned to the line division. As an Airman, or third class petty officer, you may become a plane captain. A plane captain has many responsibilities in flight operations and in the day-to-day maintenance of modern aircraft.

As a more senior petty officer or a Chief, you may be assigned as the LPO or Branch Chief. It is important for you to know how the line division operates and the safety factors involved with line operations. This chapter briefly outlines some of these crucial factors.

ORGANIZATION

LEARNING OBJECTIVE: Identify the organization of the line division and define the responsibilities and qualifications of a plane captain.

The following text discusses the organization of the line division. Knowledge about the line organization is important because it will help you perform your duties.

The line division is a division within the maintenance department. Figure 5-1 shows how the line division fits within the maintenance department. The aircraft maintenance officer is the department

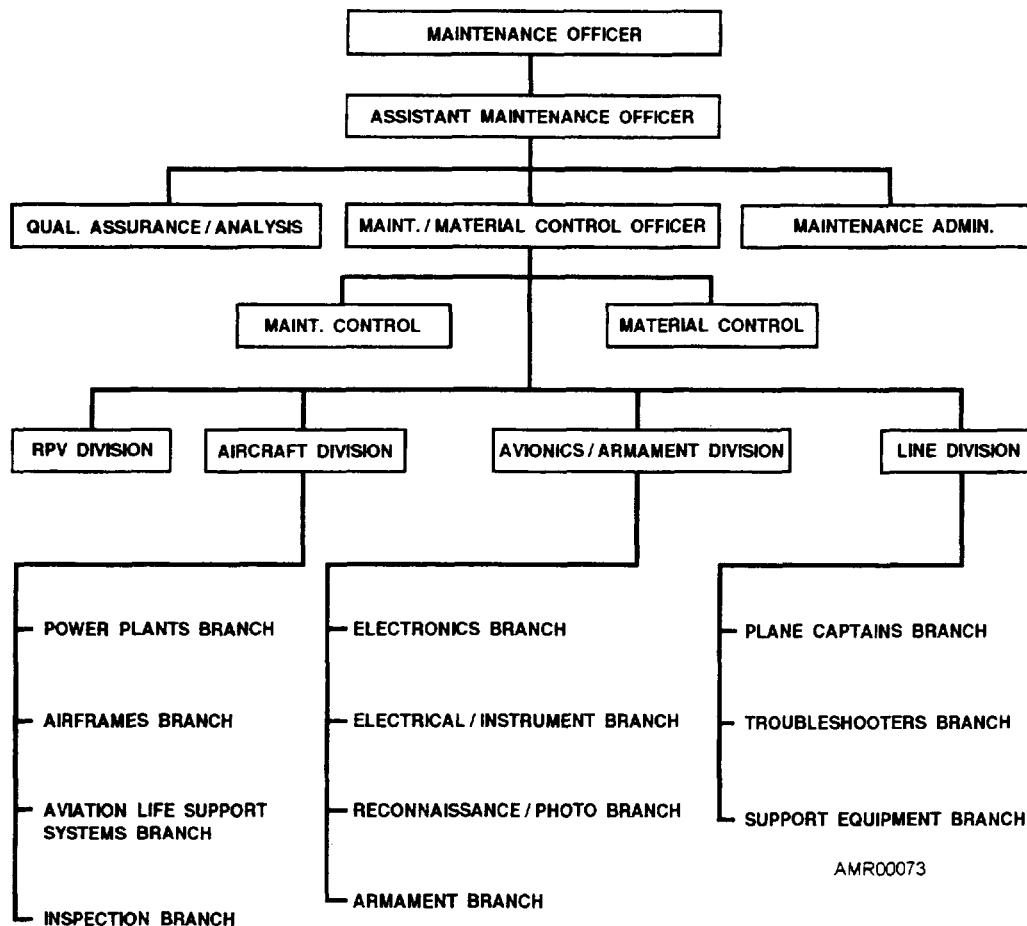


Figure 5-1.—Navy O-level maintenance department organization.

head, and each division has a division officer. The size of the squadron will determine if you have a branch officer. The line chief petty officer (CPO) is the division CPO. Normally, you will work directly for the line petty officer or a shift supervisor. There are three branches (two afloat) within the line division. The following paragraphs discuss these branches.

TROUBLESHOOTER BRANCH

The troubleshooter branch provides a rapid means of troubleshooting and repairing discrepancies discovered on the flight line. Also, troubleshooters are technical advisors to the plane captains. Troubleshooters may be permanently assigned to the line division or they may be temporarily assigned from other work centers on a daily or hourly basis. They must be knowledgeable in line operations, flight line safety, and aircraft systems.

SUPPORT EQUIPMENT BRANCH

Only shore-based squadrons have support equipment (SE) branches. Lack of space aboard ship makes it impossible to store SE; therefore, an SE branch is not possible. Normally, your squadron will check out SE needed on the line. When SE is no longer needed, it is returned to the aircraft intermediate maintenance department (AIMD). The SE branch is responsible for the SE used by the squadron. This responsibility includes the daily/operational inspections performed on the equipment, and in some cases, minor maintenance. Refer to local procedures when you work with SE.

PLANE CAPTAIN BRANCH

The plane captain branch of the line division is made up of qualified plane captains and trainees (persons in training to become qualified plane captains). This branch normally has between 75 and 95 percent of the total personnel assigned to the line division. The branch does routine maintenance (daily/turnaround inspections and cleaning) and other organizational maintenance assigned by maintenance control.

You cannot become a qualified plane captain automatically. You must work long hours and demonstrate that you know the aircraft and its operation (orally and in writing). After demonstrating your ability, you will be designated, in writing, as a plane captain by the commanding officer. The following paragraphs discuss the duties and qualifications of a plane captain.

Plane Captain Duties

Because naval aircraft are very complex, the plane captain does not have in-depth knowledge of all the systems contained in the aircraft. Therefore, technicians other than the plane captain must perform those portions of the daily and turnaround/preflight inspections that are beyond the technical qualifications of the plane captain. This assistance does not relieve the plane captain of their overall responsibility for the aircraft. The following is a list of the minimum duties of a plane captain:

- Perform daily, preflight, postflight, and turnaround inspections with assisting personnel, and assist others in performing O-level maintenance.
- Assists the pilot in flight preparation and advises the pilot of the material condition of the aircraft.
- Responsible for the cleanliness and prevention of corrosion on the aircraft by pursuing an effective and continual preventive maintenance program.
- Perform the work required and assist on phase, special, and conditional inspections within the rating specialty as required by maintenance requirements cards (MRCs).

Plane Captain Qualifications

Assignment as a plane captain carries a high degree of responsibility. The selection of the right person to be a plane captain is important. Regardless of rating, this person must possess the mechanical aptitude, personal integrity, and motivation necessary for the job. These qualities help to ensure that the aircraft is properly inspected and serviced before each flight. A broad screening of available personnel in the aviation ratings and comprehensive formal and on-the-job (OJT) training programs ensure that only the most qualified individuals are designated as plane captains. The following is a list of qualifications for plane captains.

- Possess the qualities of personal integrity, maturity, judgement, and aptitude.
- Demonstrate knowledge of the particular type of aircraft and its systems, including its cockpit, ejection seats, and controls.
- Demonstrate knowledge of the ordnance or armament equipment installed in or on the aircraft, and ensure that the armament, ejection seat, and other cartridge-activated devices are in a safe and ready condition during daily, preflight, postflight, and turnaround inspections.

- Demonstrate knowledge of and compliance with fueling and defueling procedures, and follow the applicable safety instructions.

- Demonstrate ability to use the methods of aircraft security required for various weather conditions and shipboard operations. Give particular attention to the security of control surfaces and the correct points for attaching tie-downs.

- Demonstrate, in writing and by practical application, knowledge of the procedures for riding brakes and any peculiarities of the braking system of the assigned aircraft, as well as a knowledge of the standard signals (including those contained in NATOPS, both hand and wand) used for controlling aircraft on the ground or flight deck.

- Q1. To what department is the line division assigned?*
- Q2. What branch is responsible for the support equipment used by the squadron?*
- Q3. In most squadrons, 75 to 95% of the personnel assigned to the line division are assigned to what branch?*
- Q4. After demonstrating your abilities as a plane captain, who has the final authority to designate you a plane captain?*

AIRCRAFT SERVICING

LEARNING OBJECTIVE: Recognize safety procedures and the proper equipment used in servicing aircraft.

Aircraft servicing is an important part of daily and turnaround inspections that plane captains perform. Even when plane captains do not personally perform the servicing, they must still ensure that it is done correctly.

A typical daily/turnaround record is shown in figure 5-2. However, the aircraft may require servicing at more frequent intervals. Daily and turnaround inspections are covered later in this chapter.

The servicing of an aircraft includes replenishing fuel, oil, hydraulic fluid, and other consumable materials. Also, the tires are checked for proper inflation, struts for proper extension, and the various air storage units for proper pressure.

GENERAL SAFETY PRACTICES

This section lists some general safety practices that are important in day to day maintenance operations.

Fire Hazards

Smoking is not permitted around the aircraft during fueling. Also, smoking or naked lights (such as oil lanterns, candles, matches, exposed electric switches, slip rings or commutators, dynamos or motors, any spark-producing electrical equipment, or any burning material) are not permitted within 100 feet of an aircraft that is being refueled or the fuel storage tanks. No lights other than approved explosionproof lights are permitted within 50 feet of refueling operations. No light of any sort may be placed where it can come in contact with spilled fuel. Warning signs should be posted as a precautionary measure.

All accidental spillage of aircraft fuels or other combustible liquids must be contained and removed immediately with absorbent material, by covering with a foam blanket, or by neutralizing by other means to prevent ignition. Notify the proper fire authorities anytime a large amount of aviation fuel is spilled.

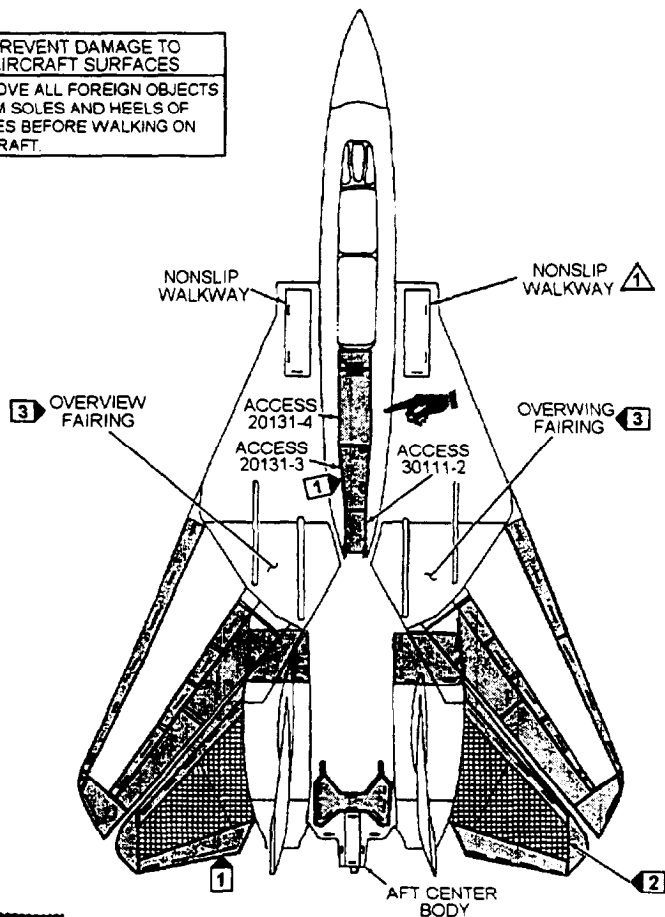
Nonspark tools must be used when work is done on any part of a system or unit that is designed for storing or handling combustible liquids. The use of leaky tanks or fuel lines is not permitted. Repairs must be made upon discovery. Always keep in mind the hazards involved.

Aircraft should be fueled in a safe place. Shore-based aircraft may not be fueled or defueled in a hangar or other enclosed space except in an emergency. Aircraft should be free from fire hazards, have the engine switches in the OFF position, and have chocks placed under the wheels before fueling or defueling operations are begun.

CAUTION

You should guard against breathing hydrocarbon (fuel) vapors. They may cause sickness, or they may be fatal. Do not let fumes accumulate. Use adequate ventilating measures. Also, avoid getting fuel on your clothes, skin, or eyes because of the high lead content. If your clothing becomes saturated with fuel, remove them as soon as possible. The parts of your body that are exposed to fuel should be washed thoroughly with soap and water. Clothing saturated with fuel creates a dangerous fire hazard. Also, painful blisters similar to fire burns may be caused by direct contact of the skin with fuel. If fuel gets in your eyes, flush them with water and obtain medical attention.

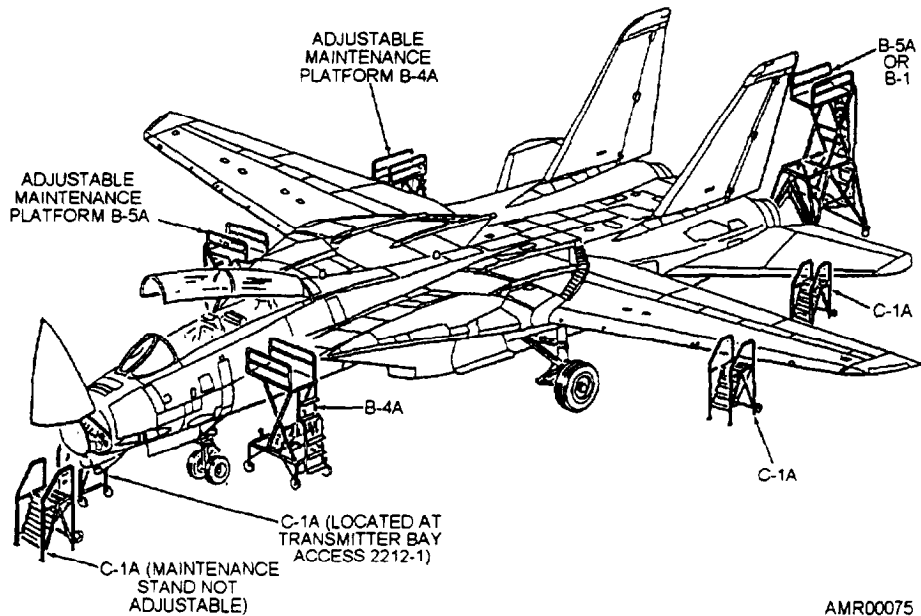
PREVENT DAMAGE TO AIRCRAFT SURFACES
 REMOVE ALL FOREIGN OBJECTS FROM SOLES AND HEELS OF SHOES BEFORE WALKING ON AIRCRAFT.



CAUTION

AIRCRAFT WALKWAYS

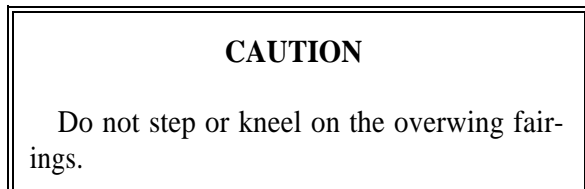
- 1 NO STEP (SHADED) AREAS ARE OUTLINED BY A NO STEP MARKING BOUNDARY. MAINTENANCE PERSONNEL SHALL NOT STEP OR KNEEL ON THESE AREAS.
 - 2 CROSSHATCHED AREA ON TOP SURFACE OF HORIZONTAL STABILIZERS SHALL BE COVERED WITH AN APPROVED NONABRASIVE-SURFACE MAT BEFORE KNEELING OR STEPPING ON SURFACE.
 - 3 DO NOT STEP OR KNEEL ON OVERWING FAIRING
- ▲ EFFECTIVELY AIRCRAFT SERIAL NO. 158612 THROUGH 158637 AND 161416 AND SUBSEQUENT.



AMR00075

Figure 5-3.—Aircraft walkways and maintenance platform placement.

There are **NO STEP** markings on the leading and trailing edges of the horizontal stabilizer. These markings form a boundary around the surface on which maintenance personnel must not step or kneel upon unless they cover it with an approved nonabrasive surface mat. The mat distributes the load over a greater area. Stepping or kneeling on the unprotected horizontal stabilizer causes localized stressed areas that could result in structural damage to the surface.



There are four **NO STEP** areas on the fuselage. These areas are aft center body, the upper speed brake, the area directly aft of overwing fairings, and the area directly behind the canopy. The **NO STEP** markings on the upper speed brake, aft center body, and the area directly aft of the over-wing fairing form a boundary around each of these surfaces on which maintenance personnel should not step.

Maintenance Platform Placement

The placement of maintenance platforms about an aircraft is shown in figure 5-3. Use the B-4 and B-5A adjustable maintenance platforms to gain access to the top of the aircraft. Then use aircraft walkways to move to the maintenance area.

NOTE: The B-1 stand may be used as an alternate for the B-5A stand.

- Q5. *Smoking and naked lights are not permitted within how many feet of a fueling operation?*
- Q6. *What type tools must be used when work is being performed on a system or unit that is designed for storing or handling combustible liquids.*
- Q7. *What are the four NO STEP areas on the fuselage?*

FUEL REPLENISHMENT

Aviation fuel is a highly volatile liquid that gives off a vapor. The vapor can be ignited by static sparks from tools, hot exhaust pipes, lighted cigarettes, and electrical devices. Thus, you must follow all fire precautions during the fueling process.

When an aircraft is to be fueled by a truck, do not locate the aircraft near possible sources of ignition, such as grinding, drilling, or welding operations. When possible, refueling an aircraft from a truck should be carried out 50 feet from any other aircraft or structure and 75 feet from any operating radar set. You should consider wind direction so fuel vapors will not be carried toward a source of ignition.

The tank truck should be driven to a point as far from the aircraft as the length of hose permits, but never within 10 feet of the aircraft, and preferably to the windward (upwind) side of the aircraft. The truck must be parked parallel to or heading away from the wing, or in such a position that it can be driven away quickly in case there is a fire. As soon as the fueling operation has been completed, the truck should be driven away from the vicinity of the aircraft.

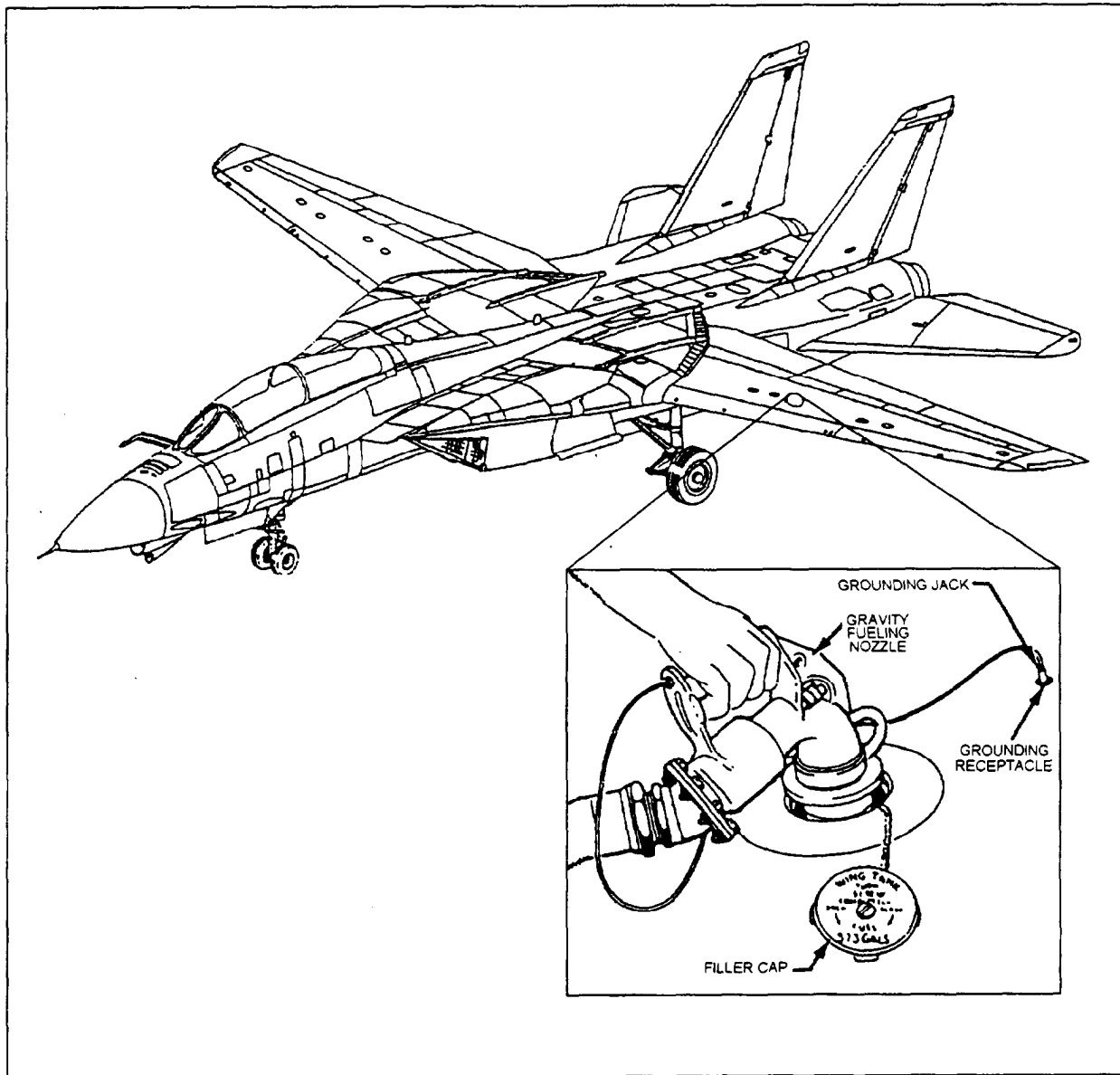
Refueling crews consist of a minimum of three people. One person stands with the fire-fighting equipment. A second person stays with the truck. The third person handles the fuel hose at the aircraft and fills the tanks. A member of the refueling crew makes sure that both the aircraft and truck are properly grounded. This prevents sparks from static electricity. Before starting fueling operations, the plane captain should check to see that all radio equipment and unnecessary electrical switches are turned off. Unless it is necessary to operate equipment involved with refueling, the crew should not connect outside electrical power to the aircraft. Before beginning refueling, the refueling crew should identify the aviation fuel. The type of fuel contained in the tank of a fuel truck is displayed across the side of each tank in 6-inch-high red lettering superimposed on 8-inch-high white reflective tape.

As a plane captain or trainee who services an aircraft, you must know the various grades of fuel and the fuel requirements of the aircraft. This knowledge ensures that you will always use the correct fuel.

Several systems are used to refuel naval aircraft. Some are refueled by the gravity system. Other aircraft may be refueled by either the gravity or pressure fueling system. Still other aircraft are fueled from a single point by the pressure fueling system.

Gravity Fueling

The hookup used for gravity fueling is shown in figure 5-4. The nozzle is grounded and then inserted into the cell filler neck. The tank is filled to the bottom of the filler port neck. The nozzle is always grounded



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Figure 5-4.—Gravity fueling.

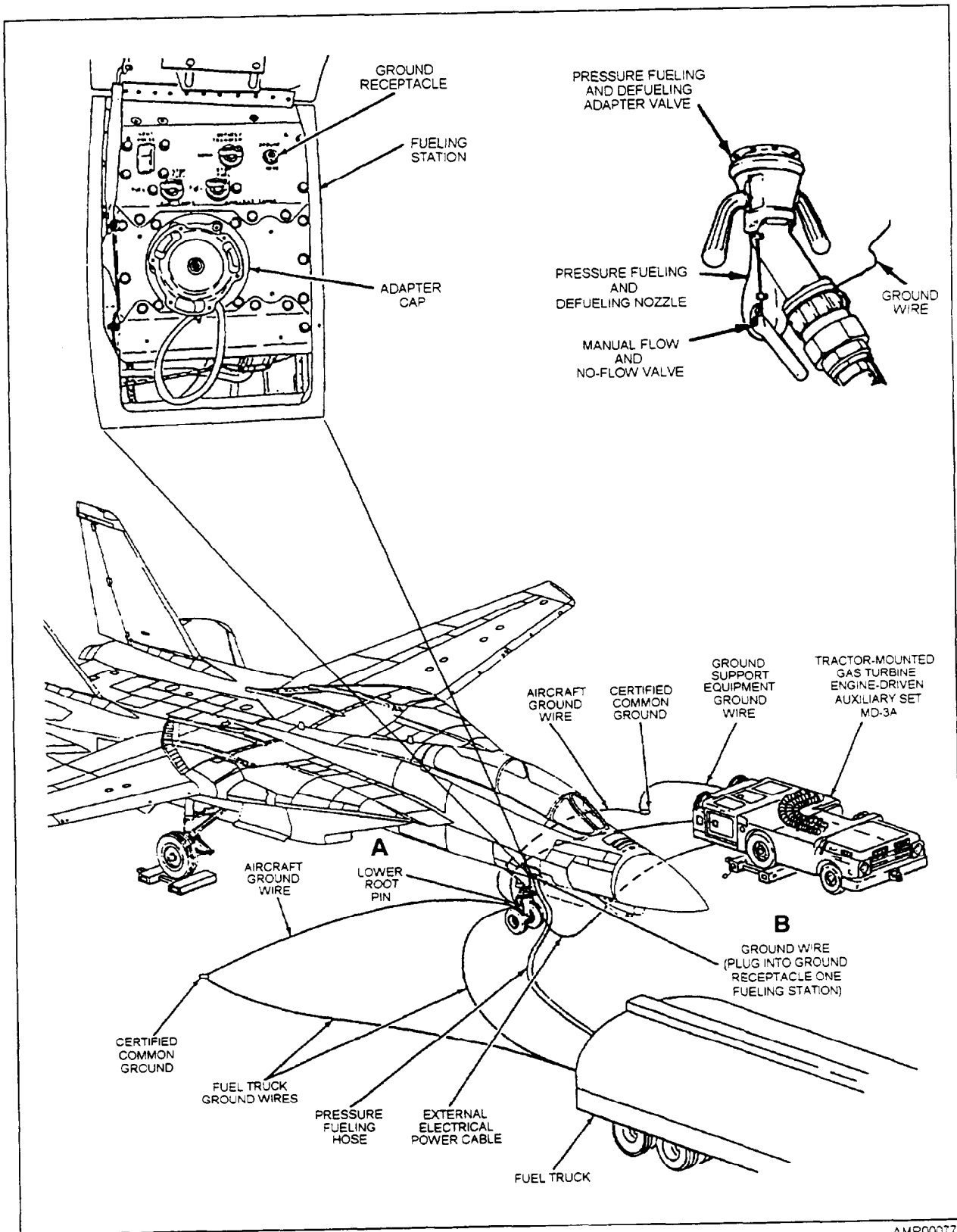
before it is placed in the filler neck to prevent sparks caused by static electricity. Static electricity is built up by the fuel flowing through the hose. The nozzle should be supported while it is in the filler neck. This will prevent damage to the filler neck and, in the case of aircraft that use bladder-type fuel cells (cells made from a type of rubberized nylon cloth), prevent the possibility of damaging the cell with the end of the nozzle.

Pressure Fueling

Most naval aircraft are refueled by the pressure fueling system. This system gives the aircraft a faster operational turnaround time.

Pressure fueling on an aircraft is usually done from a single point. Fuel from this point is supplied to the various wing and fuselage tanks. In some cases, the drop tanks and flight refueling package may be refueled from this point.

The pressure-fueling station on the aircraft has a pressure-fueling and defueling receptacle and an electrical control panel (fig. 5-5). The pressure-fueling receptacle is standard on all aircraft that use the pressure-fueling method. However, the electrical panel and controls differ from one aircraft to another, depending upon the complexity of the fuel system. The general and servicing section of the applicable



AMR00077

Figure 5-5.—Pressure fueling.

maintenance instruction manual (MIM) contains illustrations of and instructions for the pressure fueling system.

The pressure nozzle shown in figure 5-5 is permanently attached to the fuel hose. The pressure nozzle has a ground wire, which is used to drain off any static electricity that has built up in the nozzle. Once the nozzle is attached to the aircraft, however, it acts as a ground.

When the pressure nozzle is connected to the aircraft, it opens a spring-loaded valve within the inlet to the fuel tanks. Aircraft that use this system have automatic equipment for shutting off the fuel flow when the tanks are full.

Because the controls differ from one aircraft to another, you should always check the applicable MIM before pressure fueling an aircraft. The general procedures for pressure fueling are as follows:

1. Remove the pressure-fueling receptacle safety cap by turning it counterclockwise. Pull the pressure-fueling nozzle dust cover up and to one side of the outer shell.

2. Ground the nozzle by inserting the grounding plug into its receptacle on the aircraft.

3. Visually inspect aircraft adapter for any damage or significant wear. (A worn or broken adapter will allow the poppet valve to open and spray or spill fuel.)

4. Lift the nozzle by its handles into position. Engage the lower slot over the lower lug on the fueling receptacle. Tip the nozzle so that the upper slots engage the upper lugs. Press the nozzle in firmly so that all three nozzle lock keys are depressed. Lock the nozzle by rotating the lifting handles clockwise.

5. Set the refueling panel switches in the proper position, and apply electrical power to the aircraft.

6. Position the vent monitors, as necessary, according to the applicable MIM.

NOTE: The vent monitors are assigned to the various fuel system vents to ensure that the aircraft's fuel cells are venting properly. If the cells are not vented properly, there is the possibility that the cell will rupture and cause major structural damage.

7. When the nozzle is locked in place, the opening handle is free to turn when fueling is started. Turn the handle to the FULL OPEN position to start fueling. Rotating the opening handle more than 180° opens the poppet valve in the nozzle and locks it in the OPEN

position. Position the appropriate switch on the fuel panel to the FUEL position. The fuel should shut off automatically when the cells are full.

CAUTION

During pressure fueling, the fuel system should be inspected carefully for leakage. If any leaks are apparent, fueling should be stopped and corrective action taken. A fuel leak may cause injury or death to personnel.

8. When the fueling operation is complete, remove the pressure nozzle by rotating the lifting handles counterclockwise until the nozzle is unlocked from the fueling receptacle. Pull the dust cover up over the nozzle face immediately. Then replace the safety cap on the aircraft receptacle.

You must take every safety precaution to make sure that no dirt or foreign matter enters the nozzle. The nozzle nose should be completely clean before it is connected to the aircraft. The dust cover must always be kept on the nozzle except when actually fueling an aircraft.

The pressure fueling nozzle can be damaged by careless handling. Do not drop the nozzle or allow it to swing heavily against structures or equipment during handling. **Never drag the nozzle on the deck.**

The operating action of the nozzle should never be forced. If the unit does not couple freely or open or close readily, locate and correct the misalignment or mechanical jam.

Defueling

Defueling may be necessary for many reasons, some of which are fuel cell repairs, removal of external fuel tanks, failure of fuel system components, and changing fuel loads. Aircraft that use pressure fueling are normally defueled from the pressure fueling adapter. This allows the entire system to be defueled from a single point. Some older aircraft have one or more defueling valves. Some residual fuel will often be left in the bottom of the fuel cell following defueling. Usually, residual fuel can be emptied or drained through the fuel cell water drain valves. A special adapter and appropriate container are used to catch the fuel. When external fuel tanks are defueled,

it maybe necessary to insert the defueling hose in the filler port.

Normally, defueling operations are done outside the hangar and under controlled conditions. These conditions are specified in the general information and servicing volume of the applicable MIM. When it is absolutely necessary to defuel an aircraft in the hangar, the doors should be open to provide ventilation through the hangar. All shop doors leading into the hangar should be closed. No work should be done on or around the aircraft during the defueling operation. All sources of ignition should be prohibited in the area.

Additional information on fueling and defueling aircraft can be found in the appropriate aircraft MIMs and the *Aircraft Refueling NATOPS Manual*, NAVAIR 00-80T-109.

- Q8. Why is wind direction an important consideration in fueling operations.*
- Q9. Refueling crews consist of a minimum of how many people?*
- Q10. Before beginning refueling operations, what is the first thing the refueling crew should do?*
- Q11. What is the advantage of pressure fueling over gravity fueling?*
- Q12. What manuals provide detailed fueling information for a specific aircraft?*

OIL REPLENISHMENT

Aircraft engine oils are identified by either their military specification number (such as MIL-L-23699) or a four-digit number (such as 2085). The four-digit numbering system identifies the intended use and the viscosity of the oil. The first digit designates the intended use of the oil. The last three digits indicate the viscosity. For example, in the oil number 2085, the 2xxx series is for aircraft engine lubrication, and the 085 identifies the oil as having a viscosity rating of 85. Viscosity is defined as the internal fluid resistance to flow caused by molecular attraction.

NOTE: Both the Navy and the Air Force use the Saybolt scale for determining viscosity. Saybolt viscosity numbers should not be confused with Society of Automotive Engineers (SAE) numbers that you see on automotive oil containers.

The synthetic oils used in most turbojet engines are referred to by their military specification number, such as MIL-L-23699.

Some aircraft engines use a combination of dry and wet sump-type lubrication systems. Others are lubricated entirely with a dry sump type. Wet sump engines store the lubricating oil in the engine proper (an automobile engine is an example of a wet sump engine), while dry sump engines use an external tank mounted on or near the engine. Oil in jet engines serves the two-fold purpose of lubricating and cooling.

Servicing of the engine oil system is usually a simple task. It involves checking the tank for the proper oil level and bringing the oil level up to the required amount. On aircraft that have a dry sump system, servicing may consist of pumping uncontaminated oil directly into the supply tank. However, on some aircraft the tank is located in an inaccessible compartment, and a pressure tank is required to fill the oil tank. For specific servicing instructions of the engine oil system, refer to the applicable MIM.

HYDRAULIC FLUID REPLENISHMENT

Aircraft hydraulic fluids are identified by their military specification number. Hydraulic fluid, MIL-H-83282, is now being used in the hydraulic systems of all naval aircraft. This fluid is also used in the shock struts, shimmy dampers, and brake systems. MIL-H-83282 hydraulic fluid is colored red. It is available in 1-quart, 1-gallon, 5-gallon, and 55-gallon containers, and 16-ounce spray cans. The spray can is normally used to spray the exposed portions of oleos (the shiny part) of actuating cylinders and struts, as required during most daily inspections of aircraft.

NOTE: Hydraulic fluid MIL-H-46170 is a preservative type of hydraulic fluid used in the preservation of hydraulic systems and components. While it is red in color and considered compatible with MIL-H-83282 hydraulic fluid, it should NOT be used to service aircraft hydraulic systems.

Naval aircraft hydraulic systems are serviced by checking the fluid level (on a sight gauge usually located on the side of the reservoir) and filling the system to the prescribed level. Before fluid is added to this type of reservoir, the reservoir instruction plate should always be checked for the proper filling instructions. The instruction plate is attached to either the reservoir or to the aircraft structure near the filler opening of the reservoir. The instruction plate contains the following information:

- Total capacity of the system

- Reservoir capacity
- Refill level
- Specification and color of fluid
- Correct position of all actuating cylinders during filling
- Other information considered necessary during the filling of the reservoir

NOTE: After opening a can of hydraulic fluid, the entire contents should be poured into the fill stand or servicing unit immediately. This will prevent the fluid from absorbing dust and grit from the air. *Aviation Hydraulics Manual*, NAVAIR 01-1A-17, requires that any remaining fluid left in the hydraulic fluid container, after servicing a fill stand/servicing unit, be discarded, and that the empty fluid container be destroyed immediately and not used to store or handle other fluids.

Q13. Define viscosity.

Q14. What scale is used by both the Navy and the Air Force to determine oil viscosity?

Q15. What is the military specification number for the hydraulic fluid presently used in the hydraulic systems of all naval aircraft?

Q16. What should be done with the fluid remaining in the can after filling a servicing unit?

PNEUMATIC SERVICING

Landing gear struts, hydraulic accumulators, and various air storage bottles found on most naval aircraft must be serviced with compressed air or nitrogen. These components are serviced by Aviation Structural Mechanics (AMs). You should refer to the applicable training manuals and technical manuals for in-depth discussions of the servicing of rate-peculiar components.

Servicing Air Storage Bottles

Nitrogen and air storage bottles are used on some aircraft for various emergency operations. These bottles are necessary for the safe operation of the aircraft and the safety of the crew. Air storage bottles are used for such functions as emergency brakes, emergency landing gear extension, and emergency canopy operation. Some aircraft have a pneumatic system that will maintain the required pressure in these bottles while in flight. However, most of these pneumatic systems require servicing on the ground with an external source of high-pressure air or nitrogen before each flight.

Air storage bottles and accumulators are serviced similarly. Most air bottles have an air filler valve and a pressure gauge. They usually require higher servicing pressures than accumulators. A high-pressure compressor and other special equipment, such as the nitrogen booster, must be used to obtain these higher pressures.

Inflation of Tires

For aircraft tires to perform satisfactorily, the correct air pressure must be maintained. Aircraft tires must be inflated to the pressure specified for the type of operation (ashore or afloat) that the aircraft is performing and for the gross weight of the aircraft. Air pressure must be checked daily with an accurate gauge. Tire inflation data is usually attached to the aircraft, as shown in figure 5-6. When the aircraft does not have this plate, you can find the information in the general information and servicing section of the applicable MIM.

Overinflation or underinflation of aircraft tires causes specific problems. Overinflation reduces the

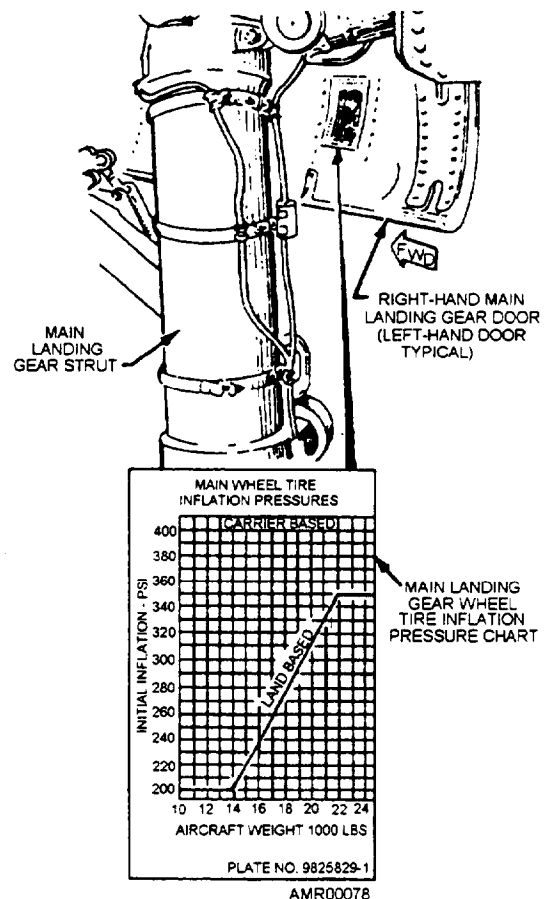


Figure 5-6.—Tire inflation chart.

contact area of the tire, causing it to wear faster at the tread center. Failure due to carcass ruptures and breaks in the tire cords that result from contact with foreign objects are usually caused by overinflation. Underinflation increases the contact area and causes the tire to wear rapidly and unevenly at the outer edges of the tread. An underinflated tire flexes excessively and develops high temperatures that weaken tire cords. An underinflated tire also may slip on the wheel during landing and shear off the valve stem.

To determine the proper inflation pressure, you should check an inflation chart like the one shown in figure 5-6. If the gross weight of an aircraft is 20,000 pounds, the correct tire pressure for that aircraft when shore based is 310 psi. If the aircraft is carrier based, the pressure is maintained at 350 psi, regardless of the gross weight. When aircraft tire pressure is low, you should add air from a regulated source.

CAUTION

An unregulated, high-pressure air source for tire inflation is a hazard. Tire inflation source pressure should be carefully monitored. If high-pressure cylinders (such as the portable air bottle or the air or nitrogen servicing trailer) are used, a regulator must be used to prevent inadvertent overinflation.

Maintenance personnel must always use a remote inflator unit when inflating tires. The operator of this unit should always stand at right angles to the landing gear axle, directly in front or in the rear of the tire. The operator should also stand at the full length of the inflator unit hose. This will prevent the operator from being struck by pieces of the wheel if it were to fail

CAUTION

When an aircraft wheel is to be removed from the aircraft, maintenance personnel must deflate the tire before removing the wheel assembly from the aircraft. This precaution is necessary because of the possibility that the bolts in split-type wheels might have been sheared during landing, causing the wheel halves to separate when the axle nut is removed. Personnel have been killed because they failed to remove the air from the tire before removing the axle nut.

Oxygen Servicing

Plane captains are responsible for making sure that the liquid oxygen systems of the aircraft are serviced. Personnel in the Aviation Structural Mechanic, Safety Equipment, (AME) rating refill these converters.

A typical liquid oxygen converter is shown in figure 5-7. Liquid oxygen is dangerous to handle and requires special handling procedures. These special handling procedures are discussed later in this chapter.

SERVICING EQUIPMENT

The following text discusses the equipment used to service aircraft, such as the high pressure air valve, servicing trailers, preoiler hand pumps, and fluid service unit HSU-1.

High-Pressure Air Valve

The high-pressure air valve is used to service struts, accumulators, air storage bottles, and other components serviced with high-pressure air. The high-pressure air valve, shown in figure 5-8, is used on most naval aircraft. It is referred to by its military specification (MS) number MS 28889-1. Air valve MS 28889-1 does not have a valve core.

When servicing a system equipped with a high-pressure air valve, you should exercise extreme

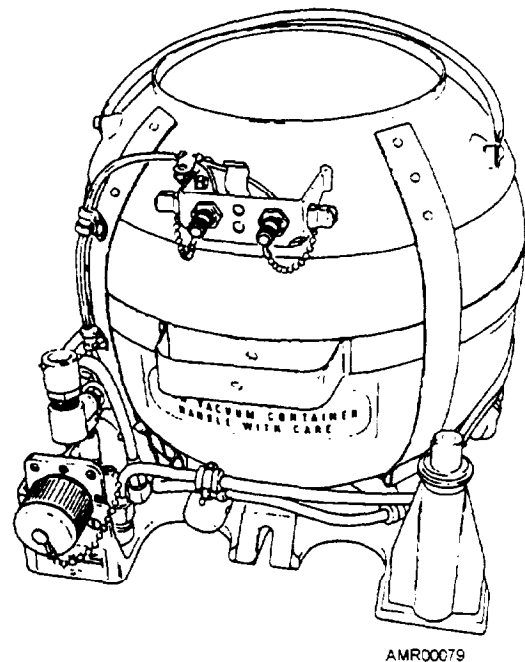


Figure 5-7.—Typical liquid oxygen converter.

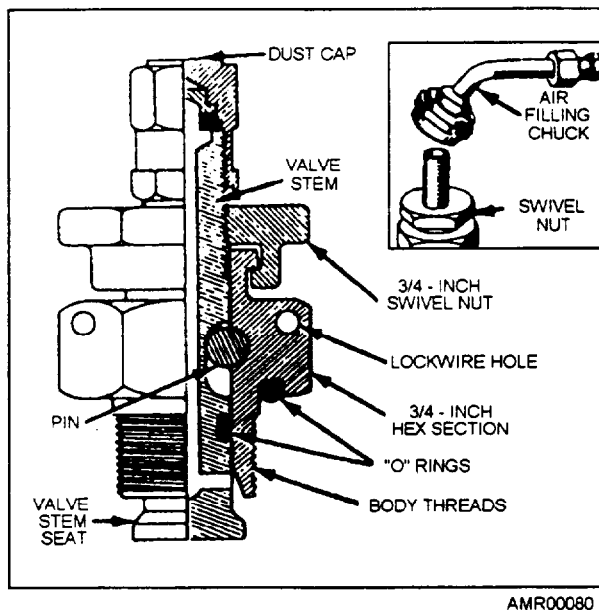


Figure 5-8.—High-pressure air valve, MS 28889-1.

caution. To release the air pressure from a system equipped with a high-pressure air valve, you should remove the dust cap from the valve and release the pressure by slowly turning the swivel nut counterclockwise.

NOTE: Dust covers are not used in most operating squadrons because they are a foreign object damage (FOD) hazard.

CAUTION

When loosening the swivel nut, you should make sure that the hex body nut is either lockwired in place or held tight with a wrench. If it were to be loosened before the air pressure is relieved, serious injury to personnel may result.

Low pressure indicates a leak in the system. This leak must be found and corrected. When a leaking, high-pressure air valve must be replaced, a new packing must be installed with the replacement air valve assembly. Ensure the required torque, as required by the MIM, is applied to the hex body. After the hex body is torqued, it is lockwired to the component or surrounding structure, as specified in the MIM, by using the holes provided in the hex body nut.

When the correct pressure has been reached in the system that is being serviced, you should secure the air valve by tightening the swivel nut in a clockwise direction. Once again, torque the swivel nut to the required torque listed in the MIM.

After using the high-pressure air valve, you should secure the pressure source, remove the air/nitrogen pressure charging chuck, and replace the valve cap. Install the valve cap fingertight.

Air or Nitrogen Servicing Trailer

A servicing trailer, similar to the one in figure 5-9, is found at most naval air activities for servicing aircraft hydraulic and pneumatic systems. This trailer carries six air or nitrogen storage cylinders and the necessary flow-controlling mechanisms. The trailer has a 30-foot hose stowed in a box that is mounted between the top two bottles.

The air or nitrogen servicing trailer has a purifier (dehydrator) assembly. This purifier assembly is essentially a reservoir that contains a chemical drying agent. The chemical drier removes moisture that may have adhered to the valves or have been accidentally introduced into the system. The chemical is contained in a metal cartridge or can, which is changed periodically. The gas passes through the drier just before it enters the servicing hose. The trailer has a set of manifold control valves and two regulator valves. The bottle on the air or nitrogen servicing trailer may be recharged by using a high-pressure compressor.

NOTE: When recharging the cylinders on the air or nitrogen servicing trailer, you should ensure that the cylinder pressure does not exceed the pressure specified for the equipment being recharged.

When operating the servicing trailer, you should observe the following safety precautions.

- When a system or component is being charged, only a qualified licensed operator should operate the trailer. Complete familiarity with the trailer is a basic prerequisite to ensure safe operating techniques.
- The servicing hose end and installation connection fitting should be thoroughly inspected before servicing, and any particles of foreign material removed.
- Never charge a system or component without the proper fusible safety plug and blowout disc in the trailer charging system.

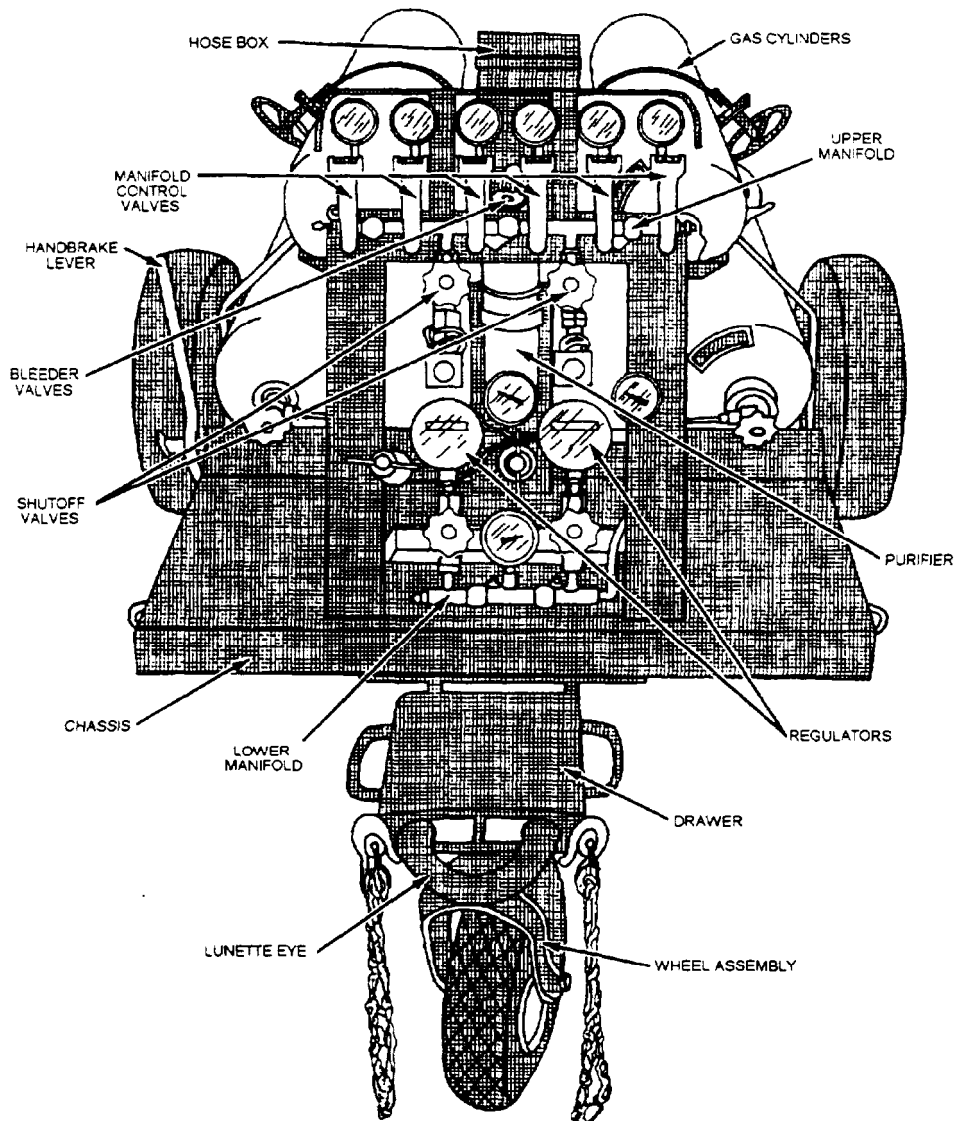


Figure 5-9.—Air or nitrogen servicing trailer.

- Always know the pressure existing in the system to be filled and the pressures in all the cylinders to be used up in the cascading process before beginning a charging operation.

- A malfunctioning pressure regulator should be disconnected from the line, closing its associated shutoff valve. The trailer can then be operated with the remaining regulator.

- The charging hose must never be stretched to reach a connection. Position the trailer so the hose is not under tension while servicing an aircraft.

- After servicing an aircraft system, stow the servicing hose in its container to ensure that it is not damaged by dragging along behind the trailer.

Preoiler (PON-6)

The preoiler (PON-6) is a portable, hand-carried, hand pump with a 3-gallon capacity. Figure 5-10 shows the major components of the PON-6. It will deliver oil at a pressure up to 100 psi. A sight glass (not shown in fig. 5-10) is located on the side of the reservoir and shows the level of the oil. An oil pressure gauge indicates oil line pressure. An oil meter records the amount of oil delivered. The meter is calibrated in ounces (outer scale) and quarts (inner scale). A push-button bleed valve relieves pressure on the meter and service hose and bleeds oil back to the reservoir. The service hose is 6 feet long. A complete drain bottle assembly is provided for overflow oil from the aircraft

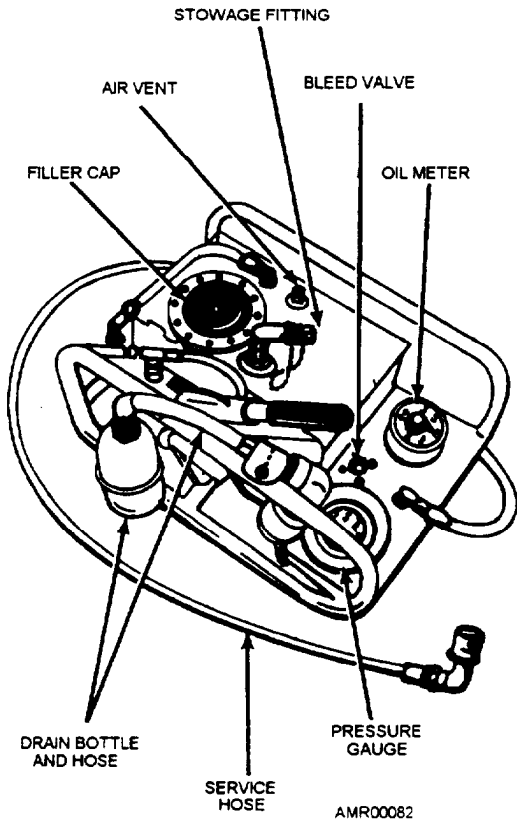


Figure 5-10.—Preoiler PON-6.

system. All components are rigidly mounted in a steel tubular framework.

Fluid Service Unit Model HSU-1

The hydraulic fluid service unit, Model HSU-1, is shown in figure 5-11. It has a fluid-holding capacity of 3 gallons. This unit accepts a standard 1-gallon container, and it contains an integral 2-gallon reservoir assembly. The HSU-1 has a replaceable, 3-micron, disposable filter incorporated to ensure delivery of contamination-free fluid.

The 2-gallon reservoir assembly (along with a hand pump assembly) is mounted to a cast aluminum base. The lower can piercer is mounted on top of the reservoir and allows fluid to flow from the installed 1-gallon container into the reservoir, automatically replenishing it. A sight gauge indicates the fluid level of the reservoir. It reads from 0 to 2 gallons in 1/4-gallon increments. An indicated level of 2 gallons or less means that the 1-gallon container is empty and can be removed for replacement. A capped deaeration port is located on top of the reservoir to permit bleeding the air from the pump and output hose.

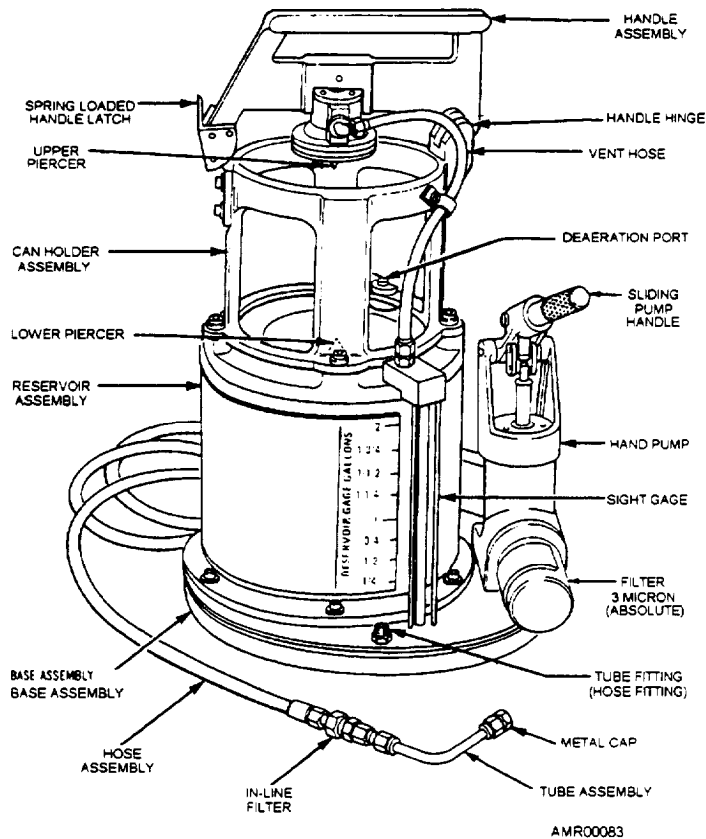


Figure 5-11.—Fluid service unit, Model HSU-1.

The can-holder and handle assemblies are mounted above the 2-gallon reservoir. The can holder positions the installed 1-gallon fluid container directly above the reservoir. Also, it provides a means of placing the handle assembly over the container top. The handle assembly is hinged to a bracket on the can-holder assembly. It has a spring-loaded latch to lock the handle in the closed position. In addition to the carrying handle, the handle assembly contains an upper can piercer, a vent check valve, and a filter. A vent hose is connected between the top of the reservoir (sight gauge) and the upper can piercer.

Fluid is delivered by a hand pump. The pump can deliver 1.5 fluid ounces per full stroke at 0 to 250 psi. The pump is operated with a sliding pump handle, which is held in the extended or retracted position by a spring-loaded ball detent. The 3-micron filter on the pump base removes particulate contamination from the hydraulic fluid being delivered to the suction side of the pump. The filter unseats a shutoff valve, which closes the suction port when the filter element is being replaced.

The HSU-1 service unit has a 7-foot service hose connected to the unit's fluid output port at the pump assembly. The hose assembly ends with a short bent-tube assembly for direct connection to fill fittings on the aircraft or components being serviced. A 3-micron, in-line filter located between the hose end and the tube prevents reverse-flow contamination and serves as a final filter. When the fluid service unit is not in use, it is stored by wrapping the hose assembly around the can-holder assembly and fastening the tube end to the hose storage fitting on the base. This keeps contaminants from entering the hose while the unit is not in use.

- Q17. *The air pressure in aircraft tires must be checked how often?*
- Q18. *Why is it important for the operator of the remote inflator unit to stand directly fore or aft of the tire being inflated?*
- Q19. *Why must a tire be deflated prior to removing a wheel assembly from an aircraft?*
- Q20. *Liquid oxygen converters are refilled by personnel from what rating?*
- Q21. *The high-pressure air valve, shown in figure 5-8, is used on most naval aircraft for what purpose?*
- Q22. *What purpose does the purifier serve on the nitrogen servicing trailer?*

Q23. *What is the holding capacity of the fluid servicing unit (HSU-1)?*

SAFETY

LEARNING OBJECTIVE: Identify safety precautions used when working around aircraft on the flight line and aboard ship.

Safety is the responsibility of everyone in the Navy. You are responsible for your own safety, and, as a sailor, you have the moral responsibility for the safety of your shipmates. As a plane captain, you will be exposed to dangerous situations. In fact, many insurance companies rate flight line operations and, in particular, the flight deck environment among the most dangerous jobs in the world. The following text will introduce you to some of the many hazards of your work area.

LINE SAFETY PRECAUTIONS

In addition to the more specific safety precautions presented in various sections of this chapter, there are a number of miscellaneous precautions that you must observe when working on the aircraft flight line and the carrier flight deck. The following precautions are of special importance to ensure your safety as well as the safety of your coworkers.

Propellers and Rotors

When working on the line around propeller-driven aircraft or helicopter rotors, the first general precaution that you must observe is to **BEWARE OF PROPELLERS**. When you see a propeller, let it be a constant reminder to **STAY CLEAR!** In general, do not cross in front of moving propellers because they are not easily seen. A good habit is to always walk around propellers. Unless you are inspecting or performing maintenance on the propeller blades, **NEVER** walk through a prop arc, even when it is not operating. The area around the aircraft must be kept clear of loose gear and debris.

Intake Ducts

Maintenance of jet engines presents major hazards. The air intake duct of operating jet engines represents an ever-present hazard to personnel working near the inlet duct of the aircraft. It can also be a hazard to the engine itself if the turnup area around the front of the aircraft is not kept clear of debris. Jet

engines will “eat” anything and they have no respect for life or limb. This hazard is greatest during maximum power settings (high-power turnup).

The air inlet duct may develop enough suction to pull hats, eyeglasses, loose clothing, and rags from pockets. Secure or remove all loose articles before working around operating jet engines. In some engines, the suction is strong enough to pull a person

up to or, in some cases, into the inlet and pull the eyeballs from their sockets. Keep clear of the intakes.

Protective screens (fig. 5-12) are supplied as part of the ground handling equipment for most jet aircraft. These screens should be installed before all maintenance turnup. Turnup screens protect both personnel and engines. It does NOT eliminate the need for caution; serious injury can still result by being

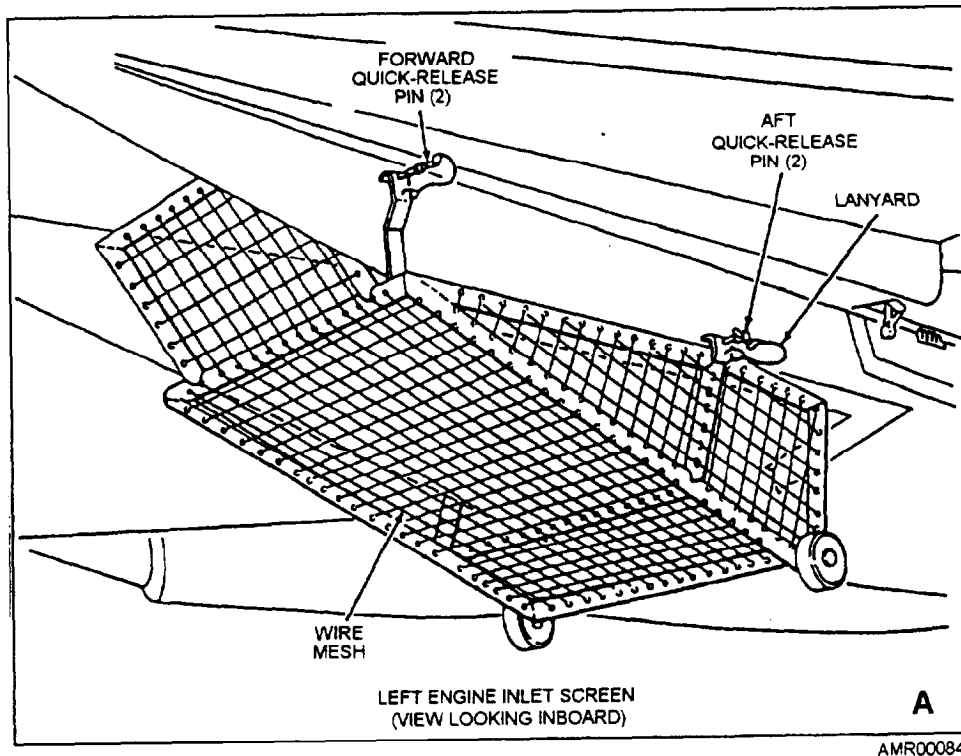
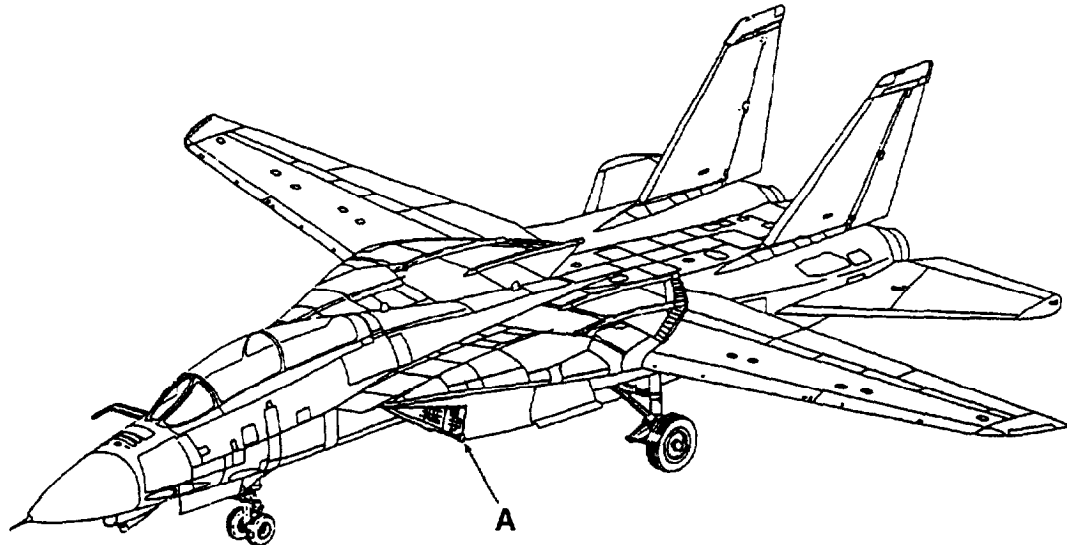


Figure 5-12.—Engine inlet protective screen.

pulled against the screen, and small items can be pulled through the *screen*. This results in thousands of dollars of damage to the engine.

Exhaust Area Hazards

Jet engine exhaust also creates hazards. Tests show that while the carbon monoxide content of jet exhaust is low, other gases are present that irritate the eyes. Less noticeable, but as important, is the respiratory irritation that may be caused by exhaust fumes.

The two major hazards of jet engine exhaust are the high temperature and high velocity of the exhaust gases from the tailpipe. High temperatures are found up to several hundred feet from the tailpipe, depending on wind conditions. Closer to the aircraft, temperatures are high enough to damage asphalt pavement. The blast from the exhaust is strong enough to knock a person down at close distances and can even blow a body off of the flight deck overboard. Do not take the signs lightly. **BEWARE OF JET BLAST.**

When a jet engine is started, excess fuel accumulates in the tailpipe. When the fuel ignites, long flames can be blown out of the tailpipe. All flight line personnel should be aware of this hazard, and all flammable materials should be kept clear of the danger area.

During maximum power settings, the high velocity of the exhaust gases may pick up and blow loose dirt, sizable rocks, sand, and debris several hundred feet. This is an eye and FOD hazard. Therefore, you should use caution when parking an aircraft for run-up. The general information section of the applicable MIM contains information concerning the exhaust area hazards. These instructions should be strictly followed. **No one should foolishly experiment with the specified safety margins.**

After engine operation, no work should be done to the exhaust section for **AT LEAST ONE-HALF HOUR** (preferably longer). If work is necessary immediately, you must wear leather gloves.

Engine Noise

Jet engines produce noise capable of causing temporary as well as permanent loss of high-frequency hearing. When working around jet engines, you should take the following precautions to protect your hearing:

- Wear the proper ear protection (ear plugs or sound attenuators and sometimes both).

- Do not exceed the time limits on exposure to the various sound intensities.
- Have periodic checks on your hearing ability.

Engine noise is broadcast from the aircraft in patterns, which vary in direction, distance, and intensity with engine speed. The most intense sound areas are in the shape of two lobes extending out and aft from the aircraft center line. However, dangerous intensities are also present to the side and forward of the aircraft. (See fig. 5-13) This information is found in the applicable Naval Air Training and Operating Procedures Standardization (NATOPS) manual.

Damage to hearing occurs when the ear is exposed to high sound intensities for excessive periods. The higher the sound intensity, the shorter the period of exposure that will produce damage. Above 140 decibel (dB) sound intensity, any exposure without ear protection can cause damage.









NOTE: Sound intensity is measured in decibels (dB). A dB is a number that relates a given sound intensity to the smallest intensity that the average person can hear.

By wearing regulation earplugs or sound attenuators, you can raise the limits of time exposure. Personnel working within danger areas should be familiar with calculated noise dB levels (as specified in the applicable MIM), and should wear the necessary protective equipment.

- Q24. *According to many insurance companies, what is considered the most dangerous environment in the world?*
- Q25. *When you work around aircraft with propellers, when is it safe to walk through or stand in the prop arc?*
- Q26. *Does a protective screen over the inlet of an operating aircraft engine eliminate the possibility of serious injury?*
- Q27. *What are the two major hazards of jet engine exhaust?*
- Q28. *Any exposure, without ear protection, can cause hearing damage above what decibel (dB) level?*





Movable Surface Hazards

Moveable surfaces, such as flight control surfaces, speed brakes, power-operated canopies, and landing gear doors, are a major hazard to flight line personnel. These units are normally operated during ground

SOUND LEVELS IN dBA		
THIS TABLE CONTAINS ESTIMATED SOUND LEVELS FOR TF30-P-414/414A AND F110-GE-400 (MIXED FLOW AUGMENTED) AFTERBURNING TURBOFAN ENGINES. SOUND LEVEL CONTOUR LETTERS A, B, C, AND D (SHOWN IN THIS ILLUSTRATION) REPRESENT A SPECIFIC dBA VALUE. WHEN dBA VALUE IS IN THIS TABLE, IT SHALL BE SUBSTITUTED IN PLACE OF CONTOUR LETTER.		
CONTOUR	MAXIMUM AFTERBURNER POWER	INTERMEDIATE POWER (MILITARY POWER)
A 	134	123
A 	145	140
B 	130	119
B 	140	135
C 	127	116
C 	135	132
D 	123	112
D 	130	130

NOTE
SOUND LEVEL CONTOURS SHOWN ARE FOR SINGLE-ENGINE PO OPERATION. CONTOURS ARE SYMMETRICAL ABOUT ENGINE CENTERLINES DURING DUAL-ENGINE OPERATION.

EAR PROTECTIVE DEVICES

			
UNIVERSAL FIT EARPLUG	EARPLUG V-51-R TYPE OR SIMILAR	TYPICAL EAR MUFF	FLIGHT DECK SOUND-ATTENUATING HELMET (INCLUDES EAR MUFF)

WARNING

EARPLUGS AND EAR MUFFS SHALL BE WORN TOGETHER WHEN PERFORMING ENGINE RUNUP.

IF ENGINES ARE RUN UP IN FRONT OF BLAST DEFLECTOR, EXHAUST JET WAKE AND SOUND SHALL BE DEFLECTED UP AND TO SIDES, RESULTING IN DISTORTION CONTOUR PATTERNS SHOWN.

AT MAXIMUM POWER, TF30-P-414/414A AND F110-GE-400 ENGINE AFTERBURNERS ARE AT INTERMEDIATE POWER (MILITARY POWER). THE NOZZLES ARE FULLY CLOSED (MINIMUM OPENING)

ALLOWABLE NOISE EXPOSURE SOUND LEVEL IN dBA (SLOW RESPONSE)							
TYPE EAR PROTECTIVE DEVICES	EXPOSURE TIME (HRS)						
	1/4	1/2	1	2	4	6	8
NO PROTECTION	115	110	105	100	95	92	90
EARPLUGS WITH AVERAGE SEAL	127	122	117	112	107	104	102
EARPLUGS AND EAR MUFFS	135	130	125	120	115	112	110

* DURATION OF EXPOSURE PER DAY
REF. BUMED INST 6260.5B, 5 MARCH 1970

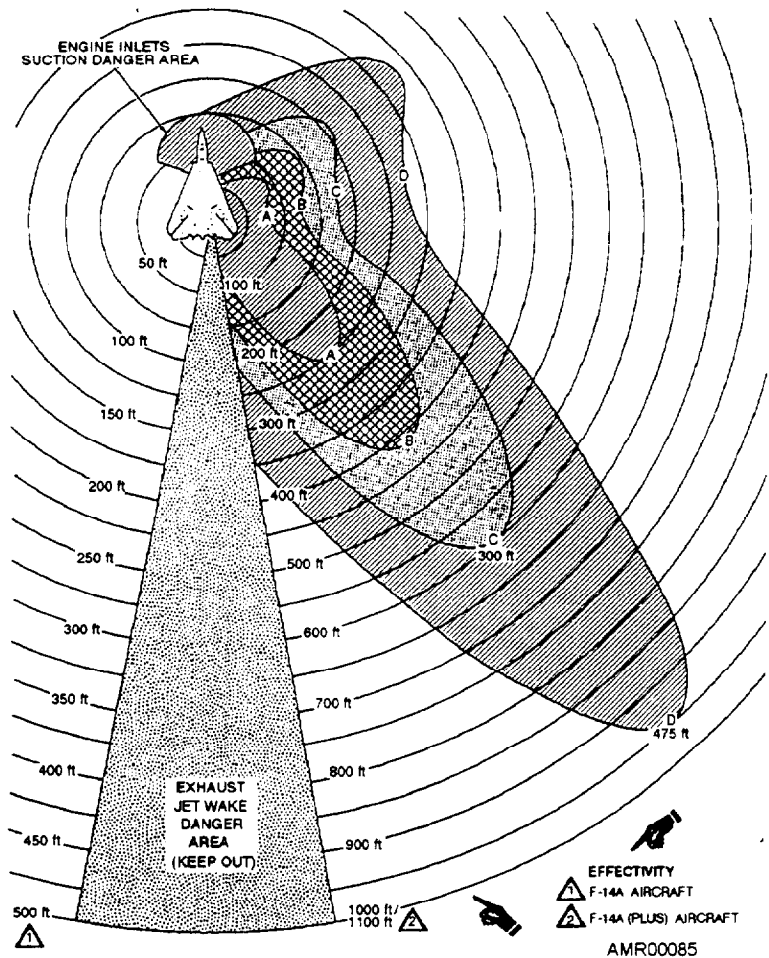


Figure 5-13.—Noise danger areas.

operations and maintenance. Therefore, you should make sure that all personnel and equipment are clear of the area before operating any movable surface.

Power-operated canopies have safety locks that must be installed during ground-handling operations. These safety locks prevent the accidental closing of

the canopy, preventing personnel from being crushed as the canopy closes.

The general information and servicing section of each MIM contains specific information concerning the various movable surface hazards and specifies the safety locks that must be used. Personnel involved with line operations and maintenance should pay

particular attention to this information because some of these units move extremely fast with terrific power.

Seat Ejection Mechanisms

You must strictly observe all safety precautions when working around an aircraft equipped with an ejection seat. These safety precautions cannot be overemphasized because accidental actuation of the firing mechanism can result in death or serious injury to anyone in the cockpit area.

Each ejection seat has several ground safety pins; the exact number depends upon the type of seat. These safety pins are provided on red-flagged lanyards for use at every point of potential danger. They must be installed when the aircraft is on the ground or deck, and must never be removed until the aircraft is ready for flight.

Always keep in mind the following general precautions when you are working on or around ejection seats:

- Treat ejection seats with the same respect as a loaded gun.

- Always consider an ejection seat system loaded and armed.
- Before entering a cockpit, know where the ejection seat safety pins are and be certain they are installed.
- Only authorized personnel may work on ejection seats and components and only in an authorized area.

Overheated Wheel Brakes

If an aircraft has been subjected to excessive braking, the wheels may be heated to the point there is danger of a blowout or fire.

NOTE: Excessive brake heating weakens the tire and wheel structure, increases tire pressure, and creates the possibility of fire in magnesium wheels. When the brakes on an aircraft have been used excessively, the fire department should be notified immediately. All unnecessary personnel should leave the immediate area.

If blowout screens, such as the one shown in figure 5-14, are available, they should be placed around both

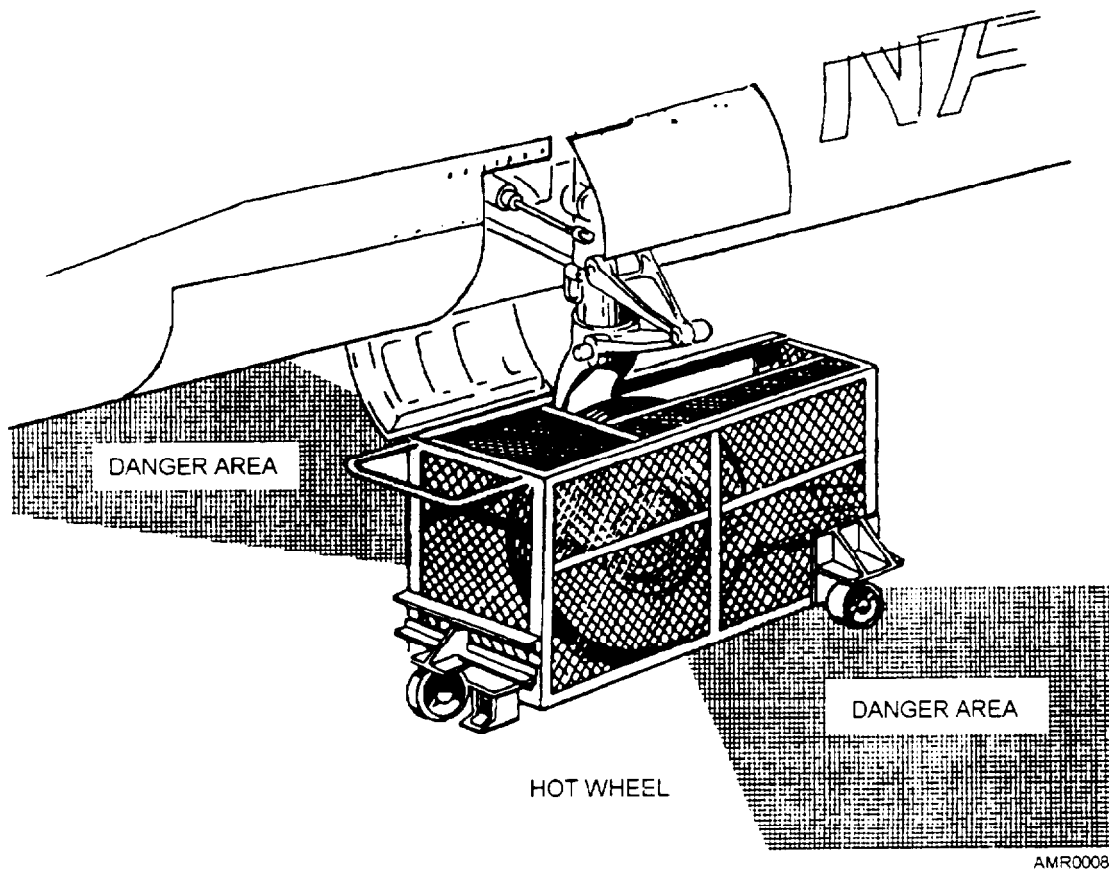


Figure 5-14.—Blowout screen for overheated brakes.

main wheels. These screens help prevent damage or injury if a blowout occurs. If the tire is flat, explosive failure of the wheel or tire will not result. However, upon sudden cooling, an overheated wheel may fracture or fly apart, which could hurl bolts or fragments through the air with sufficient speed to injure personnel.

Required personnel should approach overheated wheels with extreme caution in the fore or aft directions—never in line with the axle.

NOTE: The area on both sides of the tire and wheel, in line with the axle, is where the fragments would be hurled if the tire were to explode. Therefore, it is called the danger area (fig. 5-14).

Heat transfer to the wheel will continue until the brake is cooled. Therefore, the danger of explosive failure may exist after the aircraft is secured if the overheated brake is not cooled. The recommended procedure for cooling overheated wheel, brake, and tire assemblies is to park the aircraft in an isolated location. Then, allow the assembly to cool in ambient air for 45 to 60 minutes. Cooling agents should not be used to accelerate cooling unless operational necessity dictates their use. If such an operational necessity were to occur, the cooling should be supervised by someone in the AM rating.

WARNING

Never use CO₂ to cool overheated brakes.
A violent explosion can occur.

Liquid Oxygen (LOX)

When working with or around liquid oxygen, you must take the following safety precautions:

- Do not operate liquid oxygen equipment unless you are qualified, licensed, or working under the supervision of qualified personnel.
- Do not permit smoking, open flames, or sparks in the liquid oxygen handling areas.
- Do not carry matches in liquid oxygen handling areas.
- Always call oxygen by its proper name. Do not confuse it with compressed air. Never use oxygen in place of compressed air for any purpose.

- Handle converters, storage tanks, and transfer equipment with care to avoid damage to the insulating space.
- Keep work areas and equipment free from oil, grease, or any other combustible material.
- Keep tools and clothing free from oil and grease.
- Avoid spilling liquid oxygen on the floor or deck areas. In case of accidental spillage, ventilate the area thoroughly.
- If the body comes into contact with liquid oxygen or there is reason to suspect some part of the body has been frozen or chilled, thaw the exposed area, preferably by immersion or by bathing it in water that is slightly above normal body temperature. Then wrap the exposed area loosely with a clean, dry dressing. Report to a doctor immediately. Do not apply anything else to the affected area other than a clean, dry dressing.

CAUTION

Liquid oxygen can explode when it comes into contact with oil or grease.

LOX Protective Clothing

Protective clothing allows you to work safely with LOX. Wear clothing in the following ways:

- Wear goggles or safety glasses with side shields or a face shield when handling LOX.
- If LOX is spilled on clothing, remove the clothing immediately and air it promptly. In general, wear all clothing so that, if there were spillage, the liquid would roll off the clothing and not become trapped in gloves, shoes, or pockets. Other items of protective clothing are plastic or rubberized fabric aprons, high-top shoes or rubber boots, and cuffless trousers worn outside the shoe tops. The clothing should not have pockets, and sleeves and trousers should not be rolled up.
- Do not handle with your bare hands any tubing or fittings through which LOX is flowing. Wear clean, dry gloves when handling parts of equipment cooled by LOX. Use loose-fitting leather gloves so they can be thrown off quickly if any of the LOX gets into them.

FLIGHT DECK SAFETY

The flight deck of an aircraft carrier is a very busy and dangerous place during launching, recovery, and respotting of aircraft. Plane captains and other maintenance personnel assigned specific duties associated with the flight deck must be constantly aware of the dangerous environment in which they work.

You should receive predeployment training lectures on aircraft handling procedures, flight and hangar deck safety precautions, responsibilities during launch and recovery of aircraft, tie-down requirements and techniques, and special shipboard maintenance procedures and safety precautions. This training requirement is in addition to the general indoctrination given all personnel concerning flight quarters, general quarters, fire, abandon ship, man overboard, and other general drills. Also, this indoctrination covers ship conditions, smoking and safety precautions, and watchstanding requirements peculiar to shipboard operations.

Flight line safety precautions (previously discussed) apply to flight deck operations. The primary difference is the limited space and tempo of operations experienced on the flight deck, causing flight deck operations to be more dangerous.

During launch and recovery of aircraft, all personnel not required should leave the flight deck and catwalk areas. The safe parking area aft of the island is also an unauthorized space for personnel during aircraft recovery.

Personnel should not stand in or otherwise block entrances to the island structure or exits leading off the catwalks. Never turn your back on aircraft taxiing on the flight deck. Always be alert for the unexpected. There is never room for carelessness, daydreaming, or skylarking on the flight deck.

All personnel assigned flight quarters on or above the hangar deck must wear appropriate jerseys and helmets. Personnel on the flight deck during flight quarters must wear the cranial impact helmet or its equivalent, goggles, sound attenuators, flight deck shoes, flotation gear, an adequately secured whistle, and a survival light. The authorized flight quarters clothing for the different flight deck jobs is shown in figure 5-15.

Any maintenance performed on aircraft that will require wingspread/fold, respot, turnup, blade track, jacking, *or* maintenance that will prevent the aircraft

from being moved must be approved through the activity's maintenance control. This is true regardless of how much or how little time is required for the work to be performed. The activity's maintenance control, before it can grant approval, must obtain permission from the aircraft handling officer by way of the air wing, group maintenance liaison officer, or his or her representative.

When an aircraft is being turned up or jacking operations are being performed, make sure that the permission of the aircraft handling officer has been received and that all ship's safety regulations are observed. Safety men, with sufficient line to block off the area, must be stationed around the aircraft.

Each ship may have safety precautions unique to that ship due to operational requirements and special circumstances. Petty officers are responsible for knowing and enforcing the safety precautions that apply to their area of work and their personnel.

- Q29. What system or mechanism should you always treat with the same respect as a loaded gun?*
- Q30. In relation to overheated wheel brakes, what area is considered the "danger area"?*
- Q31. What item, if used to cool overheated brakes, is likely to cause an explosion?*
- Q32. Why is it important to keep tools, work areas, and clothing free from grease and oil when working around LOX?*
- Q33. What are the primary differences between flight line and flight deck operations?*

SPECIAL PROGRAMS

LEARNING OBJECTIVE: Identify the Navy's special maintenance programs related to Naval Aviation and their purposes.

The special programs discussed in this chapter are covered in detail in the *Naval Aviation Maintenance Program*, OPNAVINST 4790.2. Until Volume V of OPNAVINST 4790.2 is issued, which covers Naval Aviation Maintenance Standard Operation Procedures (NAMSOP), a local, more convenient source of information on these special programs is your squadron maintenance instructions (MIs). Technical information and local policy are issued through MIs. MIs describe techniques that do not direct the performance of work at defined intervals but are sustaining in nature. MIs include policy, procedures, and methods of managing specific maintenance

PERSONNEL	HELMET	FLOTATION VEST	SYMBOLS, FRONT AND BACK
Aircraft handling crew and chock men	Blue	Blue	Crew number
Aircraft handling officers and plane directors	Yellow	Yellow	Billet title—crew number (note 1)
Arresting gear crew	Green	Green	A
Aviation fuels crew	Purple	Purple	F
Cargo handling personnel	White	Green	“SUPPLY”/“POSTAL” as appropriate
Catapult and arresting gear officers	Green	Yellow	Billet title
Catapult crew	Green	Green	C
Catapult/AG QA	Green	White	ALRE QA
Catapult safety observer (ICCS)	Green	(Note 4)	Billet title
Crash and salvage crews	Red	Red	Crash/Salvage
Elevator operators	White	Blue	E
Explosive ordnance disposal (EOD)	Red	Red	“EOD” in black
GSE troubleshooter	Green	Green	“GSE”
Helicopter LSE	Text	Text	Text
Helicopter plane captain	Red	Brown	H
Hook runner	Green	Green	A
Landing signal officer	None	White	LSO
Leading petty officers:			
Line	Green	Brown	Squadron designator and “Line COP”
Maintenance	Green	Green	Squadron designator plus “Maint. COP”
Quality assurance	Brown	White	Squadron designator and “QA”
Squadron plane inspector	Green	White	Black and white checkerboard pattern and squadron designator
LOX crew	White	White	LOX
Maintenance crews	Green	Green	Black stripe and squadron designator
Medical	White	White	Red cross
Messengers and telephone talkers	White	Blue	T
Ordnance	Red	Red	3-inch black stripe and squadron designator/ships billet title
Ordnance QA	White	(Note 6)	Squadron designator and “ORDNANCE QA/SAFETY”
Photographers	Green	Green	P
Plane captains	Brown	Brown	Squadron designator
Safety	White	White	“SAFETY”

Figure 5-15.—Authorized flight quarters clothing.

PERSONNEL	HELMET	FLOTATION VEST	SYMBOLS, FRONT AND BACK
Supply VERTREP coordinator	White	Green	“SUPPLY COORDINATOR”
Tractor driver	Blue	Blue	Tractor
Tractor king	Blue	(Note 5)	TK
Transfer officer	White	White	“TRANSFER OFFICER”

1. Only personnel charged with the actual control or direction of aircraft movements on the flight or hangar deck shall wear yellow jerseys. Personnel in charge of a detail, such as aviation fuels, ordnance, and maintenance, shall wear a helmet and jersey corresponding in color to that of their respective detail and with their billet title on the jersey and flotation vest.

2. Helmets for the following personnel shall be marked with three reflective international orange stripes, one inch wide, evenly spaced, running fore and aft:

- All air department officers.
- Air department chief petty officers and leading petty officers.
- EOD team members.
- All ordnance officers and gunners.
- Ordnance handling officer and air gunner.

3. Helmets for all other personnel shall be marked with a 6-inch square (or equivalent) of white reflective tape on the back shell and a 3-inch by 6-inch (or equivalent) of white reflective tape on the front shell. Landing signal officers are not required to wear helmets or sound attenuators when engaged in aircraft control. Helmets shall have a 2-inch piece of velcro on the left side of the front shell and velcro on the survival light.

4. New requirement for ICCS is green jersey and yellow vest.

5. Yellow jersey/blue flotation vest.

6. White jersey/red flotation vest.

Figure 5-15.—Authorized flight quarters clothing—Continued.

programs. When issued, the NAMSOP will eliminate the need for maintenance instructions at command level. NAMSOPs will standardize these programs throughout aviation maintenance. As a plane captain, you will be involved with these programs. Therefore, you must know the purpose and scope of the special programs discussed in the following text.

FOREIGN OBJECT DAMAGE (FOD) PREVENTION PROGRAM

FOD is damage to aeronautical equipment caused by objects and debris foreign to that equipment. Foreign objects are also major safety hazards to personnel if the objects are left on the flight line/flight deck to be blown around by aircraft.

The ingestion of foreign objects and debris into gas turbine engines is a problem that accounts for the largest percentage of premature engine removal. The removal of these engines consumes maintenance man-hours, imposes unscheduled workloads on supporting activities, and creates an unwarranted shortage of engines and spare engine parts in the

supply system. Thus, the training capability and fleet operational readiness are drastically reduced. The majority of gas turbine engines undergoing depot rework exhibit some degree of FOD.

Most FOD is caused by poor housekeeping, facility deterioration, improper maintenance practices, and carelessness. FOD cannot be tolerated; thus, the requirement to reduce FOD is mandatory. A successful FOD prevention program depends upon command support, personnel knowledge and awareness, and its integration into the total maintenance effort.

As a plane captain, you can help prevent FOD by checking the deck for loose gear (nuts, bolts, washers, and safety wire) after maintenance is completed. Also, you should check the intakes and exhausts of your aircraft during the daily/turnaround inspection.

TOOL CONTROL PROGRAM (TCP)

The Tool Control Program (TCP) reduces the potential for tool FOD-related mishaps and keeps down the cost of tool replacement. This program gives you a fast way to account for all tools, both before and

after completing a maintenance task on an aircraft or its related equipment. The material control officer coordinates the Tool Control Program and makes sure that tools are procured and issued according to the approved tool control plan (TCPL). A TCPL contains information that includes material requirements, tool inventories, and detailed instructions for operation of the TCP for a specific type/model of aircraft.

The TCP is based upon the instant inventory concept. It provides internally configured, silhouetted tool containers. All tools have individual locations to highlight a missing tool. An inventory listing is included within each container. On containers that cannot be silhouetted, a note with the inventory and drawing of the container outline is fastened to the container. It is securely fastened so it will not become a FOD hazard. Either system lets you quickly determine that all tools have been retrieved after a maintenance action. The most significant benefit of this program is the saving of lives and equipment by eliminating tool FOD-caused accidents. Additional benefits of the Tool Control Program are listed below.

- Reduced initial outfitting and tool replacement costs
- Reduced tool pilferage
- Reduced man-hours required to complete each maintenance task
- Assurance that proper tools are available for specific maintenance tasks

METROLOGY AND CALIBRATION PROGRAM (METCAL)

Most maintenance shops are provided with a variety of calibrated support equipment that is used to maintain many different systems. This calibrated SE is used to measure, gauge, test, inspect, or otherwise examine material, supplies, and equipment to determine compliance with requirements established in technical documents. The accuracy of this equipment is vital in everyday maintenance. The METCAL program was designed to make sure that all equipment requiring calibration/servicing is maintained at maximum dependability. The recall of equipment for calibration at established intervals is assisted by the Metrology Automated System for Uniform Recall and Reporting (MEASURE). The MEASURE goal is to provide a single, uniform management information system for the Navy METCAL Program.

As a plane captain, you are responsible for checking each piece of equipment (hydraulic servicing unit, oil servicing unit, etc.) to make sure that the calibration label is valid (has the current date on it). If you find an out-of-date calibration label, the piece of equipment should not be used, and you should make an immediate report to your supervisor.

JOINT OIL ANALYSIS PROGRAM (JOAP)

The Joint Oil Analysis Program (JOAP) was designed so the oil condition of equipment can be diagnosed and monitored without removing or extensively disassembling equipment. As a plane captain, you will be directed by maintenance control through a Visual Information Display System/Maintenance Action Form (VIDS/MAF) or NALCOMIS to take an oil sample. The oil sample you take might be from a certain aircraft engine, transmission, or other aircraft component. You must be careful when taking the sample. You must be sure that you do not cause the sample to become contaminated. Additionally, you must fill out an Oil Analysis Request Form (DD Form 2026), shown in figure 5-16. After you have completed this form, the sample is sent to the appropriate oil laboratory where it is checked for contamination. If contamination is present in the sample, corrective action is taken.

HYDRAULIC CONTAMINATION CONTROL PROGRAM

Hydraulic fluid contamination is the presence of undesirable foreign matter, which may or may not be visible to the unaided eye. Typical fluid contaminants include metallic and nonmetallic debris (both self-generated and externally introduced), water, and other foreign fluids. This contamination degrades system performance and component life. The Hydraulic Contamination Control Program also includes other systems that contain fluid. Examples are the F-14 aircraft's radar liquid coolant and missile coolant systems. Also, some pieces of SE are included in this program.

Hydraulic system contamination levels are monitored by means of a fluid surveillance program. When systems fail to meet required cleanliness levels, decontamination procedures are used to restore systems to an acceptable level. The acceptable contamination levels, related maintenance doctrine, and detailed maintenance requirements are specified in the *Aviation Hydraulics Manual*, NAVAIR 01-1A-17.

TRANSIT AIRCRAFT OIL ANALYSIS RECORD																
ASSIGNED OIL ANALYSIS LABORATORY					LABORATORY TELEPHONE NO. <i>(Aircraft)</i> <i>(Commercial)</i>					END ITEM MODEL AND SERIAL NO.						
										EQUIPMENT MODEL AND SERIAL NO.						
LAB CODE	DATE	TOTAL TIME SINCE		FE	AG	AL	CR	CU	MG	NI	PB	SI	SN	TI	MO	LAB REC
		OVERHAUL	OIL CHG													
SAMPLE																
DATE DEPARTED <i>(Return this form with aircraft)</i>																
REMARKS																

OIL ANALYSIS REQUEST			KEYPUNCH CODE
TO	OIL ANALYSIS LABORATORY		1-3
FROM	MAJOR COMMAND		4
	OPERATING ACTIVITY <i>(Include ZIP Code/APQ/DOAAAD)</i>		5-10
EQUIPMENT MODEL/APPLICATION			11-14
EQUIPMENT SERIAL NUMBER			15-20
END ITEM MODEL/HULL NUMBER			
END ITEM SERIAL NUMBER/END ITEM CODE			
DATE SAMPLE TAKEN <i>(Day, Mo., Yr.)</i>		LOCAL TIME SAMPLE TAKEN	21-24
HOURS/MILES SINCE OVERHAUL			25-29
HOURS/MILES SINCE OIL CHANGE			30-33
REASON FOR SAMPLE <input type="checkbox"/> ROUTINE <input type="checkbox"/> LAB REQUEST <input type="checkbox"/> TEST CELL <input type="checkbox"/> OTHER <i>(Specify)</i>			34
OIL ADDED SINCE LAST SAMPLE <i>(Pps. Qty. Gal.)</i>			35-36
ACTION TAKEN <input type="checkbox"/>			
SAMPLE			
DISCREPANT ITEM			
HOW MALFUNCTIONED			
HOW FOUND <input type="checkbox"/> LAB REQUEST <input type="checkbox"/> AIR OR GROUND CREW			
HOW TAKEN <input type="checkbox"/> DRAIN <input type="checkbox"/> TUBE	SAMPLE TEMPERATURE <input type="checkbox"/> HOT <input type="checkbox"/> COLD	TYPE OIL	37-38
REMARKS			
FOR LABORATORY USE ONLY			
SAMPLE RESPONSE TIME			39-40
FE 41-43	AG 44-46	AL 47-49	CR 50-52
			CU 53-55
			MG 56-58
			NI 59-61
PB 62-64	SI 65-67	SN 68-70	TI 71-73
			MO 74-76
LAB RECOMMENDATION			77-78
SAMPLE NO.	SIGNATURE	FILE MAINT 79	DATA SEQ 80

DD FORM 2026 NOV 77 PREVIOUS EDITION WILL BE USED. S/N 01021-LF-002-0261 AMR00088

Figure 5-16.—Oil Analysis Request, DD Form 2026.

The prime objective of the Hydraulic Contamination Control Program is to maintain a satisfactory level of fluid purity in hydraulic systems,

thereby providing for safe and efficient operation of naval aircraft and SE. Undetected and uncontrolled contamination in an aircraft hydraulic system poses a

serious threat to flight safety. This program is an ongoing effort to control hydraulic fluid contamination.

AIRCRAFT FUEL SURVEILLANCE PROGRAM

Foreign contaminants and water in aircraft fuel systems constitute a major hazard in naval aircraft. Harmful effects of water, particulates, and microbiological growth include erratic or incorrect fuel quantity indications; icing of filters, valves, and other fuel system components; engine failure caused by carburetor/fuel control icing or malfunction; and jet engine starting difficulties. Further, if contamination remains undetected, rubber fuel cells deteriorate and become permanently damaged. Constant vigilance by maintenance personnel is required to ensure that clear, bright, and dry fuel is delivered to the aircraft, and subsequently to its engines.

All aviation fuels are produced under rigidly controlled specifications. To maintain its high quality, maintenance personnel must take careful and continual measures to prevent contamination.

Contamination can occur from fuel mixing with other bulk petroleum products as well as from dirt, rust, and water. Serious engine and airframe problems develop if inadequate attention and effort are given to maintaining fuel quality. Since no two fuel systems are identical, it is not possible to establish rigid and detailed procedures that will apply in all situations.

The plane captain takes fuel samples from low-point drains of all fuel cells/tanks before the first flight of the day. This action is normally accomplished during the daily inspection. This also includes any auxiliary, external, or in-flight refueling tanks. Additional information on this program can be obtained in the *Aircraft Refueling NATOPS Manual*, NAVAIR 00-80T-109.

- Q34. *What builds a successful FOD program?*
- Q35. *What officer coordinates the Tool Control Program?*
- Q36. *What is the most significant benefit to the Tool Control Program?*
- Q37. *What is the prime objective of the hydraulic contamination control program?*
- Q38. *What publication contains detailed information on the Aircraft Fuel Surveillance Program?*

AVIATORS BREATHING OXYGEN (ABO) SURVEILLANCE PROGRAM

Aviator's breathing oxygen (ABO) comes in both gaseous and liquid states. Liquid oxygen (LOX) is converted to a gaseous state before its delivery to the aircrew. Because oxygen can be contaminated easily, LOX requires frequent and continual monitoring by personnel to ensure detection of contamination. The safety of the aircrew is of the utmost priority.

An oxygen surveillance program is the primary method of ensuring that each operation in the LOX supply system is carried out in strict compliance with established procedures. Surveillance begins with procurement or generation of LOX and continues throughout storage, handling, transfer, and servicing in the aircraft. This program is also applicable to all naval activities involved in the support and manufacture of LOX and related equipment.

Each person associated with the Aviation Breathing Oxygen Surveillance and Contamination Program should have a thorough knowledge of the characteristics of liquid oxygen and gaseous oxygen and the hazards of contamination. Each person should also know the quality standards listed in the *ABO Surveillance Program Laboratory Manual and Field Guide*, A6-332A0-GYD-000.

EGRESS SYSTEM CHECKOUT PROGRAM

The high-performance aircraft used by the Navy places extreme demands on emergency escape systems. These systems contain high-explosive devices that are designed for onetime use only. Actuation of these devices could result in severe injury or death to personnel and damage to or destruction of aircraft. Therefore, because of the inherent dangers associated with ejection seats and canopy systems, an egress systems checkout procedure is required.

The egress/environmental work center (AME shop) indoctrinates all personnel in the hazards and safety precautions associated with these systems. A system checkout must be given by a qualified AME to all new maintenance personnel before they perform any aircraft maintenance work. Maintenance personnel must be checked out every 6 months thereafter before the last day of the requalification month. In addition, any personnel removed from aircraft maintenance responsibilities for more than 90

days must receive an egress system checkout before performing any aircraft maintenance. The egress/environmental work center and the other maintenance work centers maintain records of system checkouts, including date given, date due, and the signature of the AME performing the checkout. The plane captain must make sure that new personnel assigned to him or her for training have a current egress system checkout before entering the cockpit.

ELECTROSTATIC DISCHARGE (ESD) CONTROL/PREVENTION PROGRAM

ESD is the transfer of electrostatic charge between bodies at different electrostatic potentials. This is caused by direct contact or induced by an electrostatic field.

ESD-safe areas are required in such areas as supply, production control, and maintenance shops. In these areas, the technician is tied to a soft ground that reduces high current flow for personal safety.

The QA division ensures the following guidelines are followed in the work center.

- All work centers involved in avionics maintenance and handling of ESD-sensitive assemblies have ESD training programs.
- ESD protective equipment and materials are used to ensure personnel and equipment safety.

WARNING

For personnel safety, all energized equipment must be isolated from the work station mat and other conductive material.

TRAINING PROGRAM

The Navy places great emphasis on effective and continual training. A supervisor in a maintenance activity has an ongoing responsibility for training his or her personnel. An efficient training program minimizes the loss when experienced maintenance personnel transfer from the activity. Since the activity's operational readiness depends largely on the capability of the maintenance department, the quality of the training program is important.

In-service training is a command responsibility. Since this training represents a major contribution to

the Navy's overall training effort, a systematic in-service training program must be conducted.

In-service training is conducted in two methods—formal and informal. Formal in-service training is conducted through formal lectures and computer-based training (CBT). Informal in-service training is conducted through the performance of on-the-job training (OJT) and the completion of Personal Qualification Standards and required reading.

As a plane captain, you will be exposed to all types of training. Portions of this training will improve your skills as a plane captain and prepare you for further advancement. Other portions of this training, such as fire fighting, may, in an emergency situation, save your life. You should always learn all you can in any training situation.

HEARING CONSERVATION PROGRAM

Hearing loss is a source of concern within the Navy, both ashore and afloat. Hearing loss can occur from exposure to impulse or blast noise (gunfire, rockets, etc.) or from continuous or intermittent sounds, such as jet engines or machinery noise in industrial-type activities. Such loss may be temporary, disappearing after a brief period of nonexposure, or it may become permanent through repeated exposures to intense noise levels. Hearing loss caused by exposure to hazardous noise and the high cost of associated compensation claims pose a significant problem, which requires action to reduce or eliminate hazardous noise levels.

Your responsibilities as a plane captain make it impossible for you to avoid noise in day-to-day flight operations, but you are provided with the means of protecting your hearing. Always wear your sound attenuators (often referred to as ears) and follow the rules for noise exposure for the type of aircraft you are working on. The hearing conservation program is outlined in *Navy Occupational Safety and Health Program Manual*, OPNAVINST 5100.23, and has established as its goal the elimination and prevention of hearing loss.

RECOVERY AND RECLAMATION OF CRASH-DAMAGED AIRCRAFT

Aircraft accidents/incidents involving exposure to gross amounts of salt water, fire-extinguishing agents, or other corrosive agents require emergency action to

prevent further damage to the aircraft and/or systems. The majority of emergency reclamation actions are caused by carelessness or the lazy attitudes of individuals. For example, overhead sprinkler systems are often triggered by improper use of ground support equipment (exhausts not vented properly). Failure to close a canopy on an aircraft compounds the problem by making the aircraft subject to water damage. Proper training or supervision should keep reclamation actions to a minimum. General procedures and basic policies for the recovery, reclamation, and transfer of crash-damaged aircraft are contained in *The Naval Aviation Safety Program*, OPNAVINST 3750.6; *Aircraft Material Condition Definitions, Mission-Essential Subsystems Matrices (MESMs), and Mission Descriptions*, OPNAVINST 5442.4; and *Policy and Procedures for Aircraft, Aircraft Engines and Related Aeronautical Items Reclamation and Disposal Program*, NAVAIRINST 4500.11. These publications are available on a need-to-know basis only.

SUPPORT EQUIPMENT TRAINING AND LICENSING PROGRAM

The assistant aircraft maintenance officer manages the Support Equipment (SE) Training and Licensing Program. The quality assurance (QA) division monitors it. The results of improper use of support equipment are excessive ground handling accidents, excessive repair costs to equipment and aircraft, the reduction of operational readiness, and personnel injuries-the most expensive cost of all. The major reason for the improper use of SE is attributed to the lack of training and effective supervision.

The training program consists of classroom training conducted by the supporting activity's AIMD, on-the-job training, and completing any personnel qualification standard (PQS) for that equipment. Classroom training is given so that personnel will know the proper operation and organizational maintenance for a particular piece of support equipment. Upon satisfactory completion of the training conducted by the supporting activity, a completion certificate for the individual trained on a specific item of SE is forwarded to the permanent activity. The activity, upon receiving the completion certificate, forwards it to the appropriate division officer. The division officer ensures that the individual has received the appropriate amount of "on aircraft"

training to become qualified to use the specific unit of SE. The Restriction block on the SE license must identify the type, model, and series of aircraft on which the equipment can be used.

Once satisfied that the individual is qualified, the division officer will endorse the completion certificate and initiate the support equipment operator's license (fig. 5-17). The individual will sign the license, and then it is forwarded to the maintenance officer for signature. Each piece of equipment must be itemized; for example, NC8, NC10, etc. Any license containing general equipment statements (aircraft tow tractor, mobile electric power plant, etc.) is not valid. Only one item per line is listed. After the signatures have been obtained, the license issued is valid for 3 years for equipment and aircraft regardless of the activity to which the licensee is assigned.

Activities honoring licenses issued by other commands verify the operator's proficiency before allowing the individual use of the equipment. Transfer to an activity operating the same SE detailed on the license, but with a different type/model aircraft, invalidates the license. Transfer to an activity operating the same type/model but a different series merely requires verification of proficiency. License renewal on a new card, whether issued at the time of expiration or transfer, is granted only after a new determination of qualifications has been made.

Qualification for license renewal consists of passing the same written and practical tests used for initial licensing to ensure equipment O-level maintenance/operation and on-aircraft proficiency. Failure requires personnel to repeat the course of instruction for the equipment concerned. The expiration date for each specific type of SE is noted in column 8B on the license. The "Date Expires" block on the front of the license should be marked "NA." Commanding officers (COs) of issuing activities may, as conditions warrant, require personnel in their activities to be requalified sooner.

SUPPORT EQUIPMENT MISUSE/ABUSE PROGRAM

Support Equipment Misuse/Abuse forms can be submitted by anyone witnessing misuse or abuse (fig. 5-18). The division of the individual originating the report retains a copy of the Support Equipment Misuse/Abuse report, and the original report is sent to the organization that has Individual Material Readiness List (IMRL) reporting responsibility for the

SUPPORT EQUIPMENT MISUSE/ABUSE		CONTROL NO.	
OPNAV 4790/108 (6-81) S/N 0107-LF-047-9650			
FROM		TO	
THE FOLLOWING INFORMATION IS SUBMITTED IN REGARDS TO A REPORT OF MISUSE/ABUSE:			
PERSON WHO MISUSED/ ABUSED EQUIPMENT	NAME	RANK/RATE	
	ORGANIZATION/UNIT	SE LICENSE NO.	
		GOVT OPERATOR LICENSE NO.	
LOCATION AND EQUIPMENT INVOLVED	LOCATION	TYPE EQUIPMENT PN/FSN	TIME
			DATE
		EQUIPMENT SERIAL NO.	JCN
OPNAV 4790/108 (6-81) (BACK)	<p style="text-align: center; font-size: 2em; font-weight: bold;">SAMPLE</p>		
FIRST ENDORSEMENT			
FROM:			
TO:			
VIA:			
SUBJ: MISUSE/ABUSE	NARRATIVE DESCRIPTION		
1 ACTION TAKEN/RECOMMENDATIONS			
	PERSON CITING MISUSE/ ABUSE		RANK/RATE
	NAME		
	ORGANIZATION/UNIT		
WAS LICENSE CONFISCATED? <input type="checkbox"/> YES <input type="checkbox"/> NO		REMARKS	
IF YES, LICENSE IS BEING HELD BY:			
SIGNATURE AND TITLE OF REPORTING OFFICIAL			DATE
SIGNATURE AND TITLE			

AMR00090

Figure 5-18.—Support Equipment Misuse/Abuse Form (OPNAV 4790/108).

AIRCRAFT INSPECTIONS

LEARNING OBJECTIVE: Define the types of aircraft inspections required for proper maintenance and safety of naval aircraft.

Aircraft are subject to a variety of stresses, strains, vibrations, and detrimental environments. If not inspected regularly, the aircraft would soon become inoperable. Maintenance is performed in conjunction with inspections. This enables the aircraft to be flown safely until the next inspection. The types of inspections that are performed by activities responsible for the maintenance of naval aircraft are defined in the following paragraphs.

Acceptance inspection. This inspection is performed at the time a reporting custodian accepts a newly assigned aircraft, and upon receipt of or return of an aircraft from standard depot level maintenance (SDLM) or other major depot level work. It includes an inventory of all equipment listed in the Aircraft Inventory Record (AIR), a configuration verification, hydraulic fluid sampling, and a full systems functional check flight (FCF). It also includes an inspection of emergency systems and egress equipment. This should include functionally checking such items as fuel, oil, hydraulic shutoff valves, and prop feathering, as well as the verification of cartridge-actuated devices (CADS) and aircrew escape propulsion systems (AEPSs). In addition, a daily inspection, as required by the applicable Planned Maintenance System (PMS) publication, should also be done. Activities may elect to increase the depth of inspection if the equipment condition indicates such action is warranted.

Transfer inspection. This inspection is performed at the time a reporting custodian transfers an aircraft, including transfers to SDLM. It includes an inventory of all equipment listed in the AIR, verification of CADS and AEPS, a configuration verification, hydraulic fluid sampling, and a daily inspection as required by the applicable PMS publication. Activities may elect to increase the depth of inspection if the equipment condition indicates such action is warranted.

Daily inspection. Daily inspections are accomplished between the last flight of the day and the next scheduled flight. The daily inspection is valid for a period of 72 hours, provided no flight occurs during this period and no maintenance other than servicing has been performed. If more than 72 hours elapse between the inspection and the next flight, the

inspection must be repeated. This inspection is performed to check equipment that requires a daily verification of satisfactory functioning. It also involves the search for and correction of relatively minor problems to prevent their progressing to a state that would require major work to remedy the problems. Other items that require inspection at intervals more frequent than prescribed for calendar inspections are also included on the daily inspection, and thus are done along with the daily inspection on the day they become due.

Conditional inspection. Conditional maintenance requirements are unscheduled events required as the result of a specific overlimit condition, or as a result of circumstances or events that create an administrative requirement for an inspection. A logbook entry is required for a conditional maintenance requirement that prescribes inspections to determine equipment condition; for example, airframe hard landing, precarrier/predeployment, aircraft ferry, acceptance/transfer, or engine overspeed/overtemp inspections. Those conditional requirements that specify servicing or fluid sampling need not be logged.

Preflight inspection. The preflight inspection consists of checking the aircraft for flight readiness by performing visual examinations and operational tests to discover defects and maladjustments that, if not corrected, would cause accidents or aborted missions. This inspection is conducted before each flight to ensure the integrity of the aircraft for flight and to verify proper servicing. It is valid for a period of 24 hours, provided no flight and no maintenance other than servicing occurs during this period. When all preflight requirements are contained within the daily card set, accomplishment of the daily requirements before the first flight of the day satisfies the preflight inspection requirements. When all preflight requirements are not included in the daily card set, the preflight inspection must be performed before flight. The application statement contained on the applicable model weapons system MRC introduction card states specific requirements.

Postflight inspection. The postflight inspection is accomplished after each flight or ground operation of the aircraft. The postflight inspection is mainly a check for obvious defects (hydraulic, fuel, and oil leakage or structural damage) and the installation of the necessary safety locks and pins.

Turnaround inspection. Turnaround inspections are conducted between flights to ensure the integrity

of the aircraft for flight, verify proper servicing, and to detect degradation that may have occurred during the previous flight. The turnaround inspection is valid for a period of 24 hours, provided that no flight and no maintenance other than servicing occur during this period. The accomplishment of the daily inspection does not satisfy the turnaround requirements. On aircraft that are furnished turnaround inspection requirements, the preflight and postflight requirements do not apply.

Phase inspection. The phase maintenance concept divides the total scheduled maintenance requirements into small packages or phases of approximately the same work content. These are done sequentially at specified intervals. Completion of all required phases at their specified intervals completes the phase inspection cycle. The cycle is repetitive for the service life of the aircraft and is not interrupted during SDLM. Phase inspections are not included in the SDLM specifications, and are not done during the SDLM process. Aircraft returning from SDLM/special rework have the next phase due upon expiration of the authorized interval from the last phase inspection completed.

Special inspection. A special inspection is a scheduled inspection with a prescribed interval other than daily or phase. These intervals are specified in the applicable PMS publication and are based on elapsed calendartime, flight hours, operating hours, or number of cycles/events; for example, 7, 28 days; 50, 100, 200 hours; 10, 100 arrestments; or 5,000 rounds fired.

Zonal inspection. A zonal inspection is a general inspection of a specific area of an aircraft. These inspections are for obvious defects, such as leaks, frayed cables, cracks, corrosion, or physical damage. Zonal inspections are normally performed in conjunction with other scheduled maintenance tasks by the rating assigned, such as an Aviation Electronics Technician (AT) rating assigned to perform an inspection on a radar antenna may also be assigned a

zonal inspection of the compartment for obvious defects.

NOTE: You should refer to the *Naval Aviation Maintenance Program (NAMPP)*, OPNAVINST 4790.2, for added information about the maintenance program and the forms and records used in the program.

- Q43. *What type inspection is performed at the time a reporting custodian accepts a newly assigned aircraft?*
- Q44. *What type inspection is performed to check equipment that requires a daily verification of satisfactory functioning.*
- Q45. *What type inspection is required as the result of a specific overlimit condition?*
- Q46. *A preflight inspection is valid for a period of how many hours?*
- Q47. *What type inspection consists of checking the aircraft for flight readiness by performing visual examinations and operational tests to discover defects and maladjustments that, if not corrected, would cause accidents or aborted missions?*
- Q48. *What type inspections are normally performed in conjunction with other scheduled maintenance tasks by the rating assigned?*

SUMMARY

This chapter identified the organization of the line division. Responsibilities and qualification of a plane captain were covered but were not all inclusive. Special safety requirements and safety precautions for aircraft ashore and afloat were also mentioned. Special programs covered in this chapter touch on the basics. The information contained in these programs is more than any individual could be expected to memorize or be solely responsible for. You should keep informed of changes to programs at your command that might affect your work center.

ANSWERS TO REVIEW QUESTIONS

- A1. *Maintenance department.*
- A2. *The Support Equipment Branch.*
- A3. *The Plane Captain Branch.*
- A4. *The commanding officer.*
- A5. *100 feet.*
- A6. *Nonsparking tools.*
- A7. *Aft center body, upper speed brake, directly aft of overwing fairings and directly behind the canopy.*
- A8. *The wind may carry fuel vapors toward a source of ignition.*
- A9. *Three.*
- A10. *Identify the aviation fuel.*
- A11. *Pressure fueling gives aircraft a faster turnaround time.*
- A12. *The appropriate aircraft Maintenance Instruction Manuals (MIMs) and the Aircraft Refueling NATOPS Manual, NAVAIR 00-80T-109.*
- A13. *The internal fluid resistance to flow caused by molecular attraction.*
- A14. *The Saybolt scale.*
- A15. *MIL-H-83282.*
- A16. *It should be properly disposed of immediately.*
- A17. *Daily.*
- A18. *This prevents the operator from being struck by debris if the tire were to fail.*
- A19. *The wheel halves may separate when the axle nut is removed.*
- A20. *AME rating.*
- A21. *It is used to service struts, accumulators, air storage bottles, and other components serviced with high-pressure air.*
- A22. *It removes moisture that may have adhered to the valves or that was accidentally introduced into the system.*
- A23. *3 gallons. 2 gallons in the unit reservoir and 1 gallon in the can.*
- A24. *The flight deck.*
- A25. *Only when actually performing maintenance on the propeller.*
- A26. *No! Serious injury can still result by being pulled against the protective screen.*
- A27. *High temperature and high velocity of exhaust gases.*
- A28. *140 decibels (dB).*
- A29. *Ejection seats.*
- A30. *The area on both sides of the tire and wheel, in line with the axle.*

- A31. *CO₂.*
- A32. *LOX can explode when it comes in contact with oil or grease.*
- A33. *Limited space and tempo of operations.*
- A34. *Command support, personnel knowledge and awareness, and its integration into the total maintenance effort.*
- A35. *The material control officer.*
- A36. *Saving lives and equipment by eliminating tool FOD-related accidents.*
- A37. *To maintain a satisfactory level of fluid purity in hydraulic systems to provide safe and efficient operation of naval aircraft and SE.*
- A38. *The Aircraft Refueling NATOPS Manual, NAVAIR 00-80T-109.*
- A39. *90 days.*
- A40. *Navy Occupational Safety and Health Program Manual, OPNAVINST 5100.23.*
- A41. *The assistant aircraft maintenance officer (AAMO).*
- A42. *Anyone witnessing the misuse or abuse.*
- A43. *Acceptance inspection.*
- A44. *Daily inspection.*
- A45. *Conditional inspection.*
- A46. *24 hours, provided no flight and no maintenance have occurred during this period.*
- A47. *Preflight inspection.*
- A48. *Zonal inspections.*

CHAPTER 6

WORK CENTER MANAGEMENT AND QUALITY ASSURANCE

To most personnel, an assignment to a supervisory position is a welcome challenge. They like the feeling of the added prestige, authority, and the responsibility that accompanies the assignment. However, when you do reach this level, you may soon realize that the position of Work Center Supervisor is not as easy as it may have seemed when viewed from another position.

Each day you may be confronted with many new problems and situations that require immediate action. If you know the duties, responsibilities, personnel, equipment, tools, and job priorities, it will be easier to function in a supervisory capacity. However, if you don't possess this knowledge, your troubles may multiply at an alarming rate.

The first part of this chapter will discuss some of the general duties and responsibilities of a supervisor and a few ways to prevent some problems before they are problems.

THE WORK CENTER SUPERVISOR

LEARNING OBJECTIVES: Describe the primary concerns of the work center supervisor. Describe how the work center layout affects efficiency and safety.

To be a supervisor, you must clearly understand the terms *supervision* and *supervisor*. SUPERVISION can be defined as the act of guiding, directing, overseeing, evaluating, and controlling the activities of others in the accomplishment of an objective. A SUPERVISOR can be defined as the one who is responsible for and directs the work of others.

THE SUPERVISORY POSITION

The job of supervising your personnel in a work center is a many sided task. Some of the techniques are learned through past experience; others will be learned during actual supervision. Still other techniques may be learned from self-study courses and technical publications.

A supervisor sets in motion the plans, schedules, and policies of his superiors. When you become a supervisor, you are primarily concerned with seeing that the job is done correctly, safely, and efficiently with no waste of materials. You will not necessarily perform the work yourself. You must know your personnel, know their limitations, assign them the work to be done, train them to do the best job possible, and, if necessary, direct them through the performance of the work. YOU assume the responsibility for seeing that the job is done, and done right. This role demands skill, common sense, and mutual respect.

OBJECTIVES OF THE WORK CENTER SUPERVISOR

A specific list of duties and responsibilities can be made concerning only a specific position. However, listed below are some typical duties and responsibilities common to all work center supervisors:

- Get the right person on the job at the right time
- Use and place materials economically
- Ensure personnel and equipment safety
- Promote high morale
- Maintain quality work
- Keep accurate records and reports
- Maintain discipline within the work center
- Plan and schedule work
- Train personnel
- Procure the proper tools and equipment to do the work
- Inspect, preserve, and protect tools and equipment
- Give clear orders and directions
- Maintain liaison with other work centers
- Check and inspect jobs and workmanship
- Promote teamwork
- Maintain good housekeeping

By analyzing the typical duties and responsibilities listed above, you will find that they can be grouped into three broad objectives.

1. Operate with maximum efficiency and safety
2. Operate with minimum expense and waste
3. Operate free from interruption and difficulty

While these are the primary objectives of a work center supervisor, it is important for you to keep in mind that it also affords you the opportunity to gain practical experience toward eventual promotion to Chief Petty Officer.

Q1. What is the primary concern of a work center supervisor?

Q2. The typical duties and responsibilities of the supervisor can be grouped into broad objectives. List these three objectives.

OPERATING WITH MAXIMUM EFFICIENCY AND SAFETY

The operational efficiency of a work center is dependent to a large extent upon how conveniently the work spaces and equipment are arranged. As equipment in your work center becomes obsolete, new equipment and new models are phased into the inventory. With this occurrence, efficiency naturally increases. This happens even in a poorly arranged work center, but the full work center potential may not be realized. It may not be economically feasible to make drastic changes in the work center spaces and equipment. However, if drastic changes result in improved use of equipment, personnel safety, and in generally improved working conditions, then the change should be made. The supervisor should make an assessment of the existing work center layout to ensure the most efficient arrangement possible.

The supervisor, by virtue of the position, has authority over other individuals. The supervisor tells them what to do, when to do it, and if necessary, how to do it. This authority alone is not enough to gain maximum effectiveness performance from the crew. A good supervisor must know the limitations and capabilities of subordinates to obtain the most efficient performance from them. The capabilities of the crew should be exploited. If at all possible, a well qualified person should be assigned to each job. Individuals that are less qualified but who are ready for advanced on-the-job training should be assigned to assist.

A good supervisor anticipates the eventual loss of experienced personnel through transfers, separations, etc. These things can be offset by establishing an effective and continuing training program. Use the *Naval Aviation Maintenance Program*, OPNAVINST 4790.2, manual as a guideline for this program. In addition to raising the skill level of the work center, the training program ensures that personnel otherwise qualified will be prepared for the next Navy-wide advancement examination.

A work center safety program must be organized and administered if the work center is to function efficiently. Current Navy directives and local policies are quite specific as to the establishment of safety training programs.

Accurate, complete, and up-to-date records are the primary factors in the efficient operation of a work center. This includes records of usage data, work accomplishments, and personnel qualifications. The most efficient record keeper is one who has enough information without having records and files bulging with useless and outdated materials.

As supervisor, you should schedule your workload in such a way that planned absences of key workers do not interrupt the daily routine. When scheduling the workload, keep in mind the skill level required for various tasks, and assign jobs to individuals in such a way that the work may still progress if any worker is unexpectedly absent.

The discussion thus far indicates that an efficient and safe work center is one in which the supervisor practices balanced supervision. Balanced supervision means applying sufficient attention to each phase of the supervisor's responsibilities. Do not emphasize production at the expense of safety or training. Also, do not become so concerned with the human element that production is neglected. Keep paperwork current and updated to prevent having to spend long periods catching up at the expense of other important interests. Always strive to place the proper emphasis on each phase of responsibility to promote work center efficiency and harmony.

Q3. How does work center efficiency naturally increase?

Q4. How can an effective supervisor offset the loss of experienced personnel?

OPERATING WITH MINIMUM EXPENSE AND WASTE

LEARNING OBJECTIVE: Describe the supervisor's responsibility to operate with minimum expense and waste.

As a work center supervisor, you don't actually handle money, but you still must be aware of expenses. Remember that not only will such things as a misdirected effort, broken tool, wasted time, wasted material, and injuries actually add to your expenses, they also cut down on efficiency. You have the responsibility for properly ordering and accounting for spare parts and material. Impress upon your personnel the need for thrift in the use of these materials. Train your less experienced personnel to become cost-conscious without sacrificing efficiency.

OPERATING FREE FROM INTERRUPTION AND DIFFICULTY

LEARNING OBJECTIVE: Describe the effects of judicious delegation of authority.

The success of this objective depends largely upon the extent to which the work center, files, test equipment and tools are maintained. Also, the skill level and training of assigned personnel must be considered in meeting this objective. Accurate tracking of test equipment requiring calibration, ensuring tools are in safe working condition, and up-to-date files and publications are also important factors. They contribute to an efficient job completion with minimal interruption or difficulty.

Smooth functioning of the work center may be further enhanced if you delegate authority to other responsible petty officers. Delegation of authority does not relieve you, as supervisor, of the overall responsibility for work accomplishment. It is primarily a means of relieving you of details. If you become too involved with details, you can lose your effectiveness as a supervisor. If your work center can run smoothly and efficiently under normal conditions without your personal directions and efforts, (for a reasonable period of time) your delegation of authority to other members of the crew has been successful.

- Q5. Which of the three broad objectives are affected by wasted materials?*
- Q6. Describe the primary purpose of delegation of authority.*

PLANNING WORK CENTER ARRANGEMENT

LEARNING OBJECTIVES: Identify the two types of maintenance that concern the supervisor. Describe the purpose of the daily maintenance meeting.

It is entirely possible that you may never have the opportunity to plan or assist in planning a work center in a new facility. In almost every case, the supervisor takes charge of an existing functional work center. If your unit is moved to a new base or facility, you are usually assigned to spaces already equipped or laid out for your specific needs. In either case, as the supervisor, you should evaluate the work center's layout. This reevaluation of the work center's layout should include researching applicable allowance lists to determine if the work center equipment allowances have been updated or changed in any way. If changes have been made and the equipment is not available, you should initiate efforts to procure it immediately. There is no use in relocating work center equipment if there are lighting, wiring, ventilation, or plumbing changes to be made if improved replacement models are authorized and available.

Purpose of the Work Center

A basic consideration in planning a work center layout is the purpose of the work center. When more than one working space is available, the supervisor must decide which space is best suited for a particular job. For example, if two spaces are identical in size, one may be completely unacceptable for performing hydraulic sample patch tests, yet may be perfectly suited for a drill press, vise, and workbench.

The general function of the work center must be considered in the allocation of space and equipment. The ideal arrangement contains enough space to have workbenches, special tools, parts and tool stowage space, technical publication stowage, and ample space for the workers. Since this is not always possible, especially aboard ship, the supervisor must decide which of these is most important and what can be sacrificed. It may be decided that all of the toolboxes and special tools should be located in a central toolroom. At the intermediate level, the supervisor may simply have to decide which work centers are to be combined. However, the decision to combine different maintenance functions should be based on

safety, economy, functional compatibility, and convenience.

Arrangement

The arrangement of the furnishings should be made on the basis of use rather than appearance. Moving shop-installed equipment into an out-of-the-way corner may improve the appearance of the space but greatly reduces the efficiency of the personnel using the equipment. It may also create a safety hazard. A good rule to follow is to locate the equipment where it can be safely used by the greatest number of authorized persons with minimum effort in the least amount of time.

Work tables and benches should be positioned with respect to fixed equipment so that the equipment most often used is most quickly and easily reached. Electrical and compressed air outlets should be readily available to workbenches. Needless delays are caused by having to rig unnecessarily long connections from poorly located outlets.

You should give special considerations to the installation of special lighting, such as explosionproof, vaporproof, or interference-free lights, near workbenches where specific or intricate work is to be performed. Another special consideration is that of ventilation. All work spaces should have adequate ventilation under all conditions that are expected to exist in that work space.

The use of paint in various colors to emphasize portions of intricate machinery for safety and reflective purposes is known as dynamic painting. Painting in this category should be kept in an efficient state for maximum effectiveness; however, this type of paint should not be used for normal building maintenance.

The work center layout plan should have a provision for an information or bulletin board. Safety posters, maintenance posters, instructions, notices, plan of the day (POD), and such other information as appropriate should be placed on this board. This board should be located in a prominent place in the work center, preferably near the entrance where everyone assigned must pass at sometime during the day. Material on the bulletin board should be kept current, expired notices removed promptly, the current POD posted early, and safety posters rotated periodically. If the same material is presented in the same format day after day, personnel begin to ignore the board. A new arrangement will arouse curiosity and interest.

Scheduling and Assignment of Workload

Your most important concern as a supervisor is the assignment and accomplishment of the scheduled and unscheduled workload.

Scheduled maintenance can be defined as maintenance that is required by hours, calendar periods (days or weeks), and starts. This type of maintenance is always anticipated and planned. By tracking flight or operating hours, maintenance control knows exactly when a particular aircraft is due for a phase inspection. It is also easy to determine when an aircraft or piece of equipment is due for a 28-day inspection.

Unscheduled maintenance is defined as maintenance that occurs on aircraft or equipment other than scheduled. For example, an aircraft develops a hydraulic fluid leak on preflight, or perhaps while performing scheduled maintenance on an aircraft engine, a worker discovers a cracked or chaffed line. The repair or replacement of that line is unscheduled maintenance.

As the work center supervisor, you should attempt to coordinate the installation of technical directives (TDs) and correct minor discrepancies to coincide with scheduled maintenance. You may not be authorized to wait until the next scheduled maintenance period for the installation of a TD; the assigned category (priority) determines the maximum allowable time period for compliance with the directive. A directive classified IMMEDIATE ACTION may be issued with instructions to be completed "prior to further use of equipment" or "prior to next flight"; a directive classified ROUTINE ACTION must be accomplished within 18 months of the date of issue.

The supervisors objective is the satisfactory completion of assigned tasks in a reasonable amount of time, using available personnel and materials as efficiently as possible. To achieve this objective, the supervisor must become skilled in estimating the amount of time required for each task and the number of workers required. To be able to estimate effectively, you, as the supervisor, must be familiar with the task and know the capabilities of your personnel. You must realize the importance of assigning qualified and unqualified persons to the same job, when possible. Allow for planned interruptions, and yet do not operate on so tight a schedule that minor, unplanned

interruptions completely disrupt the maintenance effort.

Q7. Describe scheduled and unscheduled maintenance.

Estimating Time and Personnel Requirements

Estimating times for completion of maintenance tasks will be one of the supervisors responsibilities. The quality and quantity of personnel assigned to perform these tasks directly affect the time required for completion. Other items that affect time are the type and complexity of maintenance, the availability and condition of materials, work center tools and equipment, and working conditions or job site (in-shop, cold flight deck, etc.).

Probably the most important single aid in estimating time and personnel requirements for maintenance tasks is a JOB PLAN. Within an office, a work center, or on the line, job planning is one of the most important functions of the supervisor. The person who allows an organization to run haphazardly, who never thinks ahead, who is never ready for an emergency or extra workload, and who does not delegate work or trust subordinates is not a good supervisor.

Proper planning saves time, reduces cost, and makes the work easier, safer, and more pleasant for everyone. Proper planning can eliminate friction and confusion, as well as make better use of in-port periods for tasks that cannot be performed underway; it also frees the supervisor from petty details. Planning expedites the work, eliminates "bottlenecks," and makes the supervisor's job easier.

The following hints can help you as a supervisor. In planning a job, use the BIG SIX—WHAT, WHY, WHERE, HOW, WHO, and WHEN.

1. WHAT is the task? What does it involve and what special tools may be required?
2. WHY is the work to be done? (This helps to establish priorities.)
3. WHERE can the job be done? (In-shop, hanger bay, etc.)
4. HOW is the job done? (Electrical or air requirements, etc.)
5. WHO is affected? (Are there other work centers involved? Who is the best qualified?)

6. WHEN is the job to be started and what are the time constraints?

It is not necessary to have an answer to all of these questions; however, the more you can answer, the better plan you will have. As supervisor, start each new shift by checking over the work to be done; plan for maximum use of manpower, equipment, and material. Also, ensure that you attend the maintenance meeting with other work center supervisors. Periodically during the shift, make checks to ensure that work is progressing as planned.

Daily Maintenance Meeting

The daily maintenance meeting is one of the best tools for ensuring a smooth flow of information about maintenance between shifts and other supervisors. This meeting allows all the supervisors within your department or division to brief the maintenance chief on the status of equipment, components, or aircraft that currently have ongoing work or are scheduled to have maintenance performed. It also allows supervisors to coordinate time frames for sharing certain facilities, equipment, or electrical power requirements. In addition, these maintenance meetings may bring to the attention of the maintenance chief items of material that may be difficult to obtain. It may identify certain document numbers that require "hand massaging" by the supply chief.

Q8. What is the most effective tool for ensuring a smooth flow of information regarding maintenance between shifts, other work centers, and maintenance control?

Personnel Work Assignments

Rotate work assignments so that each person in your work center can develop skills in all phases of maintenance. Personnel in lower paygrades should be encouraged to get involved in many different types of maintenance. A worker who understands a system or aircraft will be a better troubleshooter. Additionally, when you rotate work assignments and encourage a wide range of maintenance skills, the work becomes more interesting to the worker. More interest, more quality! If one highly skilled mechanic performs all of the work of a certain type, the supervisor and the work center would suffer if that technician were to transfer, be assigned TAD, or even take a period of well earned leave; this is another reason for rotating work assignments. Assign less experienced workers to work with the skilled mechanics so they can become

proficient at a particular skill. This also permits each person to broaden his/her knowledge.

Allowing for Planned Interruptions

During an average workday, personnel will need to leave their work center for various personal reasons; this may easily interrupt the scheduled workload. Some reasons can be anticipated and some cannot. Among those that can be anticipated are training lectures, inspections, immunization schedules, rating examinations, meals, watches, and other military duties.

Before assigning a task, the supervisor should determine what delays can be anticipated. It may be possible to arrange assignments so that work interruptions are held to a minimum. It is much easier for the same technician to complete a task that he started than for another to pick up where the first worker left off. If interruptions cannot be avoided, the supervisor should allow for these predictable delays when estimating completion times.

QUALITY ASSURANCE

LEARNING OBJECTIVE: State the purpose and concept of Quality Assurance.

When you progress up the ladder of responsibility in aviation maintenance, you become more involved in quality assurance (QA). You may be assigned as a QA representative or a collateral duty inspector. Therefore, you must become quality conscious.

The quality assurance (QA) division determines deficiencies, analyzes discrepancy trends, prescribes inspection procedures, and determines the quality of maintenance accomplished. The division also provides follow-up action and functional guidance to stimulate QA at the departmental level.

NOTE: At the time of publication of this training manual, the NAMP Policy Committee has determined that Naval Aviation Maintenance Program Standard Operating Procedures (NAMPSOP) will take the place of Maintenance Instructions (MIs) throughout naval aviation. MIs are mentioned frequently throughout this chapter as they are still referred to in the NAMP. The next update of the NAMP may reflect the use of NAMPSOP rather than local MIs. Refer to OPNAV NOTICE 4790 for further information regarding NAMPSOP.

CONCEPTS OF QUALITY ASSURANCE

The QA concept is fundamentally the prevention of the occurrence of defects. This includes all events from the start of maintenance operations until their completion. Quality is the responsibility of all maintenance personnel. Achievement of quality assurance depends on prevention, knowledge and special skills.

Prevention of the occurrence of defects relies on the principle of eliminating maintenance failures before they happen. This principle extends to safety of personnel, maintenance of equipment, and virtually every aspect of the total maintenance effort. Prevention is concerned with regulating events rather than being regulated by them.

Knowledge is obtained from factual information. This knowledge is acquired through the proper use of data collection and analysis programs. The maintenance data collection system provides maintenance managers limitless quantities of factual information. Correct use of this information gives management the knowledge needed to achieve maximum readiness of aircraft and weapons systems.

Special skills, normally not possessed by production personnel, are required by a staff of trained personnel for the analysis of data and supervision of QA.

The terms *inspection*, *quality assurance*, and *audit* (as used in this context) have distinct meanings and should be used accordingly. The following definitions are provided to clarify the differences in these terms.

Inspection is the examination (including testing) of supplies and services, including raw material, documents, data, components, and assemblies. Inspection is done to determine if the supplies and services conform to technical requirements.

Quality assurance is a planned and systematic pattern of actions necessary to provide confidence that the product will perform satisfactorily in service. QA is also the monitoring/analyzing of data to verify the validity of these actions.

An *audit* (as it applies to QA) is a periodic or special evaluation of details, plans, policies, procedures, products, directives, and records.

QA provides an efficient method for gathering, analyzing and maintaining information on the quality characteristics of products, on the source and nature of

defects, and their impact on the current operation. It permits decisions to be based on facts rather than intuition or memory. It provides comparative data that will be useful long after the details of the particular times or events have been forgotten. QA requires both authority and assumption of responsibility for action.

A properly functioning QA points out problem areas to maintenance managers so they can act to accomplish the following:

- Improve the quality, uniformity, and reliability of the total maintenance effort.
- Improve the work environment, tools, and equipment used in the performance of maintenance.
- Eliminate unnecessary man-hour and dollar expenditures.
- Improve the training, work habits, and procedures of maintenance personnel.
- Increase the quality and value of reports and correspondence originated by the maintenance activity.
- Distribute technical information more effectively.
- Establish realistic material and equipment requirements in support of the maintenance effort.
- Support the Naval Aviation Maintenance Discrepancy Reporting Program.
- Support the Foreign Object Damage (FOD) Prevention and Reporting Program.

QA serves both management and production equally. Management is served when QA monitors the complete maintenance effort of the department and furnishes the factual feedback of discrepancies and deficiencies. In addition, it acts to improve the quality, reliability, and safety of maintenance. Production is served by having the benefit of collateral duty inspectors who are formally trained in inspection procedures; it is also served by receiving technical assistance in resolving production problems. The introduction of QA to the maintenance function does not relieve production personnel of the basic responsibility for quality work; instead, that responsibility is increased by adding accountability. This accountability is the essence of QA.

RESPONSIBILITIES FOR QUALITY OF MAINTENANCE

The commanding officer is responsible for the inspection and quality of material within a command and the full cooperation of all hands to meet this responsibility. The responsibility for establishing a successful program to attain high standards of quality workmanship cannot be discharged by merely creating a QA division within a maintenance organization. To operate effectively, this division requires the full support of everyone in the organization. It is not the instruments, instructions, and other facilities for inspection that determine the success or failure in achieving high standards of quality; it is the frame of mind of all personnel.

Quality maintenance is the objective. The supervisor must know that high quality work is vital to the effective operation of any maintenance organization. To achieve this high quality work, each person must know not only a set of specification limits, but also the purpose for those limits.

The person with the most direct concern for quality workmanship is the production supervisor. This concern stems from the supervisor's responsibility for the proper professional performance of assigned personnel. A production supervisor is responsible for the assignment of a collateral duty inspector (CDI) at the time work is assigned. This procedure allows the inspector to conduct the progressive inspection required so the inspector is not then confronted with a job already completed, functionally tested, and buttoned up. The completion of production work is not a function of the QA division. Production personnel in the added role of inspector cannot certify inspection of their own work.

Direct liaison between the QA division and production divisions is a necessity and must be energetically pursued. Although the QA officer is responsible to the aircraft maintenance officer (AMO) for the overall quality of maintenance within the department, division officers and work center supervisors are responsible for ensuring that required inspections are conducted and that high quality workmanship is attained.

Q9. What is the purpose of the quality assurance division?

Q10. The prevention of the occurrence of defects relies on what principle?

- Q11. What are the three factors that ensure the achievement of quality assurance?*
- Q12. State the definition of a Q/A audit.*
- Q13. What does the frame of mind of all personnel assigned to a department determine?*
- Q14. When must the production supervisor assign a collateral duty inspector to a task?*

**QUALITY ASSURANCE
DIVISION RESPONSIBILITIES
AND ORGANIZATION**

LEARNING OBJECTIVE: Describe the quality assurance division's responsibilities and its organization.

The quality assurance responsibilities assigned to the QA division include the following:

- Maintain the central technical publications library for the department, including technical directives (TDs). Control classified technical publications for the department. Ensure that each division or branch receives all publications applicable to its respective work areas and that these are kept current and complete.
- Establish qualification requirements for quality assurance representatives (QARs), collateral duty quality assurance representatives (CDQARs), and collateral duty inspectors (CDIs). Review the qualifications of personnel nominated for these positions, and endorse these nominations to the department head.
- Periodically accompany CDIs during scheduled and unscheduled maintenance tasks to observe their proficiency.
- Ensure that all work guides, checklists, check sheets, maintenance requirements cards, etc., used to define or control maintenance operations are complete and current before they are issued to crews or individuals.
- Review all engineering investigation (EI) requests, quality deficiency reports (QDRs), technical publications deficiency reports (TPDRs), hazardous material reports (HMRs), hazard reports (HRs), and aircraft discrepancy reports (ADRs) to ensure that they are accurate, clear, concise, and comprehensive before mailing.

- Monitor inspections of precision measuring equipment (PME) to ensure compliance with calibration intervals and safety instructions.
- Perform inspections of all maintenance equipment and facilities to ensure compliance with fire and safety regulations; that satisfactory environmental conditions exist; that equipment operators and drivers are properly trained, qualified, and licensed; and that equipment is maintained in a safe operating condition.
- Provide a continuous training program in techniques and procedures pertaining to the conduct of inspections. When directed or required, provide a technical task force to study trouble areas and submit recommendations for corrective action.
- Use information from the maintenance data reports (MDRs) and NALCOMIS reports to develop discrepancy trends, and to identify failure areas or other maintenance problems.
- Review source documents and periodic inspection records, and note recurring discrepancies that require special actions.
- Maintain liaison with contractors via the contracting officer's representative (COR), Naval Aviation Engineering Services Unit (NAESU), Naval Aviation Depot Operations Center (NAVAV-NDEPOTOPSCEN), and other available field technical services. Establish and maintain liaison with other maintenance and rework activities to obtain information on ways to improve maintenance techniques, quality of workmanship, and QA procedures.
- Obtain and use appropriate inspection equipment, such as lights, borescopes, mirrors, magnifying glasses, fluorescent inspection kits, tensiometers, pressure gauges, and carbon monoxide testers. Ensure that production personnel have such equipment available, in operating condition, calibrated, if applicable, and in use.
- Ensure that established standard procedures are observed for conducting scheduled and unscheduled inspections, ground tests and bench checks of components, including engines. Periodically (at a minimum, once a quarter) accompany check crews or plane captains during inspections. Check the performance of their work to ensure that the desired quality level is obtained.
- Ensure check pilots and aircrew members are briefed before the post maintenance functional check flight (FCF) so the purpose and objective of the flight are clearly understood. After completion of the FCF,

conduct a debrief with the check pilot, aircrew members, a maintenance control representative, and applicable work center representatives for compliance with objectives outlined on the FCF checklist, and to clarify discrepancies noted. The completed check flight checklists are retained in the aircraft maintenance files for a minimum of 6 months, or one phase cycle, whichever is greater.

- Ensure the configuration of aircraft, aeronautical components, and support equipment (SE) is such that all essential modifications have been incorporated.

- Ensure an inspection is conducted on all equipment received for use, returned for repair, or held awaiting repair to verify that its material condition, identification, packaging, preservation, and configuration are satisfactory; and, when applicable, that shelf-life limits are not exceeded.

- Review all incoming technical publications and directives to determine their application to the maintenance department.

- Prepare or assist in the preparation of maintenance instructions to ensure that QA requirements are specified (until *Naval Aviation Maintenance Program Standard Operating Procedures*, NAMPSOP, Volume V, of OPNAVINST 4790.2 is issued).

- Maintain current assignments of personnel qualified for specific QA responsibilities. Activities using Naval Aviation Logistics Command Management Information System (NALCOMIS) should refer to the User's Manual for specific procedures.

- Be responsible for the effective monitoring of the Enhanced Comprehensive Asset Management System (ECAMS).

- Be responsible for effective monitoring of hazardous material and hazardous waste procedures within the aircraft maintenance department.

The QA division is organized with a small group of highly skilled personnel. These permanently assigned personnel, under the QA officer, are responsible for conducting and managing the QA effort of the department. The maintenance personnel assigned to the QA division are known as QARs. To obtain more efficient use of the information collected by the aviation Maintenance Data System (MDS) and to increase the scope of QA for commands still operating under VIDS, a qualified data analyst is assigned to the QA/A division. The primary duties of the data analyst or NALCOMIS system administrator

are discussed briefly in Chapter 1 and are outlined specifically in OPNAVINST 4790.2.

The number of personnel assigned to the QA division varies among activities, depending on the size of the unit and number of work shifts. When activities with four or less aircraft assigned or small OMDs elect to organize a QA division, the QA officer and the QA supervisor will be permanently assigned. Usually, in a small OMD under a one work center concept, qualified personnel are designated as CDQARs to carry out the QA verification functions.

Q15. At a minimum, how often must plane captains have their qualifications monitored by Q/A?

Q16. Why must a QAR brief the check pilots and aircrew prior to a functional check flight (FCF)?

Q17. What division is responsible for reviewing all incoming technical publications and directives to determine their application to the maintenance department?

Q18. In relation to the organization of a quality assurance division, what determines the number of assigned personnel?

QUALITY ASSURANCE REPRESENTATIVES

LEARNING OBJECTIVE: Describe the functions and qualifications of QARs, CDQARs, and CDIs.

The need for quality control requires that only highly skilled maintenance personnel be designated as QA representatives/inspectors. QARs and CDIs must be highly qualified personnel with the ability to ensure quality of maintenance within their technical areas. Under this concept, the personnel in the production divisions are ultimately responsible for the quality of work performed in the department. The QA division monitors the production and ensures that high quality workmanship is accomplished by maintenance personnel and that specifications and quality standards are met. QA is concerned with the completeness and adequacy of inspections, and emphasis is placed on the thoroughness of the inspection rather than the number of units inspected.

Quality Assurance Representatives Functions

The nucleus of the QA division is a group of QARs. These permanently assigned representatives

are, in most activities, supplemented by designated CDIs. The QARs perform the following functions:

- Review incoming technical publications and directives to determine their application to the maintenance department.
- Assist in the certification of production personnel.
- Participate as members of technical task forces to investigate trouble areas and recommend corrective actions.
- Ensure QA objectives and requirements are defined during MI preparation (until completely under the NAMPSOP).
- Review qualifications of personnel nominated to become CDIs or CDQARs, and provide recommendations as appropriate.
- Investigate Hazard Reports (HRs), as defined in OPNAVINST 3750.6 (series), applicable to the unit that are received from other activities. Assist in the preparation of NAMDRP reports. Review all report entries for adequacy and correctness before distribution.
- Provide technical assistance to CDIs and production personnel. Periodically accompany CDIs on assigned inspections and evaluate their performance.
- Review MDRs, NALCOMIS reports, Maintenance Action Forms (MAFs), NAMDRP reports, and HRs to determine discrepancy trends and specific problem areas in areas of responsibility.
- Upon completion of tasks that require certification by QARs, conduct final inspections.
- Monitor the calibration or certification status of equipment, tools, and personnel used in each work center.
- Coordinate with the analyst in the development of discrepancy trends and such charts and graphs that are necessary to depict quality performance.
- Maintain liaison with contractors via the COR NAESU, NAVAVNMAINTOFF, cognizant field activities (CFAs), and other available field technical services. Establish and maintain liaison with other maintenance and rework activities to obtain information for improving maintenance techniques, quality of workmanship, and QA procedures.
- Develop checklists for auditing work centers, specific maintenance programs, and processes that require monitoring by QA.

- If flight control malfunctions occur, comply with the applicable type/model/series conditional maintenance requirements cards.

- Perform QA inspections, ensuring each inspection includes an examination of the work area for sources of potential FOD. Ensure contractor and field maintenance teams are briefed about the FOD Prevention Program requirements and reporting procedures.

Quality Assurance Representative Qualifications

All personnel considered for selection as a QAR should possess the following qualifications:

- Senior in grade and experience. This means a petty officer (E-6 or above) with a well-rounded maintenance background. Unusual circumstances may temporarily require the use of other than E-6 or above personnel. Under such circumstances, the most experienced personnel available, as determined by the AMO, may be temporarily designated as a QAR.
- Fully developed skills and experience related to the technical-fields under their cognizance.
- The ability to research, read, and interpret drawings, technical manuals, and directives.
- The ability to write with clarity and technical accuracy.
- Stability and excellence in performance.
- The motivation and personal desire to develop greater knowledge of his or her technical specialty.
- An observant, alert, and inquiring nature.
- The ability to work with others.

Billet descriptions are prepared for QA division personnel to ensure that all QA functions and responsibilities, covered in the Naval Aviation Maintenance Program (NAMP), are assigned.

COLLATERAL DUTY QUALITY ASSURANCE REPRESENTATIVES

When CDQARs are assigned to work centers or production divisions, they function in the same capacity as QARs and must meet the same minimum qualification requirements as their QA division counterparts. When CDQARs are assigned to work centers or production divisions because of temporary shortages of skills, and these shortages have not been

alleviated within 90 days, a letter must be submitted to the aircraft controlling custodian (ACC), through the chain of command, advising of the personnel problems, action taken, and intent to continue the assignments. ACCs will take action to authorize activities to continue or to curtail the assignment. The letter will contain name, rate, Navy enlisted classification (NEC), and functional area.

Permanent CDQARs may be assigned to organizational maintenance activities that have minimal ordnance delivery in their assigned mission, and where manning the armament billet would not be justified. An organizational activity may also designate a permanent aircrew personal protective/survival equipment CDQAR and an egress/environmental systems CDQAR when the activity's aircraft are not equipped with ejection seats. Permanent CDQARs also may be designated to supplement multiple work shifts or detachments, provided QA division billets are fully manned. Permanent CDQARs may also be assigned when the activity maintains four or less aircraft and is organized according to guidelines set forth in the NAMP.

COLLATERAL DUTY INSPECTORS

The CDIs assigned to the production or maintenance training unit (MTU) work centers inspect all work and comply with the required QA inspections during all maintenance actions performed by their respective work centers. They are responsible to the QA officer when performing these functions. CDIs spot check all work in progress. This requires them to be familiar with the provisions and responsibilities of the programs that QA manages and monitors.

The QA division establishes minimum qualifications for personnel selected for CDI. Division officers are responsible for ensuring that sufficient qualified personnel are nominated for CDI to comply with QA inspections required during all maintenance actions. Due to the importance and responsibility of duties performed by CDIs, division officers and work center supervisors must carefully screen all candidates for these assignments. CDIs must demonstrate their knowledge and experience on the particular type of equipment by successfully passing a locally prepared written test administered by the QA division. In addition, a locally prepared oral or practical examination may be administered. When a CDI is transferred from a production work center, his or her designation as a CDI for that work center remains valid

for only as long as his or her qualifications are current, as judged by the cognizant division officer.

NOTE: A CDI will NOT inspect his or her own work and sign as inspector.

QUALITY ASSURANCE REPRESENTATIVE TRAINING

The QA officer ensures that personnel assigned to perform QA functions receive continuous training in inspecting, testing, and quality control methods specifically applicable to their area of assignment. The QA officer also ensures that QARs receive cross training to perform those QA functions not in their assigned area. This training should include local training courses, on-the-job training (OJT), rotation of assignments, personnel qualifications standards (PQS), and formal schools. According to OPNAVINST 4790.2, QARs should attend a Fleet Aviation Specialized Operational Training Group Detachment QA course.

Division officers are responsible for establishing and maintaining training programs for production personnel involved with QA functions. This responsibility includes training in troubleshooting, testing, and inspection techniques; ensuring that operations requiring certified operators are accomplished; and that steps are taken to qualify and certify affected personnel.

QARs, CDQARs, and CDIs must be designated in writing by the AMO. The only deviation authorized allows the officer in charge (OIC) of a detachment to designate QA personnel provided (1) the deployment period is more than 90 days, and (2) all procedures and requirements for designating QA personnel are accomplished by the detachment. See figure 6-1 for a sample of a Quality Assurance Representative/Inspector Recommendation/Designation form.

ISSUE AND CONTROL OF QUALITY ASSURANCE STAMPS

QA stamps may be used in place of a signature. They are required in an intermediate maintenance activity/aircraft intermediate maintenance department (IMA/AIMD), but are optional at organizational-level maintenance. In an IMA/AIMD, all QARs, CDQARs, and CDIs receive QA stamps.

At the organizational level, QA stamps are to be used by QARs and CDQARs only. These open-purchased, numbered, impression stamps, which

QUALITY ASSURANCE REPRESENTATIVE/INSPECTOR RECOMMENDATION/DESIGNATION

CANDIDATE NAME	RATE
----------------	------

I. DIVISION OFFICER RECOMMENDATION

In accordance with the current OPNAVINST 4790.2 the above named person is recommended for:

QAR
 CDQAR
 CDI

FOR: (AIRCRAFT / SYSTEM / WORK CENTER / ETC.)

DIVISION OFFICER TYPED NAME AND RANK	SIGNATURE	DATE
--------------------------------------	-----------	------

II. QUALITY ASSURANCE/ANALYSIS OFFICER ENDORSEMENT.

The candidate has been examined in accordance with the current OPNAVINST 4790.2 and has passed all requirements satisfactorily. Recommend approval.

QA/A OFFICER TYPED NAME AND RANK	SIGNATURE	DATE
----------------------------------	-----------	------

III. AIRCRAFT MAINTENANCE OFFICER ACTION

DESIGNATED
 NOT DESIGNATED

AIRCRAFT MAINTENANCE OFFICER TYPED NAME	SIGNATURE	DATE
---	-----------	------

IV. DESIGNEE RESPONSIBILITY

SAMPLE

I UNDERSTAND MY RESPONSIBILITY AS SET FORTH HEREIN:

"When performing inspections, I am considered to be the direct representative of the Commanding Officer for ensuring safety of flight of the item concerned. I will not permit factors, such as operational desires, maintenance consideration, personal relations or the approach of liberty to modify my judgment. By signing an inspection report, I am certifying upon my own individual responsibility that the work involved has been personally inspected by me, that it has been properly completed and is in accordance with current instructions and directives; that it is satisfactory; that any related parts or components which may have been removed by the work are properly replaced and all parts are secure; and that the work has been performed in such a manner that the item is completely safe for flight or use."

CANDIDATE TYPED NAME AND RANK	STAMP NO.	SIGNATURE	DATE
-------------------------------	-----------	-----------	------

OPNAV 4790/12 (Rev. 8-90) S/N 0107-LF-010-5700

Original to:
Copy to:

Individual
Quality Assurance/Analysis Officer
Division Officer

AMR00091

Figure 6-1.—Quality Assurance Representative/Inspector Recommendation/Designation (OPNAV 4790/12).

identify the inspector, are used in place of signatures to certify completion of inspections on maintenance documents and in place of initials where use of initials is specifically authorized. The QA division closely controls these stamps. Once a QA stamp is turned in by an inspector, either due to transfer or loss of qualifications, it may not be reassigned within a period of 3 months.

Q19. Who has the responsibility to review MDRs, NALCOMIS reports, and VIDS/MAFS to determine discrepancy trends and specific problem areas?

Q20. Under normal circumstances, what paygrade is usually assigned as a QAR?

Q21. How long may a CDQAR be assigned to a work center without having to notify the aircraft controlling custodian?

Q22. When may a CDI inspect his own work and sign as inspector?

Q23. When a deployment period is more than 90 days and all requirements for assigning QA personnel have been met by the detachment, who may designate QA personnel?

Q24. What is used to annotate an inspection on a VIDS/MAF in place of a signature at an AIMD?

QUALITY ASSURANCE INSPECTIONS

LEARNING OBJECTIVE: Identify the types of quality assurance inspections.

QA inspections are essential elements of an effective QA program. To comply with assigned responsibilities, QA personnel perform the following QA inspections:

- Mandatory QA inspections specified in maintenance instruction manuals (MIMs), TDs, and local MIs.

- Those inspections required to be conducted by QA personnel during and/or upon the completion of a maintenance action.

- QA maintenance requirements cards (MRCs) provided for all maintenance tasks that, if improperly performed, could cause equipment failure or jeopardize the safety of personnel. The "QA" appearing on MRCs signifies that a QA function is required. Local commands must determine and designate, in writing, by annotating the master and the work center decks,

whether a QAR, CDQAR, or CDI performs the QA functions listed in the MRCs. QA inspections are performed during or after task performance.

If the proper performance of a task cannot be determined after the task is completed, a QA inspection is required while the task is being performed. Work cannot proceed past the inspection point indicated on the task MRC without the approval of the inspector. For these inspections, the notation "QA Required" appears on the MRC containing the task. If the proper performance of a task can be determined by a visual inspection after the task was completed, a QA inspection is required after task completion.

Each work center sets up procedures to ensure that the QA inspection requirements are complied with during all maintenance evolutions. With these procedures developed, inspections normally fall into one of the three following inspection areas.

- **RECEIVING OR SCREENING INSPECTIONS.** These inspections apply to material, components, parts, equipment, logs and records, and documents. CDIs normally conduct these inspections to determine the condition of material, proper identification, maintenance requirements, disposition, and accuracy of accompanying records and documents.

- **IN-PROCESS INSPECTIONS.** These inspections are specific QA functions that are required during the performance of maintenance requirements and actions when satisfactory task performance cannot be determined after the task has been completed. When designated, these inspections include witnessing application of torque, functional testing, adjusting, assembling, servicing, installation, and similar tasks.

- **FINAL INSPECTIONS.** These inspections comprise specific QA functions performed following the completion of a task or series of tasks. QA inspection of work areas following task accomplishment by several different personnel is an example of a final inspection.

In-process and Final Inspections

CDIs normally conduct these inspections; however, QARs and CDQARs must conduct in-process and final inspections of all tasks that require the aircraft to have a functional check flight (FCF) in an O-level maintenance activity. QARs and CDQARs also must perform inspections of maintenance tasks involving egress systems, personnel parachutes, and flotation devices when the affected mechanism or function of that equipment is not reinspected or

functionally tested before flight. Aircraft maintenance officers determine which additional maintenance tasks require QAR or CDQAR level in-process and final inspections. Only those personnel designated as QARs, CDQARs, and CDIs are authorized to sign as inspector for QA inspection requirements. While not all QA inspections conducted during the various phases of maintenance require a signature, all specified QA inspections are conducted, witnessed, and/or verified by designated QA personnel.

Quality Assurance Inspection Sign-offs

The QA inspector who actually performs the inspection of the standards of the work signs the "INSPECTED BY" block on all VIDS/MAFs. The sign-off on documents that do not involve an actual inspection (for example, a control document for a phase inspection) is a certification that all QA functions associated with the inspection have been performed and that the designated QA inspectors received and accepted all necessary documentation. In activities using NALCOMIS, refer to the *NALCOMIS User's Manual* for specific details and procedures related to QA inspection sign-offs.

NOTE: Do not be tempted by operational tempo or commitment to sign off any maintenance task without physically inspecting the job.

In-flight Maintenance Sign-offs

In the absence of designated QA personnel during in-flight maintenance, the senior aircrew maintenance person is authorized to sign as inspector. He or she inspects the work performed from a technical standpoint to ensure that sound maintenance procedures were followed and that areas where maintenance was performed are free of foreign objects. If the discrepancy involves safety of flight, a QAR inspects the repairs upon return to home base. This is in addition to the inspection already performed by the in-flight personnel.

Transient Maintenance Sign-offs

In the absence of designated QA expertise during transient maintenance, the pilot in command is authorized to either sign as inspector or designate a qualified member of the aircrew to function in this capacity. The pilot or person designated inspects the work performed from a technical standpoint, ensures that sound maintenance procedures were followed,

and that the areas where maintenance was performed are free from foreign objects. If the discrepancy involves safety of flight, a QAR reinspects the repairs upon return to home base.

- Q25. *What person or activity decides if a CDI, CDQAR, or QAR is to perform inspections required by "QA " annotated on an MRC?*
- Q26. *During a maintenance evolution, inspections normally fall into three categories. What are the three categories?*
- Q27. *QAR and CDQAR are required to conduct in-process and final inspections of all maintenance tasks that require what actions?*
- Q28. *When must a QAR reinspect in-flight maintenance sign-offs?*

QUALITY ASSURANCE PROGRAMS

LEARNING OBJECTIVE: Describe the programs that are managed and monitored by quality assurance.

The QA division manages or monitors many different types of programs. Until Volume V of the NAMP, OPNAVINST 4790.2 (NAMPSOP), is distributed, local MIS should be prepared by your activity for each program

QUALITY ASSURANCE MANAGEMENT

Currently local maintenance instructions contain procedures for implementing management programs that contain information, techniques, local policy procedures, and methods to manage each program. Soon NAMPSOP will replace these MIs. The programs managed by QA are covered in the following paragraphs.

Quality Assurance Audits

Audits are essential elements of an effective QA program. Audits provide an evaluation of performance throughout the department and serve as an orderly method of identifying, investigating, and correcting deficiencies. They also evaluate various maintenance tasks and procedures. Audits monitor those specific maintenance programs assigned to QA for monitoring. Audits fall into two categories—work center audits and special audits.

THE WORK CENTER AUDIT.—QA conducts these audits quarterly to evaluate the overall quality performance of each work center. As a minimum, QA evaluates the following items:

- Personnel and skills
- Technical publications
- Compliance with NAMP programs and MIs (or NAMPSOP)
- Adherence to directives, procedures, inspections, and applicable end-to-end testing
- Adequacy and availability of written process, test, and inspection procedures
- Availability, calibration status, and proper use of test and measuring devices
- Accuracy and proper use of the Maintenance Data System (MDS)
- Certification of personnel performing special processes, such as nondestructive inspection (NDI) and welding
- Designation of plane captains, if applicable
- Licensing of personnel for taxi, turnup, and operation of SE
- Handling, packaging, protection, and storage of aeronautical material
- Cleanliness and condition of working spaces
- Compliance with fire and safety regulations
- Configuration of aircraft, components, and SE
- Accuracy of equipment logs and records
- Material condition of aircraft and SE
- Validation of VIDS boards and VIDS operating procedures if operating using VIDS. If operating NALCOMIS OMA, review and verify newly initiated. MAFs by using the work center workload report; if NALCOMIS IMA, validation of current job status
- Compliance with the FOD prevention program
- Industrial Radiation Safety Program

SPECIAL AUDITS.—In addition to scheduled work center audits, QA conducts special audits to evaluate specific maintenance tasks, processes, procedures, and programs. These audits provide a systematic, coordinated method of investigating known deficiencies, evaluating the quality of workmanship, and determining the adequacy of and adherence to technical publications and instructions.

QA uses special audits to monitor maintenance programs and processes specifically assigned to QA for monitoring. In addition, QA conducts special audits of periodic inspections, testing, and servicing of aircraft by organizational maintenance activities. The QA officer normally directs special audits.

Quality assurance develops audit forms with checklists for each work center. The QA division also prepares an audit MI and includes the audit checklists as enclosures to the MI.

Upon completion of an audit, QA reviews the findings with the work centers involved. QA submits a report of the findings, with recommendations when required, to the AMO with a copy to the cognizant division(s). Records of audits are maintained for 1 year. Follow-up procedures ensure that discrepancies found during a QA audit are resolved in a timely fashion.

Maintenance Department or Division Safety

The QA division is assigned the overall responsibility for the maintenance department safety. The intent of this program is to assist in the coordination of the total safety effort.

The maintenance department safety program helps to identify and eliminate hazards. Effectiveness and safety result when properly trained personnel use properly designed equipment and follow procedures under competent supervision. It is an **all hands** effort.

Any safety effort must address aviation and industrial safety. OPNAVINST 3750.6 contains the instructions for maintenance personnel participation in command aviation safety programs. It also contains the instructions for investigating and reporting naval aviation hazards that are not reportable under the NAMP. Even though OPNAVINST 3750.6 calls for specific reports, you still have to follow reporting procedures called for in the NAMP.

Other references you may use in relation to maintenance department safety are as follows:

- *Navy Occupational Safety and Health Programs for Forces Afloat*, OPNAVINST 5100.19, which contains safety precautions to be followed while aboard ship.
- *Standard Organization and Regulations of the U. S. Navy*, OPNAVINST 3120.32, which contains the standards for organizing a ship/station/squadron's

safety department and information on billet descriptions and responsibilities.

- *NAVAIROSH Requirements for the Shore Establishment*, NAVAIR A1-NAOSH-SAF-000/P-5100-1, which contains safety precautions to be followed while ashore.

QA's responsibilities to the maintenance department safety program are as follows:

- Disseminate safety posters and literature.
- Report all hazards, mishaps, and unsafe practices in the department.
- Conduct safety meetings within the department, at least monthly.
- Coordinate aspects of safety with the aviation safety officer.
- Participate in the activity's safety surveys and stand downs.

When a report is required by OPNAVINST 3750.6, the QA division collects and provides maintenance and material data necessary for preparation of required reports.

Q29. What programs are managed by quality assurance?

Q30. What are the two categories of audits performed by Q/A?

Q31. Upon completion of an audit, the findings are forwarded to the AMO, with a copy going where?

Q32. How long are past audits maintained by Q/A?

Q33. In addition to reporting naval aviation hazards in accordance with OPNAVINST 3750.6, you still must follow reporting procedures called for in what manual?

Q34. With regard to maintenance department safety, what does the Q/A division have a responsibility to do at least monthly?

The Naval Aviation Maintenance Discrepancy Reporting Program (NAMDRP)

NAMDRP is the method for reporting hazardous deficiencies in material, publications, substandard workmanship, and improper QA procedures.

The QA division manages the program and assists the various work centers in determining if one or more of these reports are needed for a maintenance problem

or occurrence within the activity. They are also responsible to review all HMRs, EI requests, QDRs, and TPDRs to ensure they are accurate, clear, concise, and comprehensive. The work center supervisor provides assistance to the QA representative with information needed to complete the message request.

The QA division also initiates and maintains a report log and assigns a report control number (RCN) to each NAMDRP report. RCNs are assigned sequentially throughout the calendar year, regardless of the type of report.

The RCN is composed of 12 elements as follows:

- Element (1) is the Service Designator code of the originating activity. Refer to the OPNAVINST 4790.2 for Service Designator codes.
- Elements (2) through (6) are the Unit Identification Code (UIC) of the originating activity, followed by a dash (-).
- Elements (7) and (8) are a two-character identification of the calendar year, followed by a dash (-).
- Elements (9) through (12) are the locally assigned "control numbers." These numbers are sequential, beginning with 0001 each calendar year.

The various reports required under the NAMDRP are as follows:

- Hazardous Material Report (HMR)
- Engineering Investigation (EI) request
- Quality Deficiency Report (QDR)
- Technical Publication Deficiency Report (TPDR)
- Aircraft Discrepancy Report (ADR)

The aviation safety officer, with assistance from QA, reviews all correspondence concerning aircraft, ground, flight, flight-related, and explosive mishaps.

All hands have a responsibility to be alert for safety-related defects or discrepancies, which is the primary reason for submitting each report.

If a report meets the criteria for an HMR and warrants an EI Request, a Category (CAT) I QDR, or TPDR, is sent as a dual message report.

Exceptions to the NAMDRP and its reporting procedures are as follows:

- Changes or corrections to the Naval Air Training and Operating Procedures Standardization (NATOPS) manuals or tactical manuals are reported by using procedures found in OPNAVINST 3710.7 and NAVAIRINST 3710.10 using OPNAV 3710/6.

- Deficiencies resulting from incorrect preservation, packaging, marking and/or handling (when reported by supply activities) or deficiencies in shipment that are the result of overage, shortage, expired shelf life, or misidentified material are reported according to instructions found in NAVSUPINST 4440.179.

- Locally procured material found to be deficient by the procuring activity is reported according to instructions contained in NAVSUPINST 4440.189.

- Deficiencies in letter-type instructions and notices are reported by letter to the sponsor. Discrepancies in OPNAVINST 4790.2 are reported by naval letter to Naval Aviation Maintenance Office (NAMO) (Code 46), via the chain of command.

- Incorrect source, maintenance, and recoverability (SM&R) codes are reported according to NAVAIRINST 4423.11.

- Recommendations for improvements in procedures that do not result from incorrect information contained in publications are reported by letter to Naval Air Technical Services Facility (NAVAIRTECH-SERVFAC).

- Explosive incidents, dangerous defects, and malfunctions or failures involving explosive systems, launch devices, and armament weapons support equipment are reported under OPNAVINST 8600.2 as an Explosive Mishap Report (EMR) or a Conventional Ordnance Deficiency Report (CODR). These reports still fall under the NAMDRP for accounting and monitoring purposes.

A brief description of each of the programs of the NAMDRP is contained in the following paragraphs.

HAZARDOUS MATERIAL REPORT.—This report provides a standard method for reporting material deficiencies that, if not corrected, could result in death or injury to personnel, or damage to or loss of aircraft, equipment, or facilities. Report such incidents regardless of how or when the discrepant condition was detected. Submit an HMR priority precedence message within 24 hours of discovery under one or more of the following conditions:

- Malfunction or failure of a component that, if not corrected, could result in death or injury to personnel, or damage to or loss of aircraft, equipment, or facilities. In case of a naval aircraft mishap, as defined in OPNAVINST 3750.6, submit required reports according to that instruction. The submission of reports required by OPNAVINST 3750.6 does not eliminate any of the requirements for submission of reports required by the NAMP.

- A configuration deficiency discovered in aeronautical equipment (aircraft, SE, components, etc.) that constitutes a safety hazard.

- An urgent action or assistance required and a corrective action completed at an early date because of an operational requirement.

- A system malfunction or failure may occur because of a part design, which might allow the part to be installed improperly.

- A potential or experienced in-flight or on-the-ground loss of aircraft parts in which maintenance or material factors are involved. Use the term *things falling off aircraft (TFOA)* when referring to such incidents. TFOA includes incidents generally categorized in other areas, such as a foreign object damaged engine, which sheds parts, or a helicopter rotor blade pocket failure.

ENGINEERING INVESTIGATION.—EIs apply to all aircraft and weapons systems, their subsystems, equipment, components, related SE, special tools, fluids, and materials used in operating the equipment. The three types of EIs are (1) disassembly and inspection, (2) material analysis, and (3) engineering assistance.

Submit EI requests under one or more of the following conditions:

- Safety is involved. This includes EI requests prepared in conjunction with aircraft mishaps, and HMRs when it is evident that an unsafe condition exists.

- Additional technical or engineering information is required to complete an aircraft mishap investigation.

- Aircraft readiness is seriously impaired due to poor material reliability (including SE).

- A component is rejected through the Joint Oil Analysis Program (JOAP) after authorized repairs are attempted and exhausted at the O and I levels of maintenance.

- When environmental issues force material or process changes that conflict with existing publications or TDs.

- When directed by higher authority.

Submit the EI request by routine precedence message within 5 working days after discovery of the deficiency unless combined with the HMR, in which case the combined report is to follow HMR reporting criteria. The supporting supply department and the CFA supply department are information addressees on the EI message.

QUALITY DEFICIENCY REPORT.—This report provides maintenance activities with a method for reporting deficiencies in new or newly reworked material. Unless the materials are under warranty, failures must have occurred at zero operating time, during initial installation, operation, test, check, turnup, or first flight. It differs from the EI program in that it reports on possible deficiencies in quality assurance during the manufacturing or rework process. The goal is to improve the quality of work done by naval aviation depots (NAVAVNDEPOTs), contractors, and subcontractors returning reworked material to supply stock.

There are two types of QDRs.

- CAT I. A quality deficiency which will, or may, affect safety of personnel, impair the combat efficiency of an individual or organization, or jeopardize mission accomplishment.

- CAT II. All quality deficiencies that are assessed to have significant and widespread material or human resource impact and do not affect the conditions of a CAT I.

CAT I QDRs are reported by routine precedence message within 1 working day after the discovery of the deficiency unless combined with an HMR. A combined HMR CAT I QDR follows HMR reporting guidelines.

CAT II QDRs are submitted on an SF 368 to the CFA within 5 working days of the discovered deficiency.

TECHNICAL PUBLICATION DEFICIENCY REPORT.—This report applies when a technical publication deficiency is detected that, if not corrected, could result in death or injury to personnel, or damage to or loss of aircraft, equipment, or facilities. The action addressees for the message report is NAVAIRTECHSERVFAC and the CFA for the

aircraft weapons system or item being reported. If the CFA for the weapons systems or material cannot be determined, the action addressee is NAVAIR-TECHSERVFAC. This report is a CAT I TPDR and must be submitted within 24 hours of the discovered deficiency.

A CAT II TPDR is a simplified procedure for reporting technical publication deficiencies. Publication deficiencies include technical errors, wrong measurement values, incorrect use of support equipment, wrong sequence of adjustments, part number errors or omissions, and microfilm deficiencies, such as poor film quality.

Technical publications include MRCs, checklists, Work Unit Code (WUC) manuals, MIMs, illustrated parts breakdowns (IPBs), and other technical manuals. The TPDR program does not apply when deficiencies in instructions or notices are reported. Submit improvement procedures that do not result from incorrect information contained in the publication but are recommendations by letter to NAVAIR-TECHSERVFAC.

AIRCRAFT DISCREPANCY REPORT.—The ADR is a method for reporting defects discovered in newly manufactured, modified, or reworked aircraft that require immediate attention to ensure acceptable standards of quality in aircraft maintenance and rework procedures. The cognizant defense plant representative office, administrative contracting office, or NAVAVNDEPOT will enclose sufficient copies of the ADR form (Standard Form 368) with envelopes preaddressed, in each aircraft logbook for delivery with the aircraft. Additionally, they ensure that a copy of the previous reporting custodian's work request is furnished to the ferry pilot and functional wing. Naval Aviation Depot Operations Center (NAVAVNDEPOTOPSCEN) is the ADR screening point on aircraft commercially reworked under the procuring contract office.

An acceptance inspection is performed and a functional check flight flown as soon as possible after the aircraft is delivered and prior to maintenance (other than required to complete the acceptance inspection) or further flight. Only those discrepancies noted by the ferry pilot or crew and those found during the acceptance inspection and check flight are reported.

In reporting the initial acceptance of an aircraft, use "Initial Acceptance Inspection of Aircraft" as the subject of the Standard Form 368. Submit this initial

report within 5 working days of the acceptance check flight. A supplemental report, if needed, must be submitted not later than 30 days after completion of the check flight.

Support Equipment Misuse/Abuse

SE Misuse/Abuse forms can be submitted by anyone witnessing misuse or abuse (fig. 6-2).

The division of the individual originating the report retains a copy of the SE Misuse/Abuse report. The report is sent to the organization that has Individual Material Readiness List (IMRL) reporting responsibility for the SE. A copy of the report is sent to the CO of the command to which the offender is attached and/or the CO of the command that held custody of the item where the misuse or abuse occurred for appropriate action. As a minimum, the QA division

OPNAV 4790/108 (S-1) (BACK)							
FIRST ENDORSEMENT			DATE				
FROM:							
TO:							
VIA:							
SUBJ: MISUSE/ABUSE							
I. ACTION TAKEN/RECOMMENDATIONS							
<div style="text-align: center; font-size: 2em; font-weight: bold; opacity: 0.5;">SAMPLE</div>							
				SUPPORT EQUIPMENT MISUSE/ABUSE			CONTROL NO.
				FROM		TO	
				THE FOLLOWING INFORMATION IS SUBMITTED IN REGARDS TO A REPORT OF MISUSE/ABUSE:			
				PERSON WHO MISUSED ABUSED EQUIPMENT	NAME		RANK/RATE
					ORGANIZATION/UNIT		SS LICENSE NO.
							GOVT OPERATOR LICENSE NO.
				LOCATION AND EQUIPMENT INVOLVED	LOCATION		TYPE EQUIPMENT PN/PN
							TIME
							DATE
							EQUIPMENT SERIAL NO.
				JCN			
				NARRATIVE DESCRIPTION			
				SIGNATURE AND TITLE			
				PERSON CITING MISUSE/ ABUSE	NAME		RANK/RATE
ORGANIZATION/UNIT							
WAS SS LICENSE CONFISCATED?		<input type="checkbox"/> YES	<input type="checkbox"/> NO				
IF YES, LICENSE IS BEING HELD BY:		REMARKS					
SIGNATURE AND TITLE OF REPORTING OFFICIAL			DATE				

AMR00092

Figure 6-2.—SE Misuse/Abuse Form (OPNAV 4790/108).

of the command receiving the report conducts an investigation. Also, QA performs an analysis to provide appropriate recommendations for corrective action.

Aviation Gas Free Engineering (AVGFE)

The purpose of the AVGFE program is to ensure a safe environment when aeronautical fuel systems are worked on. NAVAIR 01-1A-35 outlines requirements for the AVGFE program. Technicians certified under the AVGFE program must be qualified QARs or CDQARs and have graduated from an approved AVGFE program course. O-level activities normally provide their own AVGFE technicians; however, those activities with less than three gas free engineering (GFE) requirements in a 6-month period may request the services of the supporting I-level AVGFE technician.

- Q35. *What is the Naval Aviation Maintenance Discrepancy Reporting Program?*
- Q36. *What division assists the aviation safety officer in reviewing all correspondence about aircraft, ground, flight, or flight-related mishaps and explosive mishaps?*
- Q37. *Who has the responsibility to be alert for safety related defects or discrepancies?*
- Q38. *OPNAVINST 3710.7 contains procedures to report discrepancies in what type of publication?*
- Q39. *If a system failure or malfunction occurs because of a part design, which could allow improper installation of the part, an HMR priority precedence message must be submitted within what time frame?*
- Q40. *What term should be used in conjunction with an HMR when an aircraft part is lost in flight?*
- Q41. *What are the three types of engineering investigations (EIs)?*
- Q42. *What type of report provides activities with a means of reporting deficiencies in new or newly reworked material?*
- Q33. *How long does the accepting activity have to submit a supplemental ADR?*
- Q44. *Where is the original misuse/abuse report sent?*

QUALITY ASSURANCE MONITORING

The QA division monitoring includes the continuous collection and distribution to cognizant personnel of all messages, letters, instructions, and other information concerning the programs or processes being monitored.

The QA division does not manage any of these programs and processes. However, they are responsible for overall surveillance of these programs and processes to identify problems and to verify compliance. Audits are one of the tools used in monitoring these programs and processes. QA gives continuous attention to program performance. They prepare checklists that describe the specific functions needed to effectively monitor each assigned program and process. These checklists are the same for O- and I-level maintenance with a few exceptions.

QA monitors the programs and processes listed below:

- FOD
- Fuel surveillance
- Joint Oil Analysis Program (JOAP)
- Aviators' breathing oxygen (ABO)
- Hydraulic contamination control
- SE Operator Training/Licensing and SE Planned Maintenance Systems (PMS)
- SE testing
- Calibration
- Nondestructive inspection (NDI)
- Tool Control Program
- Corrosion prevention and control
- Plane captain qualification
- Tire and Wheel Maintenance Safety
- Individual Component Repair List (ICRL)
- Egress system checkout
- Explosives Handling Personnel Qualification and Certification Program
- Electrostatic Discharge (ESD) Control/Prevention Program
- Miniature/microminiature (2M)
- Laser hazard control

- Aeronautical Equipment Welder Certification and Recertification
- Vibration analysis
- Aircraft battle damage repair (ABDR)
- Enhanced Comprehensive Asset Management System (ECAMS)

Under the NAMP, local MIs must show the responsibilities of personnel concerning these programs and processes. The QA division should use the MI with the checklists to monitor each of these programs and processes. These programs and processes are covered in detail in the NAMP. Some of these programs and processes that are included in the NAMPSOP do not require additional instructions or maintenance instructions (MIs). As new instructions are included in the NAMPSOP, existing

MIS will be discarded. Refer to the NAMP for further information on NAMPSOP.

SUMMARY

Throughout this chapter, we have discussed the numerous responsibilities of the work center supervisor as well as many of the programs and responsibilities of the QA division. This is by no means all inclusive. To ensure mission accomplishment, both positions require dedication, diligence, and, most of all, experience. So when you become the work center supervisor, remember you are ultimately responsible for the work performed by your personnel, so take the initiative to stay involved in every aspect. When you become a quality assurance representative, remember that you are there to assist, train, and monitor, not just to be a policeman.

ANSWERS TO REVIEW QUESTIONS

- A1. *Seeing that the job is done correctly, safely, and efficiently with no waste of materials.*
- A2. *Operate with maximum efficiency and safety, operate with minimum waste an expense, and operate free from interruption and difficulty.*
- A3. *Update equipment as old models become obsolete.*
- A4. *Through an effective and continuing training program.*
- A5. *Operating with minimum expense and waste.*
- A6. *A means of relieving the work center supervisor of the details of a task.*
- A7. *Scheduled maintenance is maintenance required by hours, calender periods (days or weeks), and starts. Unscheduled maintenance is maintenance that occurs on aircraft other than scheduled.*
- A8. *The daily maintenance meeting.*
- A9. *Determine deficiencies, analyze discrepancy trends, prescribe inspection procedures, and determine the quality of maintenance.*
- A10. *Eliminating maintenance failures before they happen.*
- A11. *Prevention, knowledge, and special skills.*
- A12. *A periodic or special evaluation of details, plans, policies, procedures, products, directives, and records.*
- A13. *The success or failure in achieving high standards of quality.*
- A14. *At the time the task is assigned.*
- A15. *Quarterly.*
- A16. *To ensure the purpose and objective of the check flight are clearly understood.*
- A17. *Quality assurance division.*
- A18. *The size of the unit and the number of work shifts.*
- A19. *Quality assurance representatives.*
- A20. *Normally, an E-6 or above is assigned as a QAR.*
- A21. *90 days.*
- A22. *Never.*
- A23. *The officer in charge.*
- A24. *A Q/A stamp.*
- A25. *Local commands make the decision and annotate the master and work center MRC decks.*
- A26. *Receiving or screening inspection, in-process inspection, and final inspection.*
- A27. *Functional check flights.*
- A28. *When the discrepancy involves safety of flight.*

- A29. *a. QA audits.*
 - b. CTPL.*
 - c. Department/division safety.*
 - d. NAMDRP.*
 - e. SE misuse/abuse.*
 - f. Aviation gas free engineering (AVGFE).*
- A30. *Work center audits and special audits.*
- A31. *The cognizant division.*
- A32. *One year.*
- A33. *NAMP, OPNAVINST 4790.2.*
- A34. *Conduct maintenance department safety meetings.*
- A35. *The NAMDRP is a method for reporting hazardous deficiencies in material, publications, substandard workmanship, and improper Q/A procedures.*
- A36. *Quality assurance division.*
- A37. *All Hands.*
- A38. *Naval Air Training and Operating Procedures Standardization (NATOPS) manuals.*
- A39. *Within 24 hours of discovery.*
- A40. *TFOA (Things falling off aircraft).*
- A41. *Disassembly and inspection, material analysis, and engineering assistance.*
- A42. *Quality deficiency report (QDR).*
- A43. *Within 30 days after completion of the check flight.*
- A44. *The report is forwarded to the organization that has IMRL reporting responsibility for the item abused.*

CHAPTER 7

MAINTENANCE AND PRODUCTION CONTROL

This chapter is designed to assist senior personnel in preparing for a maintenance managers position. It is not all inclusive of a maintenance or production chiefs daily tasks, but it should help you to understand some of their required functions.

MAINTENANCE MANAGEMENT

LEARNING OBJECTIVE: Recognize the definitions of "maintenance" and "management."

Management is defined as "the efficient attainment of objectives" and maintenance is defined as "all actions taken to retain material in a serviceable condition or to restore it to serviceability." When combined, maintenance management can be defined as "the actions necessary to retain or restore material or equipment to a serviceable condition with a minimum expenditure of resources." It is the responsibility of every maintenance manager to manage resources in an efficient manner.

- Q1. Define the term "management."*
- Q2. What is the definition of maintenance?*
- Q3. Define the term "maintenance management. "*

MAINTENANCE CONTROL

LEARNING OBJECTIVE: Identify the responsibilities of Maintenance Control.

Maintenance control (M/C) is at the nucleus of the production divisions. It manages and coordinates the overall production effort to maintain squadron aircraft in a mission-capable condition. The general responsibilities of M/C include, among others, the following:

- Coordinates/monitors the maintenance department workload.
- Maintains liaison with the supporting activities and the local supply department to ensure that the squadron requirements are known and satisfied.
- Controls the daily workload, and assigns work priorities to the various division work center supervisors.

- Issues maintenance instructions (MIS), as required, to ensure adequate communication and control.
- Ensures that the full capability of the department is used in support of the department workload.
- Submits NALCOMIS or VIDS/MAF work requests to the supporting intermediate maintenance activity (IMA) for those functions beyond the capability or responsibility of the activity.
- Maintains technical directive (TD) control procedures for the department by initiating all TD compliance actions, ensures that required material is ordered, and schedules timely incorporation of technical directives.
- Reviews maintenance instructions and local maintenance requirements cards (MRCs) and ensures compliance.
- Conducts a monthly maintenance meeting and publishes a monthly maintenance plan.
- Attends the monthly maintenance meeting conducted by the supporting aircraft intermediate maintenance department/intermediate maintenance activity (AIMD/IMA).
- Establishes procedures for controlling and directing cannibalization.
- Ensures that aircraft undergo functional maintenance check flights (FCFs), as required.
- Maintains aircraft logs and associated equipment records (with the operations department), including weight and balance data and inventory logs.
- Reviews monthly Maintenance Data System (MDS) reports to ensure effective use of personnel, equipment, and facilities.
- Establishes procedures to monitor the Subsystem Capability and Impact Reporting (SCIR) system.
- Keeps the Equipment Master Roster (report number E-00) current to reflect those inventory and status changes that have occurred during the reporting period.

- Plans material requirements to support the department workload.
- Furnishes technical advice and information to the supporting supply department about the identity and quantities of supplies and spare parts required to support the department workload.
- Establishes and maintains a Tool Control Program (TCP).
- Reviews allowance lists and the Individual Material Readiness List (IMRL) for adequacy, and initiates action for revisions, as required.
- Ensures divisions assign qualified personnel for the completion of scheduled maintenance and inspections.
- Maintains close liaison with QA, particularly when maintenance changes major components. Maintenance control must inform QA when such changes occur.
- Validates the Not Mission Capable Supply/ Partial Mission Capable Supply (NMCS/PMCS) status listings each day.
- Validates work center VIDS display boards.
- Keeps the AMO advised of the overall workload and material situation as it affects the department.
- Ensures compliance with the Oil Analysis Program.
- Ensures compliance with the Hydraulic Contamination Program.
- Establishes departmental maintenance procedures for all support equipment (SE) for which the activity has IMRL reporting responsibility, and ensures such maintenance conforms with the SE Planned Maintenance System (PMS) and the Metrology and Calibration (METCAL) program.
- Develops an understanding of the Naval Aviation Logistics Command Management Information System (NALCOMIS) concept and its application to management and automated data processing (ADP) requirements. Refer to the *NALCOMIS User's Manual* for specific details related to maintenance/material management.
- Provides pilots/aircrews with a record of aircraft discrepancies and corrective actions for the last 10 flights of the aircraft by maintaining the Aircraft Discrepancy Book (ADB). (Discussed later in this section and in chapter 1.)

- Q4. *What work center manages and coordinates the overall production effort to maintain squadron aircraft in a mission-capable condition?*
- Q5. *What division controls the daily workload and assign work priorities to the various work center supervisors?*
- Q6. *What division is responsible for publishing a monthly maintenance plan?*
- Q7. *What division is responsible for ensuring that aircraft undergo functional maintenance check flights as required?*
- Q8. *What division maintains the Aircraft Discrepancy Book?*

MAINTENANCE MEETINGS

LEARNING OBJECTIVE: Define the purpose of the daily maintenance meeting.

Without a doubt, the best tool for ensuring a smooth flow of information about maintenance between shifts and other supervisors is the daily maintenance meeting. The meeting allows all the supervisors within your department or division to brief the maintenance chief on the status of equipment, components, or aircraft that currently have ongoing work or are scheduled to have maintenance performed. It also allows maintenance control to coordinate time frames for sharing certain facilities, equipment, or electrical power requirements. In addition, these maintenance meetings may bring to the attention of the maintenance chief specific tasks that need items of material or equipment that may be difficult to obtain. It may also identify certain document numbers that require "hand massaging" by the supply chief.

The maintenance chief can use the information obtained at the maintenance meetings to "plan ahead," such as obtaining support equipment that another squadron has checked out or coordinating a time period that the corrosion branch needs to paint or even reassign aircraft to the flight schedule. This allows specific maintenance to be performed on specific aircraft.

Always remember that **nothing** happens to any aircraft without the maintenance chiefs approval. The maintenance chief releases the aircraft as "safe for flight." He/she **MUST** know what is happening on every aircraft at every moment.

- Q9. *What is the primary purpose of the daily maintenance meeting?*

AIRCRAFT STATUS REPORTS

LEARNING OBJECTIVE: Recognize the purpose and reporting procedures of the Aircraft Material Readiness Report (AMRR).

Aircraft status reports are nothing more than a compilation of information on each aircraft assigned to your squadron and its current mission capability status.

Your command may construct such a report locally that provides the chain of command with consolidated information on all aircraft assigned to your organization. Also, COMNAVAIRLANT/COMNAVAIRPAC INSTRUCTION 5442.5D, *Aircraft Material Readiness Reporting* (AMRR), provides specific instructions on reporting procedures for certain commands and conditions. This report enables supporting commanders to assess current aircraft material condition and rapidly identify significant aircraft support deficiencies.

The content of this report includes information as follows:

- Number of aircraft assigned
- Number of aircraft in reporting status (IR)
- Number of aircraft full mission capable (FMC)
- Number of aircraft partial mission capable (PMC)
- Number of aircraft nonmission capable (NMC)
- Document numbers associated to NMC/PMC aircraft
- Flight hours flown since last report
- Sorties scheduled/sorties flown

These reports are normally due for transmission by unclassified immediate message no later than a given time every day. The information may vary, depending on type aircraft, command, and deployed condition; however, specific information can be obtained in CNAL/CNAPINST 5442.5D.

Q10. What instruction provides specific guidelines on procedures for reporting your squadrons readiness and material condition to supporting commanders?

AIRCRAFT DISCREPANCY BOOK (ADB)

LEARNING OBJECTIVE: Identify the purpose and guidelines for maintaining the aircraft discrepancy book (ADB).

Maintenance control maintains an ADB for each aircraft assigned. The ADB gives maintenance/aircrew personnel an accurate, comprehensive, and chronological record of flights and maintenance performed on a specific aircraft by bureau number (BUNO) for at least the last 10 flights. For phase and special inspections, only the control document representing all look phase actions needs to be displayed in the ADB. The ADB must reflect the status of all outstanding maintenance requirements, as shown on the maintenance control/work center VIDS boards. The ADB for each specific BUNO must be validated for completed and outstanding VIDS/MAFs before certifying the aircraft safe for flight.

NOTE: When a special inspection is completed, the control document VIDS/MAF copy 3 must be retained in the ADB for 10 flights, or until completion of the next like special inspection.

Q11. When a special inspection is completed, how long must copy 3 of the controlling document be retained in the ADB?

RELEASING AIRCRAFT FOR FLIGHT

LEARNING OBJECTIVE: Identify the purpose of the Aircraft Inspection and Acceptance Record.

One of the most critical aspects in naval aviation is the release of an aircraft that is safe for flight. It is the responsibility of the aircraft maintenance officer or his designated representative, usually the maintenance chief, to release the aircraft by signing the Aircraft Inspection and Acceptance Record (OPNAV 4790/141). This record indicates that the aircraft being released for flight has had all required maintenance completed safely and is safe to fly. Specifically, the person releasing the aircraft must, as a minimum, comply with the following requirements:

- Review the aircraft discrepancy book (ADB) to ensure all downing discrepancies are signed off, all flight safety quality assurance inspections are complete, and a valid daily/turnaround inspection is complete.

- Ensure fuel samples are taken as required by the applicable maintenance requirements cards (MRCs) or prior to the first flight of the day.
- Ensure the oil consumption has been reviewed for each engine/gearbox prior to every flight.
- Update the aircraft weight and balance and configuration for each flight.
- Review with the debarking pilot during hot seating operation any new discrepancies encountered during the previous flight to ensure flight safety for the next flight. Ensure the debarking pilot signs the Aircraft Inspection and Acceptance Record verifying that the aircraft is safe for flight.

The pilot in command of the aircraft is also required to review the ADB for aircraft discrepancies and corrective actions taken for at least the 10 previous flights. The pilot will sign block 11 of the Aircraft Inspection and Acceptance Record (fig. 7-1) assuming full responsibility for the safe operation of the aircraft and safety of the other individuals aboard.

Additional information on the release of aircraft safe for flight and the Aircraft Inspection and Acceptance Record can be obtained in OPNAVINST 4790.2.

- Q12. *Who is responsible for releasing an aircraft as "safe for flight"?*
- Q13. *What is the title of OPNAV 4790/141?*
- Q14. *When an aircraft is released as safe for flight, if not specified otherwise, when must fuel samples be taken?*

AIRCRAFT HISTORICAL FILES

LEARNING OBJECTIVE: Recognize the purpose and procedures for maintaining historical files.

Aircraft historical files are records of maintenance and inspections performed on each aircraft in the squadrons custody.

Procedures for maintaining these files vary slightly, depending on the administrative operating procedures for each squadron. Those operating under NALCOMIS have slightly different requirements than those operating with VIDS/MAFS. Both are discussed briefly; however, detailed information can be found in OPNAVINST 4790.2, Vol III.

NALCOMIS activities will store the current month and two preceding months of completed MAFs on the host computer in the electronic historical data format. Once the material is offloaded, the data must be retained for a minimum of 12 months or one complete inspection cycle, whichever is greater.

Historical file requirements for activities using paper VIDS/MAFS are as follows:

- Aircraft Inspection File. This file is maintained by bureau number(BUNO) and should be retained for one inspection cycle or 6 months, whichever is greater. Conditional inspection documents should be maintained in this file for 6 months from the date of completion.
- Aircraft General File. Maintained by BUNO in JCN sequence and grouped by month of

AIRCRAFT INSPECTION AND ACCEPTANCE RECORD				OPNAVINST 4790.2E							
1. A/C BU/SER NO.	2. T/M/S	3. RPT. CUST.	4. OXY	5. FUEL		6. OIL				7. DATE	
				GRADE	QTY	GRADE	1	2	3	4	
8. ORDNANCE / SPECIAL EQUIPMENT / LIMITATIONS / REMARKS:				9. I have personally inspected this aircraft IAW the applicable MRCs/checklists. Any discrepancies noted have been entered on OPNAV 4790/38.							
				SIGNATURE OF PLANE CAPTAIN				RANK/RATE			
				10. Certification of safe for flight condition by the MO, MMCO, or MCO Other persons may sign this form if authorized.							
				SIGNATURE				RANK/RATE			
				11. I have reviewed the discrepancy reports of the 10 previous flights, insured proper filing of weight and balance data, and accept this aircraft for flight.							
				SIGNATURE OF PILOT IN COMMAND				RANK			

OPNAV 4790/141 (12-89) S/N 0107-LF-008-4600 AMR0093

Figure 7-1.—Aircraft Inspection and Acceptance Record (OPNAV 4790/141).

completion. This file should include all aircraft and engine-related MAFs.

- TD Compliance File. This file will be maintained by BUNO for a minimum of 6 months from the completed date.
- Miscellaneous File. This file will contain all non-BUNO MAFs and may be separated by Type Equipment code, serial number, or job control number (JCN) at the commands discretion.
- Aircrewman's Flight Equipment File. Each aircrewman has a separate file containing the Aircrew Personal Equipment Record and Aircrew Systems Records. Copy 1 of completed MAFs on all maintenance performed on this equipment is retained for 6 months.

Q15. What publication contains detailed information on aircraft historical files?

Q16. How long must aircraft inspection documents be maintained on file?

Q17. A completed VIDS/MAF requesting "local manufacture of drip pans" would be maintained in what historical file?

SUBSYSTEM CAPABILITY AND IMPACT REPORTING (SCIR)

LEARNING OBJECTIVE: Describe Subsystem Capability Impact Reporting and its purpose.

Subsystem Capability and Impact Reporting reports show an equipment's mission capability. These reports are generated from Equipment Operational Capability (EOC) codes placed on the VIDS/MAF or in NALCOMIS. SCIR provides factual information, generated at the lowest level of maintenance, as to aircraft or equipment inventory and actual subsystem performance. It provides specific aircraft or equipment mission capability and uniquely defines the categories of full mission capable, partial capable, and not mission capable for a specific type and model aircraft or equipment.

EOC codes are documented when a specific system or subsystem is degraded and impacts the mission capability of that equipment or aircraft. The EOC code is a three-position code. The first position is derived from the *Mission Essential Subsystem Matrices* (MESM), published as an enclosure to OPNAVINST 5442.4. The last two positions are computer generated as determined by the documented

Work Unit Code. Only the first position is entered on the MAF or in NALCOMIS. For more information on EOC codes and levels of aircraft or equipment mission capability, refer to OPNAVINST 5442.4. More information on SCIR reports can be obtained in Vol III of OPNAVINST 4790.2.

Q18. Equipment Operational Capability (EOC) codes are used on VIDS/MAFs or in NALCOMIS to generate what reports?

Q19. The Mission Essential Subsystem Matrices (MESM) is used to select what position of the EOC code that is entered on the MAF?

Q20. How are the second and third positions of the EOC code determined?

AIRCRAFT LOGBOOKS

LEARNING OBJECTIVE: Recognize the different sections of the aircraft logbook and their purpose.

The aircraft logbook is a hard-cover, loose-leaf, ring binder that contains separators and page insert forms. Since the logbook contains loose-leaf forms, it is imperative that the model and bureau number be on both sides of each page in the spaces provided to ensure positive identification when pages are removed or new continuing pages are initiated. Each form is for recording specific information about the aircraft. The maintenance control office keeps the logbook in its spaces, and an AZ normally makes the entries. As a maintenance supervisor, you should be familiar with the information required in the aircraft logbook.

Each aircraft logbook has a record of rework, major repairs, and flight and operational data. Also included in the logbook, in the appropriate sections, is a record of maintenance directives affecting the aircraft, its components, and accessories. Figure 7-2 shows aircraft logbook construction and sequence.

Upon acceptance of a new naval aircraft, the original accepting activity will initiate the logbook and ensure the number of flights and flight hours since new are logged, including the hours flown by the manufacturer. The aircraft logbook is maintained by the reporting or physical custodian. For aircraft supported under contractor maintenance, the onsite support center liaison officer will ensure verification of the logbook or records required.

The following text provides a brief description of the sections in the aircraft logbook. Refer to

Logbook Binder (OPNAV 4790/19)

Structural Life Limits Separator (OPNAV 4790/142A)
Structural Life Limits (OPNAV 4790/142)

Monthly Flight Summary Separator (OPNAV 4790/21)
Monthly Flight Summary (OPNAV 4790/21A)

Inspection Record Separator (OPNAV 4790/22)
Inspection Record (OPNAV 4790/22A)

Repair/Rework Record Separator (OPNAV 4790/23)
Repair/Rework Record (OPNAV 4790/23A)

Technical Directives Separator (OPNAV 4790/24)
TDSA TD Lists Nos. 02 and 04 (Aircraft Only)
Technical Directives (OPNAV 4790/24A)

Miscellaneous/History Separator (OPNAV 4790/25)
Miscellaneous/History (OPNAV 4790/25A)

Preservation/Depreservation Record Separator (OPNAV 4790/136)
Preservation/Depreservation Record (OPNAV 4790.136A)*

Explosive Device Separator (OPNAV 4790/26)*
Installed Explosive Device Record (OPNAV 4790/26A)*

Inventory Record Separator (OPNAV 4790127)
Inventory Record (OPNAV 4790/27A)
Assembly Service Record (OPNAV 4790/106A)*
Equipment History Record (EHR) Card (OPNAV 4790/113)*
Schedule Removal Component Card (OPNAV 4790/28A)*

NOTE

ASR, EHR, and SRC cards are placed in
the order they are listed in the PMIC.

ALSS Record Separator (OPNAV 4790/157)*
Parachute Record (OPNAV 4790/101)*
Seat Survival Kit Record (OPNAV 4790/137)*
Aircrew Systems Record (OPNAV 4790/138)*

Supplemental Records Separator (OPNAV 4790/134)*
Aeronautical Equipment Service Record (OPNAV 4790/29)*

*If applicable on aircraft without ejection seats.

Figure 7-2.—Aircraft Logbook construction and sequence.

MONTHLY FLIGHT SUMMARY				1. TYPE / MODEL / SERIES SH-3H		2. BUNO / SERIAL NUMBER 148049		3. SERVICE PERIOD 008					
PART I - SERVICE PERIOD <small>(NAVAIR FS ACTIVITIES)</small>					PART II - TOUR / PERIOD REVISION / ADJUSTMENT <small>(OPERATING COMMANDS)</small>								
1. DATE	2. PERIOD NO	3. OPSERMOS	4. ACTIVITY		1. DATE	2. TOUR / PERIOD	3. OPSERMOS						
15 FEB 95	008	165	NADEP PENSACOLA		INITIAL	021795	11-97 198						
					REV. / ADJ. 1								
					REV. / ADJ. 2								
					REV. / ADJ. 3								
					REV. / ADJ. 4								
					REV. / ADJ. 5								
					REV. / ADJ. 6								
					REV. / ADJ. 7								
					REV. / ADJ. 8								
					REV. / ADJ. 9								
					REV. / ADJ. 10								
PART III - EXTENSIONS 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/>													
PART IV - MONTHLY DATA													
1. MONTH YEAR	2. REPORTING	3. FLYING HOURS			4. LANDINGS			5. MONTHLY TOTAL			6. ACCUMULATED TOTAL		
		A. MO	B. PERIOD	C. SINCE NEW	B	D	F	A. LAND	B. A/R	C. CATS	A. LAND	B. A/R	C. CATS
FEB 95	HS-5	21.5	21.5	8031.8	3	5	8	16	0	0	7048	0	0
MAR 95	HS-5	43.6	65.1	8075.4	0	10	35	45	0	0	7093	0	0

OPNAV 4790.21A (REV. 2-86) PREVIOUS EDITIONS ARE OBSOLETE. STOCKS WILL BE DESTROYED S/N 0107-LF-047-9107 AMR00095 PERMANENT RECORD

Figure 7-4.—Monthly Flight Summary (OPNAV 1790/21A).

PHASE						INSPECTION RECORD					
<small>(Periodical or Conditional)</small>											
1. AIRCRAFT MODEL OR EQUIPMENT NAME SH-3H			2. TYPE / MODEL / SERIES			3. BUNO OR SERIAL NUMBER 149725					
4. TYPE OR DESCRIPTION OF INSPECTION		5. REFERENCE		6. DATE COMMENCED		7. DATE COMPLETED		8. ACTIVITY		9. SIGNATURE	
PHASE A/7003.2		NA01-230HLH-6-4		12 JUL 94		15 JUL 94		HS-5		LT. A. WINTERS	
PHASE B/7098.3		NA01-230HLH-6-4		20 SEP 94		22 SEP 94		HS-5		LT. A. WINTERS	
PHASE C/7195.6		NA01-230HLH-6-4		3 DEC 94		3 DEC 94		HS-5		LT. A. WINTERS	

OPNAV 4790.22A (REV. 1-84) S/N 0107-LF-047-9110 AMR00096

Figure 7-5.—Inspection Record (OPNAV 4790/22A).

equipment maintains this record. The following is a list of the currently required applications of the AESR to specific equipment:

- Aircraft power plant
- Airborne gun pods (for example, GPU-2/A, ADEN)
- Low-level escape system
- Propeller assembly
- In-flight refueling store or package
- Auxiliary, power unit (APU)
- AN/ALQ-99 pod
- Aeronautical expeditionary airfield M-11, M-22, M-23, and V-1, V-7, and L-series lighting systems
- Gas turbine power plant (7LM 1500 PB-104)
- MK-105 magnetic minesweeping gear

- SE gas turbine engines (listed in NAV-AIRNOTE 4700)
- Engine test cell or stand

The AESR (fig. 7-15) is a permanent part of the aircraft logbook for equipments installed at the time of aircraft transfer.

**Module Service Record (MSR)
(OPNAV 4790/135)**

Modular engine design allows intermediate level facilities to readily remove and replace interchangeable with ready-for-issue (RFI) spares. The MSR (fig. 7-16) provides the method for recording the maintenance data for these modules and their life limited assemblies and components. This MSR will be attached to and accompany the component to its final destination.

AERONAUTICAL EQUIPMENT SERVICE RECORD

NOMENCLATURE OF EQUIPMENT				REPLACEMENT	
				Interval	Due
TYPE	MODEL		SER. NO. (Hub if prop.)		
INSTALLED ON--					
MODEL	BUNO/SERIAL NO.	DATE	BY (Activity)		
CURRENT ENGINE OR PROPELLER POSITION NO.					

AMR00106

DEPARTMENT OF THE NAVY, CHIEF OF NAVAL OPERATIONS
OPNAV 4790/29 (Rev. 1-84) S/N 0107-L4-047-9145

Figure 7-15.—Aeronautical Equipment Service Record (OPNAV 4790/29).

II activity can submit priority 2, 5, and 12 requisitions, depending on the urgency of requirement as related to mission readiness. A FAD III activity would submit priority 3, 6, and 13 requisitions for corresponding requirements.

Project codes are assigned to identify requisitions and related documents applicable to specific projects or programs and are mandatory entries on all requisitions.

Project/Priority codes are discussed in more detail in chapter 3 and in OPNAVINST 4790.2.

AWAITING PARTS VALIDATION

LEARNING OBJECTIVE: Recognize the purpose for performing awaiting parts validations.

Validation of AWP items, using the AWP list provided by the aviation support division (ASD), is performed jointly with the AWP unit in supply at least weekly. AWP validation ensures all parts on order by a particular command are still required and all required parts are still on order. This validation also points out possible cannibalization actions, which can reduce the number of AWP components.

Q35. What action is taken at least weekly to ensure all parts on order are still required and all required parts are still on order?

WORKLOAD PRIORITY ASSIGNMENT

LEARNING OBJECTIVE: Identify the different priorities assigned to I-level maintenance workloads.

Production control, working with the component control section (CCS) and the aeronautical material screening unit (AMSU) of the supply department, will set workload priorities based on the following:

Priority 1. Support of non-mission capable (NMC) or partial-mission capable (PMC) aircraft; NMCS or PMCS items, based on a valid outstanding requisition held by supply; expeditious repair (EXREP); or work requests causing NMC or PMS conditions on an aircraft will be assigned priority 1. Priority 1 is also assigned to activities within 30 days of deployment.

Priority 2. Repair of critical local repair cycle assets (LRCA) and SE. This priority is also assigned to O-level maintenance work stoppage requirements.

Priority 3. Repair of non-critical LRCA and SE and repair or manufacture of material for non-fixed allowance stock.

Priority 4. Processing of salvaged material and nonaeronautical work.

These priorities may be adjusted by the IMA maintenance and supply officers as necessary to meet local support requirements and operation conditions.

Q36. Production control works with what other work centers in the supply department to set workload priorities?

EQUIPMENT STATUS REPORTS

The successful operation of an IMA from production control depends on knowledge. As mentioned before, production control is the nerve center of the IMA. If a supported activity needs anything in the way of support from the I-level activity, it will contact production control. For production control to have its finger on the pulse of the entire department, it needs to be continuously updated on equipment status. From the status of support equipment to avionics test benches, the production control chief MUST know at a glance what assets he has available to work with.

Equipment status reports normally provide this information. These status reports are normally furnished to production control at the beginning of each work day and sometimes at the beginning of each shift.

Equipment status reports provide important information, such as how many NCPP-105 air start units are on board, and how many of them are up (fully operational) or how many are down, what maintenance is required to make them ready for use, and when they are anticipated to be ready for use. Almost every division in the IMA provides these reports to the production control officer, with information pertinent to the successful operation of an IMA.

SUMMARY

This chapter touched only briefly on the responsibilities of maintenance and production control. It is by no means an all inclusive recipe book for successful operation of either work center. Both maintenance control at the O-level and production control at the I-level are very important and busy management offices. Communication and teamwork are key factors in managing a successful work center.

ANSWERS TO REVIEW QUESTIONS

- A1. *The efficient attainment of objectives.*
- A2. *Actions taken to retain material in a serviceable condition or to restore it to serviceability.*
- A3. *Actions taken to retain or restore material or equipment to a serviceable condition with a minimum expenditure of resources.*
- A4. *Maintenance control.*
- A5. *Maintenance control.*
- A6. *Maintenance control.*
- A7. *Maintenance control.*
- A8. *Maintenance control.*
- A9. *It allows all the supervisors within your department or division to brief the maintenance chief on the status of equipment, components, or aircraft that currently have ongoing work or are scheduled to have maintenance performed.*
- A10. *Aircraft Material Readiness Reporting (AMRR), COMNAVAIRLANT/COMNAVAIRPAC INSTRUCTION 5442.5D.*
- A11. *At least 10 flights or until the completion of the next like inspection.*
- A12. *The aircraft maintenance officer (AMO) or his designated representative.*
- A13. *Aircraft Inspection and Acceptance Record.*
- A14. *Prior to the first flight of the day.*
- A15. *OPNAVINST 4790.2, Vol III.*
- A16. *One inspection cycle or 6 months, whichever is greater.*
- A17. *Miscellaneous file.*
- A18. *SCIR reports.*
- A19. *The first position of the EOC code.*
- A20. *They are computer generated as determined by the documented Work Unit Code (WUC).*
- A21. *Aircraft model and bureau number.*
- A22. *Reporting or physical custodians of all naval aircraft.*
- A23. *The periodic maintenance information cards (PMCs) for that specific aircraft.*
- A24. *Inspection Record OPNAV 4790/22A.*
- A25. *Repair/Rework Record, OPNAV 4790/23A.*
- A26. *Interim TDs are recorded on the same sheet as formal TDs and identified by an "I" preceding the TD number.*
- A27. *It provides a means of recording significant information that affects the aircraft or equipment for which no other space is provided in the logbook.*
- A28. *If the equipment is not preserved as part of an aircraft preservation action.*

- A29. *The appropriate records are to be forwarded as required by OPNAVINST 3750.6 and NAVAIR 13-1-13 manuals for investigation.*
- A30. *It is maintained concurrently with and becomes part of the Aeronautical Equipment Service Record (AESR).*
- A31. *Section IV.*
- A32. *The Scheduled Removal Component (SRC) Card OPNAV 4790/28A.*
- A33. *Naval Flight Record Subsystem (NAVFLIRS).*
- A34. *Production control.*
- A35. *Awaiting parts (AWP) validation.*
- A36. *Component control section (CCS) and the aeronautical material screening unit (AMSU).*

APPENDIX I

GLOSSARY

- ABO**—Aviators' breathing oxygen.
- ACC**—Aircraft controlling custodian.
- ACCUMULATORS**—Shock absorber, storage cell.
- AD**—Aviation Machinist's Mate.
- ADP**—Automatic data processing.
- ADRL**—Automatic distribution requirements listing.
- AE**—Aviation Electrician's Mate.
- AEPS**—Aircrew escape propulsion systems.
- AFFF**—Aqueous film-forming foam.
- AIMD**—Aircraft intermediate maintenance department.
- AIR**—Aircraft inventory record.
- AK**—Aviation Storekeeper.
- ALPHABETIC SEQUENCE**—A sequence that begins at the extreme left-hand position beginning with the letter A and progresses through 2 from left to right, one position at a time, until all positions of the group of letters have been considered.
- AM**—Aviation Structural Mechanic.
- AME**—Aviation Structural Mechanic, Safety Equipment.
- AMH**—Aviation Structural Mechanic, Hydraulics.
- AMS**—Aviation Structural Mechanic, Structures.
- AMSU**—Aeronautical material screening unit.
- AO**—Aviation Ordnancemen.
- AR**—As required.
- AS**—Aviation Support Equipment Technician.
- ASD**—Aviation support division.
- ASG**—Afloat Shopping Guide.
- ASO**—Aviation Supply Office.
- ASR**—Assembly service record.
- AT**—Aviation Electronics Technician (I-Intermediate Level Specialty/O-Organizational Level Specialty).
- AUTODIN**—Automatic Digital Network.
- AWM**—Awaiting maintenance.
- AWP**—Awaiting parts/aircraft awaiting parts.
- AWSE**—Armament weapons support equipment.
- BCM**—Beyond capability of maintenance.
- BUNO**—Bureau number (aircraft).
- CAD**—Cartridge-actuated device.
- CAGE**—Commercial and Government Entity. Replaced Manufacturer's code. A five-position code assigned to manufacturer's and nonmanufacturer's organizational entities and contractors of items procured by agencies of the Federal Government.
- CCS**—Component control section.
- CDI**—Collateral duty inspector.
- CDQAR**—Collateral duty quality assurance representative.
- CECR**—Change Entry Certification Record.
- CER**—Complete engine repair.
- CERRC**—Complete Engine Repair Requirement Card.
- CFA**—Cognizant field activity.
- CFE**—Contractor-furnished equipment.
- CNO**—Chief of Naval Operations.
- CO**—Commanding officer.
- COG**—Cognizant.
- COMNAVAIRSYSCOM**—Commander, Naval Air Systems Command.
- CPO**—Chief petty officer.
- CR IPL**—Consolidated remain in place list.
- CTPL**—Central technical publications library.
- CV**—Aircraft carrier.
- DAR**—Defense acquisition regulations.
- DCNO(AIR)**—Deputy Chief of Naval Operations for Air.

DOD—Department of Defense.

DON—Department Of Navy.

DOP—Designated overhaul point.

DSF—Defense stock fund, document status file. document stock file, or data services facility.

DTG—Date-time group identifies date and time a message was transmitted and who the releasing activity was.

DTPL—Dispersed technical publications library.

EGRESS—A means of going out of or ejecting from an aircraft.

EHR—Equipment history record.

EOC—Equipment Operational Capability code.

ESD—Electrostatic discharge.

EXBEP—Expeditious repair.

FAD—Force/activity designator.

FCF—Functional check flight.

FOD—Foreign object damage.

FSC—Federal supply classification.

HSU—Hydraulic fluid service unit.

ICBL—Individual component repair list.

I-LEVEL MAINTENANCE—Maintenance performed at the intermediate level as designated by the NAMP, OPNAVINST 4790.2.

IMA—Intermediate maintenance activity.

IMRL—Individual Material Readiness List.

IPB—Illustrated parts breakdown.

JCN—Job control number.

LHA—Helicopter assault landing ship.

LOX—Liquid oxygen.

LPA—Amphibious assault ship.

LRCA—Local repair cycle asset.

MAF—Maintenance Action Form.

MCIU—Master Cross-Reference List.

MDR—Maintenance Data Report.

MDS—Maintenance Data System.

MDU—Material delivery unit.

MEASURE—Metrology Automated System for Uniform Recall and Reporting.

MEK—Methyl ethyl keytone.

METCAL—Metrology and Calibration Program.

MI—Maintenance instruction.

MILSTRIP—Military Standard Requisitioning Issue Procedure.

MIM—Maintenance instruction manual.

ML-N—Management data list Navy.

MMCO—Maintenance material control officer.

MMP—Monthly maintenance plan.

MRC—Maintenance requirements card.

MRIL—Master Repairable Item List.

MS—Military specification.

MSR—Module service record.

MTIR—Mandatory turn-in repairable.

NA—NAVAIR.

NADEP—Naval aviation depot.

NALCOMIS—Naval Aviation Logistics Command Management Information System.

NAMDRP—Naval Aviation Maintenance Discrepancy Reporting Program.

NAMP—Naval Aviation Maintenance Program.

NAPI—Naval Aeronautic Publications Index.

NARU—Naval air reserve unit.

NATOPS—Naval Air Training and Operating Procedures Standardization.

NATSF, NAVAIRTECHSERVFAC—Naval air technical services facility.

NAVAIR, NAVAIRSYSCOM—Naval Air Systems Command.

NAVAIRINST—Naval Air Systems Command instruction.

NAVAVNDEPOT—Naval aviation depot.

NAVOSH—Naval Occupational Safety and Health.

NAVSEA—Naval Sea Systems Command.

NAVSUP—Naval Supply Systems Command.

NC—Not carried.

NDI—Nondestructive inspection.

NIIN—National item identification number.

NIS—Not in stock.

NMCS—Not-mission-capable supply.

NOAP—Navy Oil Analysis Program.

NON-RFI—Nonready-for-issue.

NSN—National Stock Number (13 digits).

NUMERIC SEQUENCE—A sequence of numbers beginning at the extreme left-hand position, from left to right in ascending order, one position at a time, until all digits have been considered.

NWPL—Naval warfare publication library.

OIC—Officer in charge.

OJT—On-the-job training.

OLEOS—The shiny part of actuating cylinders and struts.

O-LEVEL MAINTENANCE—Organizational-level maintenance.

OMA—Organizational maintenance activity.

OMD—Operations maintenance department.

OPNAV—Office of the Chief of Naval Operations.

OPNAVINST—Office of the Chief of Naval Operations instruction.

OUTUS—Outside continental limits United States.

PEB—Pre-expended bin.

PI SUFFIX—Publication identifier suffix.

PM—Periodic maintenance.

PMCS—Partial mission capable supply.

PME—Precision measuring equipment.

PMIC—Periodic maintenance information card.

PMS—Planned maintenance system.

PON-6—Preoiler portable, hand-carried hand pump with a 3-gallon capacity.

PQS—Personnel qualification standard.

PR—Aircrew Survival Equipmentman.

PSI—Position-sensitive indicator.

PUC—Permanent Unit Code.

QA—Quality assurance.

QA/A—Quality assurance/analysis.

QAR—Quality assurance representative.

RAC—Rapid action change.

RAMEC—Rapid action minor engineering change.

RAT—Ram air turbine.

REF—Reference.

RFI—Ready for issue.

RTV—Room temperature vulcanizing.

SCC—Sequence control chart/card.

SCIR—Subsystem capability impact reporting.

SDLM—Standard depot-level maintenance.

SE—Support equipment.

SEAOPDET—Sea operational detachment.

SERVMART—Service market.

SIM—Service instruction manual.

SIMs—Service instruction manuals.

SM&R—Source, maintenance and recoverability.

SPAWARSSYSCOM—Space Warfare Systems Command.

SPEC DWG—Specification control drawing number.

SRA—Shop replaceable assembly.

SRC—Scheduled removal component.

SRC CARD—Scheduled Removal Component Card, OPNAV 4790/28A. All components with maximum operating hours assigned (high-time items) must be accompanied by an SRC card.

SRM—Structural repair manual.

SRS—Supply response section.

SSC—Supply support center.

SSCC—Standard Subject Classification Code.

SUBJ SERIAL—Subject serial number.

SWP—Subordinate work package.

TAT—Turnaround time.

TCP—Tool Control Program.

TCPL—Tool control plan.

TD—Technical directive.

TDC—Technical directive compliance.

TEC—Type Equipment code.
TMINS—Technical Manual Identification Numbering System.
TPDR—Technical publication deficiency report.
TPL—Technical publications library.
TPS—Tactical paint scheme.
TRAMAN—Training manual.
UIC—Unit Identification Code.
UMMIPS—Uniform Material Movement and Issue Priority System.
UND—Urgency of need designator.
VAST—Versatile avionics shop test.
VIDS—Visual Information Display System.
VIDS/MAF—Visual Information Display System/Maintenance Action Form.

WARNINGS, CAUTIONS, AND NOTES—The following definitions apply to warnings, cautions, and notes found in technical manuals.

WARNING. An operating procedure, practice, or condition that may result in injury or death if not carefully observed or followed.

CAUTION. An operating procedure, practice, or condition that, if not strictly observed, may damage equipment.

NOTE. An operation, procedure, practice, or condition that is essential to emphasize.

WCC—Work Center code.

WP—Work package.

WRA—Weapons replaceable assembly.

WSE—Weapons and support equipment.

WUC—Work Unit Code.

APPENDIX II

REFERENCES USED TO DEVELOP THE TRAMAN

NOTE: Although the following references were current when this TRAMAN was published, their continued currency cannot be assured. When consulting these references, keep in mind that they may have been revised to reflect new technology or revised methods, practices, or procedures. Therefore, you need to ensure that you are studying the latest references.

Chapter 1

Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2F, Vol I, Office of the Chief of Naval Operations, Washington, D.C., 1 June 1995, Change 1 of 4 January 1996.

Chapter 2

Naval Air Systems Command Technical Manual Program, NAVAIR 00-25-100, Naval Air Systems Command, Washington, D.C., 1 July 1994.

Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2F, Vol I, Office of the Chief of Naval Operations, Washington, D.C., 1 June 1995, Change 1 of 4 January 1996.

OPNAV Application Guide and Index for the Navy Standard Technical Manual Identification Numbering Systems (TMINS), OPNAV N0000-00-IDX-0001 TMINS, Office of the Chief of Naval Operations, Washington D.C., Revision 3 of 28 September 1988.

Navy Standard Technical Manual Identification Numbering System, NAVAIR INSTRUCTION 4160.1, Naval Air Systems Command, Washington, D.C., 27 April 1988.

Chapter 3

Afloat Supply Procedures Manual, NAVSUP Pub 485, Naval Supply Systems Command, Washington, DC., August 1991 through Change 6 of 31 January 1996.

Operating Procedures Manual, MILSTRIP, Military Standard Requisitioning and Issue Procedures, MILSTRAP, Military Standard Transaction Reporting and Accounting Procedures, NAVSUP Publication 437, Naval Supply Systems Command, Washington, D.C., July 1991, Change 9 of 16 September 1996.

Naval Air Systems Command Aircraft Maintenance Material Readiness List Program, NAVAIRINST 13650.1C, Naval Air Systems Command, Washington, D.C., 16 January 1992.

Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2F, Vol I, Office of the Chief of Naval Operations, Washington, DC., 1 June 1995, Change 1 of 4 January 1996.

Chapter 4

Aircraft Weapons Systems Cleaning and Corrosion Control, NAVAIR 01-1A-509, Naval Air Systems Command, Washington, D.C., 1 May 1996.

Avionics Cleaning and Corrosion Prevention/Control Manual, NAVAIR 16-1-540, Naval Air Systems Command, Washington, D.C., April 1992.

General Aircraft Information, NAVAIR 01-F14AAA-2-1, Naval Air Systems Command, Washington, D.C., September 1993, Change 3 of 1 August 1996.

Naval Aviation Maintenance Program (NAM), OPNAVINST 4790.2F, Vol I, Office of the Chief of Naval Operations, Washington, D.C., 1 June 1995, Change 1 of 4 January 1996.

Naval Aviation Safety Program, OPNAVINST 3750.64, Chief of Naval Operations, Washington, D.C., August 1989 through Change 1 of March 1991.

Preservation of Naval Aircraft Manual, NAVAIR 15-01-500, Naval Air Systems Command, Washington, D.C., 1 February 1994.

Principles of Operation Landing Systems, NAVAIR 01-F14AAA-2-2-1, Naval Air Systems Command, Washington, D.C., April 1993.

Chapter 5

Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2F, Vol I, Office of the Chief of Naval Operations, Washington, D.C., 1 June 1995, Change 1 of 4 January 1996.

Naval Aviation Safety Program, OPNAVINST 3750.64, Chief of Naval Operations, Washington, D.C., August 1989 through Change 1 of March 1991.

Navy Occupational Safety and Health (NAVOSH Program for Forces Afloat), OPNAVINST 5100.19C, Vols I and II, Chief of Naval Operations, Washington, D.C., January 1994, Change 1 of 15 May 1996.

Chapter 6

Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2F, Vol I, Office of the Chief of Naval Operations, Washington, D.C., 1 June 1995, Change 1 of 4 January 1996.

Aviation Maintenance Ratings Supervisor, NAVEDTRA 12011-A, Naval Education and Training Program Management Support Activity, Pensacola, Florida, November 1993.

Aviation Support Equipment Technician 1, NAVEDTRA 10358, Naval Education and Training Program Management Support Activity, Pensacola, Florida, 1990 edition.

Chapter 7

Naval Aviation Maintenance Program (NAMP), OPNAVINST 4790.2F, Vols I and III, Office of the Chief of Naval Operations, Washington, D.C., 1 June 1995, Change 1 of 4 January 1996.

Aircraft Material Readiness Reporting (AMRR), CNAP/CNAL Instruction 5442.5D, Commander, Naval Air Force, United States Pacific Fleet, Commander, Naval Air Force, United States Atlantic Fleet, March 1994.

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Assignment Questions

Information: The text pages that you are to study are provided at the beginning of the assignment questions.

ASSIGNMENT 1

Textbook Assignment: "Maintenance Administration." Pages 1-1 through 1-29.

- 1-1. An important objective of the NAMP is to achieve and maintain maximum material readiness. Which of the following statements reflects additional objectives of the NAMP?
1. Conservation of time
 2. Safety and conservation of material
 3. Conservation of manpower only
 4. Safety and conservation of manpower
- 1-2. What is the purpose of the Aircraft Maintenance Department within an organization?
1. Perform scheduled maintenance on assigned aircraft
 2. Perform unscheduled maintenance on assigned aircraft
 3. Repair reported discrepancies on squadron aircraft
 4. Maintain assigned aircraft in a Full-Mission-Capable state in support of the units mission
- 1-3. What are the major types of aircraft maintenance?
1. Organizational, intermediate, and depot
 2. Standard and special
 3. Rework and upkeep
 4. Scheduled and unscheduled
- 1-4. Restorative work performed on an item of support equipment is considered what type(s) of work?
1. Intermediate maintenance
 2. Upkeep maintenance only
 3. Rework maintenance only
 4. Rework and upkeep maintenance
- 1-5. A comprehensive depot-level inspection of selected aircraft structures and materials and correction of any critical defects is what type of maintenance?
1. Upkeep
 2. Special rework
 3. Standard rework
 4. Standard upkeep
- 1-6. Maintenance performed on aircraft or equipment to improve its specific function is known as what type of maintenance?
1. Standard rework maintenance
 2. Special rework maintenance
 3. Organizational maintenance
 4. Intermediate maintenance
- 1-7. Preventive, restorative, or additive work performed on aircraft, equipment, and support equipment by an operating unit is what type of maintenance?
1. Upkeep
 2. Rework
 3. SDLM
 4. Depot
- 1-8. Scheduled work is performed on an aircraft as a result of its completing a prescribed number of flying hours. What type of maintenance is this?
1. Special upkeep
 2. Special rework
 3. Standard upkeep
 4. Standard rework

- 1-9. The ability of an aircraft to perform its mission was changed by alteration without regard to flying hours. What type of maintenance is this?
1. Special upkeep
 2. Special rework
 3. Standard upkeep
 4. Standard rework
- 1-10. Aircraft maintenance is divided into what total number of maintenance levels?
1. Five
 2. Two
 3. Three
 4. Four
- 1-11. Centralized local maintenance is performed by which of the following activities?
1. Depot-level activities
 2. Contractor plants
 3. AIMDs
 4. CMAs
- 1-12. Work performed by an operating unit on a day-to-day basis in support of its own operations is known as what type of maintenance?
1. Intermediate-level maintenance
 2. Organizational-level maintenance
 3. Special maintenance
 4. Depot-level maintenance
- 1-13. Servicing aircraft and preflight inspections are actions that are performed at what level of maintenance?
1. Depot
 2. Special
 3. Intermediate
 4. Organizational
- 1-14. Work performed in a centrally located facility within a geographical area is known as what type of maintenance?
1. Special maintenance
 2. Depot-level maintenance
 3. Intermediate-level maintenance
 4. Organizational-level maintenance
- 1-15. Work performed at an industrial-type facility is known as what type of maintenance?
1. Intermediate-level maintenance
 2. Organizational-level maintenance
 3. Special maintenance
 4. Depot-level maintenance
- 1-16. The Naval Aviation Maintenance Program is sponsored and directed by what command?
1. NAVSUP
 2. CNET
 3. CNO
 4. DCNO
- 1-17. Material and technical support for the NAMP are provided by the cognizant systems command and which of the following commands?
1. NAVSUP
 2. CNET
 3. CNO
 4. DCNO
- 1-18. What type of relationship exists between a superior and a subordinate?
1. Special
 2. Staff
 3. Management
 4. Line

- 1-19. According to directives from higher authority, what officer directs the aircraft maintenance department?
1. The assistant aircraft maintenance officer
 2. The aircraft maintenance officer
 3. The quality assurance officer
 4. The aircraft maintenance division officer
- 1-20. The functional management responsibilities for the planning, control, and production of the aircraft maintenance department rest with which of the following officers?
1. Assistant aircraft maintenance officer
 2. Aircraft division officer
 3. Aircraft maintenance officer
 4. Quality assurance officer
- 1-21. Which of the following officers ensures that staff divisions at the organizational level conform to established policies?
1. The assistant aircraft maintenance officer
 2. The staff division officer
 3. The aircraft maintenance officer
 4. The maintenance material control officer
- 1-22. Assuring that high quality maintenance work is performed is a function of what division in an organizational-level maintenance department?
1. Operations
 2. Quality assurance
 3. Administration
 4. Material control
- 1-23. Which of the following maintenance concepts allows you to regulate events rather than be regulated by them?
1. Detection
 2. Prevention
 3. Suppression
 4. Correction
- 1-24. Within an organizational-level maintenance activity, what part of the activity monitors, controls, and applies the MDS?
1. Administration
 2. System administrator/analysis
 3. Material control
 4. Production control
- 1-25. What officer is directly responsible for the overall production effort and material support of the organizational-level maintenance department?
1. The administration officer
 2. The aircraft maintenance officer
 3. The maintenance material control officer
 4. The quality assurance officer
- 1-26. What branch or division is known as the nerve center of an organizational-level maintenance department?
1. Material control
 2. Maintenance control
 3. Aircraft
 4. Quality assurance
- 1-27. The power plants, airframes, and aviator's life support equipment branches belong to what division of an organizational-level maintenance department?
1. Aircraft
 2. Line
 3. Avionics/armament
 4. Staff

- 1-28. If you work in electronics, instruments, or armament, you are normally assigned to what division of an organizational-level maintenance department?
1. Aircraft
 2. Line
 3. Avionics/armament
 4. Operations
- 1-29. In an intermediate-level maintenance activity, what is the central point of the maintenance effort?
1. Maintenance material control
 2. Maintenance control
 3. Quality assurance
 4. Production control
- 1-30. Normally, the intermediate maintenance organization has a total of how many production divisions?
1. Five
 2. Six
 3. Three
 4. Four
- 1-31. What system provides organizational and intermediate maintenance activities with a computer-based management information system?
1. NADEP
 2. NALCOMIS
 3. MDS
 4. NAVSUP
- 1-32. Maintenance managers need current status information to control the maintenance effort. What system is designed to provide maintenance managers with this information?
1. NMCS
 2. PMCS
 3. VIDS
 4. FMCS
- 1-33. The VIDS boards in each work center are verified with the maintenance control VIDS board a minimum of how often?
1. Once each shift change
 2. Twice each day
 3. Once each day
 4. Once each week
- 1-34. After the personnel in maintenance control complete the required blocks of a newly initiated VIDS/MAF, copies 1 and 5 are forwarded to
1. quality assurance
 2. material control
 3. production control
 4. the work center
- 1-35. If a check flight is required after the completion of a corrective action, notification must be given to what individual?
1. The quality assurance division officer
 2. The material control supervisor
 3. The maintenance material control officer
 4. The aircraft maintenance officer
- 1-36. After a discrepancy has been corrected, what should be done with copies 1 and 5 of the VIDS/MAF?
1. Copy 1 should be sent to quality assurance, and copy 5 is placed in the work center files
 2. Copy 1 should be sent to maintenance control, and copy 5 is sent to quality assurance
 3. Copy 1 should be sent to maintenance control, and copy 5 is placed in the work center files
 4. Copy 1 should be placed in the work center files, and copy 5 is sent to maintenance control

- 1-37. At the intermediate level of maintenance, what copies of the VIDS/MAF are forwarded to the work center upon component induction for repair?
1. Copies 1, 2, and 3
 2. Copies 2, 3, and 4
 3. Copies 1, 4, and 5
 4. Copies 1, 3, and 4
- 1-38. A component goes into an AWP status at the intermediate level of maintenance. What action is completed first with regard to the component?
1. It is stored in the work center
 2. It is properly packaged and preserved
 3. It is stripped of any usable parts
 4. It is returned to the AWP unit
- 1-39. Information entered on MDS forms must always meet which of the following requirements?
1. Be typed
 2. Be entered in pencil
 3. Be accurate and complete
 4. Be entered in pen
- 1-40. On-equipment maintenance actions are documented on
1. NALCOMIS or a VIDS/MAF
 2. WORK REQUEST or NALCOMIS
 3. DCF VIDS/MAF
 4. VIDS board
- 1-41. The portion of an inspection that involves the search for defects is known as what phase?
1. Search
 2. Fix
 3. Repair
 4. Look
- 1-42. An organizational code, the Julian date, a sequence number, and a suffix are part of what code or control number?
1. Action Taken code
 2. Job control number
 3. Sequence control number
 4. Work Unit Code
- 1-43. Maintenance was performed on an item identified by a Work Unit Code. What type of code describes this action?
1. Manufacturer's
 2. JCN
 3. Malfunction
 4. Action Taken
- 1-44. What type of code identifies a subassembly repair action that is completed separately from the major component repair action?
1. JCN Suffix
 2. Type Equipment
 3. support
 4. Malfunction
- 1-45. What type of code identifies the system, specific engine, or component/part on which work is being performed?
1. Transaction code
 2. Malfunction Description code
 3. Type Equipment code
 4. Work Unit Code
- 1-46. What type of code describes the trouble or cause of trouble in a system or component?
1. Transaction code
 2. Action Taken code
 3. Malfunction code
 4. Work Unit Code

- 1-47. What code is often referred to as the manufacturer's code?
1. JCN
 2. CAGE
 3. WUC
 4. WCC
- 1-48. An aircraft has 479 flight hours on it since new. You have just removed and replaced a damaged canopy. What entry should you place in the Time/Cycles block on the VIDS/MAF?
1. E0479
 2. A4790
 3. A0479
 4. E4790
- 1-49. A Technical Directive Status code consists of how many characters?
1. One
 2. Two
 3. Three
 4. Four
- 1-50. SE Custody and Maintenance History Record, OPNAV 4790/51, is used for which of the following purposes?
1. To record custody and transfer information
 2. To provide rework and overhaul data
 3. To identify applicable and incorporated technical directives
 4. All of the above
- 1-51. Of the following equipment, which one requires an OPNAV 4790/51 card?
1. PME equipment
 2. Engine test cells and stands
 3. GB1As
 4. VAST stations
- 1-52. On initiation of each new OPNAV 4790/51, reporting custodians retain the latest processed copy from the permanent custodian. A current copy is also maintained with any accumulated data transcribed to it.
1. True
 2. False
- 1-53. What document provides scheduled control of the predictable maintenance workload?
1. SE Custody and Maintenance History Record
 2. VIDS/MAF
 3. MDs report
 4. Monthly Maintenance Plan
- 1-54. At the organizational level, what officer sets the format and arrangement of the monthly maintenance plan?
1. The maintenance material control officer
 2. The quality assurance officer
 3. The aircraft maintenance officer
 4. The safety officer
- 1-55. At the organizational level, the MMP is distributed by what day of the month prior to the month to which it applies?
1. 1st
 2. 5th
 3. 15th
 4. 25th
- 1-56. Which of the following information is included in the MMP?
1. Current list of QARS
 2. High-time components
 3. Schedule of technical training
 4. Each of the above

1-57. To increase technical knowledge levels and enhance and improve existing formal training through diagnostic testing procedures is the primary goal of which of the following programs?

1. PQS
2. MTIP
3. FRAMP
4. NAESU

ASSIGNMENT 2

Textbook Assignment: "Publications." Pages 2-1 through 2-40.

- 2-1. What is the primary purpose of technical publications?
1. To train nonmaintenance personnel
 2. To replace technical training requirements
 3. To help you perform your assigned maintenance
 4. To support logistics
- 2-2. For a description of the NAVAIR technical manual program, you should refer to what publication?
1. NAVSUP 2002
 2. NAVAIR 00-25-100
 3. NAVAIR 00-500A
 4. NAVAIR 00-500B
- 2-3. What are the two major types of technical manuals?
1. Operational and maintenance
 2. Conventional and work package (WP)
 3. Organizational and intermediate
 4. Commercial and conventional
- 2-4. Which of the following format styles can be found in technical manuals?
1. Conventional and work package (WP)
 2. Commercial and conventional
 3. Simple and complex
 4. Organizational and intermediate
- 2-5. The format of a publication should be designed to improve which of the following key aspects?
1. Readability
 2. Reproduction of pages
 3. Replacement of page changes
 4. Usability
- 2-6. Each work package of a work package type of manual contains all information required to perform a specific task on an aircraft system.
1. True
 2. False
- 2-7. Where does the WP identification number appear on a page in a WP manual?
1. Top center
 2. Top left comer
 3. Top right comer
 4. Bottom center
- 2-8. A WP number consists of what total number of digits?
1. 12
 2. 10
 3. 8
 4. 5
- 2-9. Technical manuals are updated by what means?
1. Changes and revisions
 2. Notices
 3. RACs
 4. Difference data sheets

- 2-10. What technical publication update method involves the complete reissue of a replacement manual with all change information incorporated?
1. RAC
 2. Revision
 3. Notice
 4. Change
- 2-11. Technical Publication Deficiency Reports (TPDRs) usually result from fleet inputs that include changes for which of the following reasons?
1. To correct user-detected errors
 2. To improve verbiage
 3. To incorporate a “better way”
 4. Each of the above
- 2-12. Which of the following numbers indicates a illustration has been added to a maintenance manual because of an issued change?
1. 2-1B
 2. 2-1.1
 3. 2-B1
 4. 2.1-1
- 2-13. Which of the following occurrences in a manual does NOT require an associated change symbol?
1. Blank spaces resulting from the deletion of text material
 2. Relocation of material that changes procedures of an inspection
 3. Incorporation of a part on an illustration
 4. New material on an added page
- 2-14. What method is used to incorporate a minor design change to equipment without making a direct impact on the existing information contained in a manual?
1. Revision
 2. Change
 3. Difference data sheet
 4. Rapid action change
- 2-15. In a WP manual, what information is contained in the numerical index of effective WPs?
1. All changed pages only
 2. All deleted WPs only
 3. All revised WPs only
 4. All changed, revised, added, or deleted WPs
- 2-16. A change symbol in a WP manual is required for changes to which of the following elements?
1. IPB illustrations
 2. Diagrams only
 3. Line drawings only
 4. Diagrams, line drawings, and illustrations
- 2-17. A NAVAIR manual number consists of what parts?
1. A letter prefix and one additional part
 2. A numerical prefix and two additional parts
 3. A letter prefix and three additional parts
 4. A numerical prefix and four additional parts
- 2-18. What is identified by part I of the publication number?
1. The general subject classification
 2. The type of manual
 3. The category of manual
 4. The group of manual

- 2-19. What portion of NAVAIR publication number NAVAIR 01-75PAC-1 specifies the type aircraft and the manufacturer of the aircraft to which the publication applies?
1. 01-75 only
 2. 75PAC only
 3. 01-75PAC
 4. PAC-1
- 2-20. What portion of NAVAIR publication number NAVAIR 01-85AD-1 signifies the publication is a NATOPS manual?
1. 01
 2. -85AD
 3. -1
 4. AD-1
- 2-21. The purpose of the TMINS is to meet the requirements of all systems commands to obtain what standardized information concerning technical manuals and changes?
1. Identification only
 2. Referencing only
 3. Requisitioning only
 4. Identification, referencing, and requisitioning
- 2-22. TMINS numbers for manuals are patterned after what numbering system?
1. National Stock Number System
 2. Subject Serial Number
 3. Standard Subject Classification Code
 4. Unit Identification System
- 2-23. The publication identifier (PI) is the root of the TMINS number. It contains a total of how many characters?
1. 13
 2. 12
 3. 11
 4. 10
- 2-24. What information is identified by the first seven characters of the PI?
1. The technical manual
 2. The Standard Subject Classification code
 3. The subject serial number
 4. The hardware or subject identifier
- 2-25. What information is identified by the first letter in the PI?
1. The subject serial number
 2. The responsible command
 3. The type of manual
 4. The Standard Subject Classification code
- 2-26. What information is identified by the second group of characters in the PI?
1. The subject serial number
 2. The responsible command
 3. The type of manual
 4. The Standard Subject Classification code
- 2-27. What information is identified by the third group of characters in the PI?
1. The subject serial number
 2. The responsible command
 3. The type of manual
 4. The Standard Subject Classification code
- 2-28. The first group of characters in the technical manual identifier consists of three letters or numbers. This group is known as the TM
1. issue
 2. identifier
 3. serial number
 4. acronym

2-29. The third group of characters in the technical manual identifier consists of a single number or letter. It is known as the TM

1. issue
2. identifier
3. serial number
4. acronym

2-30. TIMINS identifies classified publications by what means?

1. Total PI composition
2. The PI prefix
3. The PI subject serial number
4. The PI suffix

2-31. What manual gives a comprehensive explanation of the TMINS?

1. NAVAIR 00-500AV
2. NAVAIR 00-500B
3. M0000-00/TMINS
4. N0000-00-IDX-000/TMS

2-32. Which section of the MIM covers component repair procedures for intermediate-level maintenance?

1. Section I
2. Section II
3. Section III
4. Section IV

IN ANSWERING QUESTION 2-33, REFER TO FIGURE 2-18 IN THE TEXTBOOK.

2-33. In which callout of figure 2-18 is information found on specific tools other than standard items to perform maintenance?

1. Callout A
2. Callout B
3. Callout C
4. Callout D

2-34. For which of the following reasons are sections of MIMs now issued as separate publications under individual identifying numbers?

1. Less expensive to produce
2. Easier to use only
3. Easier procurement, storage, filing, and use
4. Easier replacement

2-35. A listing of weapons systems component parts keyed to illustrations is provided in what type of manual?

1. Maintenance Instruction Manual
2. Structural Repair Manual
3. Illustrated Parts Breakdown manual
4. Aircraft Maintenance Manual

2-36. All aeronautical publications, changes, technical directives, and forms issued by NAVAIRSYSCOM are cataloged in the Naval Aeronautic Publications Index (NAPI).

1. True
2. False

2-37. The Naval Aeronautic Publications Index (NAPI) consists of how many sections?

1. Six
2. Two
3. Eight
4. Four

2-38. What aircraft maintenance division normally maintains a complete NAPI?

1. Maintenance material control
2. Administration
3. Quality assurance
4. Armament

2-39. For more in-depth information concerning the NAPI, you should refer to which of the following publications?

1. NAVAIR 00-25-100
2. NAVAIR 00-80T-96
3. NAVAIR 01-1A-540
4. NAVAIR 01-85ADC-1

2-40. What series of manuals covers standard aviation maintenance practices that apply to all aircraft?

1. -1
2. 01-1A
3. 01-1B
4. -8

2-41. Large, high-density avionics aircraft with computer-controlled, integrated weapons systems use what type of manual to aid the aircrew in maintaining large analysis and single flow data?

1. Structural repair manual
2. Support equipment manual
3. NATOPS manuals
4. Crew station manuals

2-42. Large, high-density avionics aircraft with computer-controlled, integrated weapons systems use what type of manual to help the aircrew troubleshoot and repair equipment to maintain mission capability while still airborne?

1. Structural repair manual
2. Support equipment manual
3. NATOPS manuals
4. In-flight maintenance manual

2-43. What NAVAIR manual contains basic structural repair data common to all aircraft?

1. NAVAIR 00-25-100
2. NAVAIR 01-1A-1
3. NAVAIR 01-1A-540
4. NAVAIR 01-85ADC-1

2-44. When you see a publication numbered NAVAIR XX-XXX-4, you know that this manual is of what type?

1. Maintenance Instruction Manual
2. Illustrated Parts Breakdown
3. Structural Repair Manual
4. Work Unit Code Manual

2-45. The Planned Maintenance System publications consist of what type or types of cards or charts?

1. MRCs only
2. PMICs only
3. SCCs only
4. MRCs, PMICs, and SSCs

2-46. What PMS publication provides information in an abbreviated walkaround order to aid personnel when they inspect aircraft surfaces?

1. Turnaround checklist
2. Daily MRC
3. Phase maintenance requirements cards
4. Periodic maintenance information Cards

2-47. What safety publication contains information and guidelines on acceptable work place safety and health standards ashore?

1. OPNAVINST 3750.6
2. OPNAVINST 5100.23
3. NAVAIR A1-NAOSH-SAF-000/P5100-1
4. NAVAIR 00-25-100

- 2-48. A technical directive change directs the accomplishment and recording of a material change, a repositioning, a modification, or an alteration in the characteristics of the equipment to which it applies.
1. True
 2. False
- 2-49. A technical directive that is issued to clarify, add to, delete from, make a minor requirement change, or cancel an existing technical directive is known as what type of technical directive?
1. Bulletin
 2. Change
 3. Revision
 4. Amendment
- 2-50. Which of the following symbols designates the second revision to a TD?
1. Rev. 1
 2. Rev. 2
 3. Rev. A
 4. Rev. B
- 2-51. A technical directive is issued to correct a safety condition that could result in fatal or serious injury to personnel. What type of technical directive is this?
1. Routine
 2. Immediate action
 3. Urgent
 4. Record purpose
- 2-52. The overall management of the technical library is a function of what activity or individual?
1. Quality assurance division
 2. Commanding officer
 3. Central library supervisor
 4. Material control division
- 2-53. What form does the dispersed librarian sign to indicate the receipt of a publication change from the central library?
1. DD Form 1348
 2. NWPL (OPNAV Form 5070/11)
 3. CECR (OPNAV Form 5070/12)
 4. OPNAV Form 4790/66
- 2-54. Routine deficiencies in technical publications are reported via OPNAV Form 4790/66 to what command or commands?
1. CNO
 2. NATSF only
 3. CFA only
 4. NATSF and CFA
- 2-55. When an activity with a central library has other libraries within the command, dispersed technical publications libraries (DTPLs), what organizational element of the activity manages these libraries?
1. The CTPL
 2. QA
 3. Admin
 4. Material control
- 2-56. At least how often does QA audit the CTPL?
1. Monthly
 2. Quarterly
 3. Biannually
 4. Annually
- 2-57. Information about discrepancies or change recommendations of a routine nature on the technical content of a NATOPS should be submitted on what form?
1. OPNAV Form 4790/66
 2. OPNAV Form 4790/12
 3. OPNAV Form 5300/32
 4. OPNAV Form 3500/22

ASSIGNMENT 3

Textbook Assignment: "Aviation Supply." Pages 3-1 through 3-26.

3-1. Which of the following numbers is a supply Project code?

1. 6RX-4920-00-237-97934X
2. AN6227-7
3. AK7
4. 63425

IN ANSWERING QUESTIONS 3-2 AND 3-3, REFER TO TABLE 3-1 IN THE TEXT.

3-2. Your squadron is categorized as a FAD II activity and you require a mission essential part. What is the highest priority that can be assigned to your request?

1. 1
2. 2
3. 7
4. 13

3-3. When a FAD III is assigned to your activity, what is the highest priority you should use to order routine replenishment stock?

1. 5
2. 2
3. 10
4. 13

3-4. Information from which of the following sources is used by supply department personnel as justification for stocking material?

1. Forecasted flights
2. Usage statistics
3. Management decisions
4. Monthly maintenance plans

3-5. Which of the following numbers is listed first in an alphanumeric parts listing?

1. 899T1384
2. AN6437
3. 216849
4. 0836948

3-6. Which of the following part numbers follows sequence number 08643759 in an alphanumeric listing?

1. 943762
2. P46843
3. ZB4738
4. 064795

3-7. What type of code identifies the agent or agency that has design control over an item?

1. CAGE
2. H4/H8
3. MCRL
4. ML-N

3-8. Which of the following is a purpose of an illustrated parts breakdown?

1. To allow supply and maintenance personnel to identify and order replacement parts for aircraft or equipment
2. To determine interchangeables, next higher assemblies, and repairables
3. To determine source codes, CAGES, and source of supply
4. To determine units used for assembly and aircraft bureau number application

3-9. What section in an IPB contains general information and instructions for using the publication?

1. Introduction
2. Group assembly parts list
3. Numerical index
4. Alphabetical index

3-10. Besides the introduction, each IPB includes which of the following information?

1. Table of contents or alphabetic index
2. Group assembly parts list
3. Numerical index
4. Each of the above

3-11. What section of the IPB contains an explanation of the source or SM&R codes used in the IPB?

1. Introduction
2. Group assembly parts list
3. Numerical index
4. Alphabetical index

3-12. What listing in the IPB lists aircraft assemblies and identifies the pages or figure numbers where the assemblies are shown in the IPB?

1. Alphabetical index
2. Group assembly parts list
3. Numerical index
4. Introduction

3-13. What section of the IPB contains a description of a component listed in the IPB?

1. Introduction
2. Group assembly parts list
3. Numerical index
4. Alphabetical index

3-14. What section of the IPB lists supplementary handbooks to which you may refer?

1. Introduction
2. Group assembly parts list
3. Numerical index
4. Alphabetical index

3-15. What is the purpose of an index number in an IPB?

1. To describe a major component
2. To establish the relationship between parts in the illustration and the corresponding parts list
3. To identify items procured from a commercial source
4. To provide a reference number

IN ANSWERING QUESTION 3-16, REFER TO FIGURE 3-2 IN THE TEXT.

3-16. In what figure can the next higher assembly for the flow regulator be found?

1. 037-00
2. 019-00
3. 029-00
4. 046-00

IN ANSWERING QUESTIONS 3-17 THROUGH 3-24, REFER TO FIGURE 3-4 IN THE TEXTBOOK.

3-17. Which of the following is a description of the units per assembly (callout 5 of figure 3-4)?

1. The column number in which the nomenclature of the item begins
2. The relationship of one part to another
3. A specific quantity has not been established
4. The aircraft bureau number on which the item can be used

- 3-18. Find index No. 5. A total of how many screws (part number MS27039-1-22) are used on the bracket assembly?
1. 5
 2. 2
 3. 12
 4. 4
- 3-19. Find index No. 9. Where must the maintenanceman refer to for wheel assembly, NLG (part number 3-1328) required per aircraft?
1. The table of contents
 2. The numerical index
 3. Figure 046-00 in the IPB
 4. The Usable-on Code index
- 3-20. Find index No. 7. The fitting assembly (part number A51G10561-1) can be used on an aircraft with which of the following bureau numbers?
1. 148885
 2. 153499
 3. 159874
 4. 152719
- 3-21. What is the Commercial and Government Entity (CAGE) code for part number 2577818-011E<F?
1. 552847
 2. 671361-101
 3. 3-1089
 4. 28 x 7.7
- 3-22. What is the Usable-On code for Index No. 2?
1. A
 2. B
 3. C
 4. D
- 3-23. What is the SM&R code for the NLG shock strut?
1. PAOZZ
 2. MDOZZ
 3. XCOOO
 4. PAOOD
- 3-24. What is the description of part number MS21042L3?
1. Screw
 2. Nut
 3. Bracket
 4. Light
- 3-25. You need to order a replacement component for an aircraft, and you do not know the part number of the item. Which of the following basic information should you be able to provide the AK so that he or she can research the IPB?
1. Type of aircraft on which the part was installed
 2. The component on which the part was installed
 3. The bureau number of the aircraft from which the part was removed
 4. All of the above
- 3-26. An SM&R code is a five- or six-position alphanumeric code.
1. True
 2. False

IN ANSWERING QUESTION 3-27, REFER TO FIGURE 3-5 IN THE TEXTBOOK.

- 3-27. What part of a part's SM&R code indicates how the part is to be acquired?
1. Source code only
 2. Maintenance code only
 3. Recoverability code only
 4. Source, Maintenance, and Recoverability codes
- 3-28. What position of the SM&R code identifies the maintenance level assigned to completely repair an item?
1. First
 2. Second
 3. Fourth
 4. Fifth
- 3-29. What information does the third position of an SM&R code provide?
1. The highest maintenance level authorized to remove, replace, and use an item
 2. The maintenance level authorized to completely repair an item
 3. The lowest maintenance level authorized to remove, replace, and use an item
 4. The Service Option code that applies
- 3-30. What two instructions govern policies, procedures, and definitions applicable to SM&R codes?
1. OPNAVINST 4790.2 and NAVSUPINST 4440.16
 2. NAVSUPINST 4423.14 and NAVAIRINST 4423.3
 3. OPNAVINST 4440.25 and NAVSUPINST 7300.6
 4. NAVSUPINST 4700.16 and NAVAIRINST 4410.4
- 3-31. When removal of a component from an aircraft is not feasible or advisable until a replacement is on hand, supply personnel can exempt the turn-in of the component (retrograde) if its part number is listed in what document?
1. LIRSH
 2. CRIPL
 3. MCRL
 4. MESSM
- 3-32. What ASO publication contains a complete list of Navy-managed material that is classified as MTR?
1. CRIPL
 2. MRIL
 3. IMRL
 4. ML-N
- 3-33. What type of material is listed in the CRIPL?
1. Material essential for flight operations
 2. Material exempt from the one-for-one turn-in rule
 3. Material considered hazardous
 4. Material subject to deterioration after a specified time
- 3-34. The reference number on a master cross-reference list refers to what number or numbers?
1. Manufacturer's part number only
 2. Drawing numbers only
 3. Drawing number and design control number only
 4. Either a manufacture's part number, a drawing number, or a design control number

- 3-35. The MCRL is used to provide a cross-reference between what items of information?
1. Noun name and CAGE
 2. CAGE and NIIN
 3. NIIN and item number
 4. Reference number and NSN
- 3-36. What is the purpose of the ICRL-A?
1. To cross-reference numbers to NSNs
 2. To provide squadrons with a list of NSNs that are exempt from the one-for-one turn-in rule
 3. To provide a list of repairables and the local IMA's capability to repair them
 4. To cross-reference CAGES to reference numbers
- 3-37. An ICRL-A is revised at what specified interval?
1. Annually
 2. Biannually
 3. Quarterly
 4. Monthly
- 3-38. What ICRL Capability code is used for check and test only?
1. Z1
 2. X2
 3. C1
 4. A1
- 3-39. Within the ICRL listing, what code is equivalent to Beyond Capability of Maintenance (BCM)-3?
1. X1
 2. X2
 3. X3
 4. X6
- 3-40. To what reference should you refer to obtain an NSN or reference number for an item when you only know the description?
1. MRIL3
 2. CRIPL
 3. ASG
 4. ML-N
- 3-41. What is the 13-digit number called that identifies an item of material in the supply system?
1. NSN
 2. NIIN
 3. FSC
 4. SMIC
- 3-42. What is the title of the overall program that provides the data required for effective management of support equipment at all levels of maintenance?
1. ICRL
 2. IMRL
 3. AMMRL
 4. AVCAL
- 3-43. What command exercises overall program management for the AMMRL program?
1. ASO
 2. NAVAIRSYSCOM
 3. NAVAIRENGCEN
 4. NAMO
- 3-44. What information is provided by the first two digits in the FSC code number?
1. The FSC group
 2. The major or broad category of the stock
 3. Manager that controls the category of material
 4. The detailed breakdown of a category of material

- 3-45. The NSN is comprised of what total number of digits?
1. 15
 2. 16
 3. 17
 4. 13
- 3-46. Which of the following acronyms identifies equipment that is required on the ground to make a system, subsystem, or end item of equipment operational?
1. IMRL
 2. ATE
 3. GFE
 4. SE
- 3-47. Within an activity, personnel in what rating normally maintain the IMRL?
1. AZ
 2. AK
 3. AS
 4. AD
- 3-48. The IMRL contains how many major sections?
1. 1
 2. 2
 3. 3
 4. 5
- 3-49. At the organizational maintenance level, the point of contact for all material requirements generated by a squadron is located in what organization?
1. Material control center
 2. ASD/SSC
 3. AIMD
 4. Production control
- 3-50. What Material Condition code tells you that an item of supply is fast moving and in high demand?
1. F
 2. I
 3. O
 4. S
- 3-51. To determine whether an intermediate maintenance activity has capability to test/check or repair an item, what I-level supply area screens all components turned into ASD/SSC?
1. AMSU
 2. SRS
 3. CCS
 4. SUADPS
- 3-52. The ASD/SSC is composed of what section or sections?
1. CCS only
 2. SRS only
 3. SRS and CCS
 4. ASD
- 3-53. The SRS limits the quantity of any item in the pre-expended bin to a 30-day supply.
1. True
 2. False
- 3-54. Within an activity, what officer must approve the item of PEB stockage when it costs more than \$150?
1. The supply officer
 2. The aviation maintenance officer
 3. The division officer
 4. The commanding officer

3-55. Supply will remove an item from the PEB if there has been no demand for the item within what total period of time?

1. 1 month
2. 6 months
3. 3 months
4. 12 months

3-56. What is the purpose of the component control section within the supply department?

1. To manage the LRCA at the ASD/SSC
2. To account for all repairables
3. To operate the rotatable pool
4. To operate as a storage unit

3-57. A LRCA is assigned a workload priority. The priority assigned is one of what total number of priorities that can be assigned to the LRCA?

1. Two
2. Three
3. Four
4. Five

3-58. An aircraft is in NMCS/PMCS status. What priority is assigned to LRCA in support of this aircraft?

1. Priority 1
2. Priority 2
3. Priority 3
4. Priority 4

ASSIGNMENT 4

Textbook Assignment: "Corrosion Control." Pages 4-1 through 4-58.

- 4-1. What is the greatest threat to the structural integrity of an aircraft?
1. Aircraft design
 2. Aircraft weight
 3. Metal corrosion
 4. Metal composition
- 4-2. Corrosion is detrimental to the integrity of an aircraft. It alters the structure of the materials that make up the aircraft in what manner?
1. Reduction in strength only
 2. Change in mechanical characteristics only
 3. Reduction in strength and change in mechanical characteristics
 4. Decreases aerodynamic efficiency
- 4-3. The materials used in the construction of an aircraft are chosen according to their
1. cost
 2. availability
 3. corrosion-resistant properties,
 4. weight-to-strength ratio
- 4-4. Metal corrosion is defined as the deterioration of metal as it combines with which of the following elements?
1. Nitrogen
 2. Argon
 3. Oxygen
 4. Helium
- 4-5. On naval aircraft, what materials are used most often to separate susceptible alloys from the corrosive environment?
1. Shrouds
 2. Paints
 3. Sealants
 4. Preservatives
- 4-6. Which of the following is a description of the flow of electrons during electrochemical attack of a metal?
1. Electrons flow from the anodic area to the cathodic area, resulting in the deterioration of the anodic area
 2. Electrons flow from the anodic area to the cathodic area, resulting in the deterioration of the cathodic area
 3. Electrons flow from the cathodic area to the anodic area, resulting in the deterioration of the cathodic area
 4. Electrons flow from the cathodic area to the anodic area, resulting in the deterioration of the anodic area
- 4-7. Which of the following conditions are factors in the electrochemical reaction that causes metals to corrode?
1. Heat and humidity only
 2. Heat and moisture only
 3. Moisture and humidity only
 4. Heat, humidity, and moisture

- 4-8. Because of variations in their composition, which of the following aircraft surfaces is the most susceptible to corrosive attack?
1. Alclad
 2. Nonclad
 3. Thin structural
 4. Thick structural
- 4-9. Which of the following conditions is the single greatest contributor to avionics corrosion?
1. Heat
 2. Moisture
 3. Stray voltage
 4. Incomplete circuits
- 4-10. Which of the following publications provides information on aircraft corrosion control for organizational-level maintenance?
1. NAVAIR 01-1A-509
 2. NAVAIR 15-01-500
 3. NAVAIR 16-1-540
 4. NAVAIR 15-02-500
- 4-11. Which of the following publications provides information on aircraft cleaning?
1. NAVAIR 01-1A-509
 2. NAVAIR 16-1-540
 3. NAVAIR 15-02-500
 4. NAVAIR 15-01-500
- 4-12. Which of the following publications provides information on avionics cleaning and corrosion prevention and control?
1. NAVAIR 15-01-500
 2. NAVAIR 15-02-500
 3. NAVAIR 01-1A-507
 4. NAVAIR 16-1-540
- 4-13. Which of the following publications provides information on the preservation of aircraft engines?
1. NAVAIR 15-01-500
 2. NAVAIR 01-1A-518
 3. NAVAIR 01-1A-507
 4. NAVAIR 16-1-540
- 4-14. Which of the following publications provides information on the preservation of naval aircraft?
1. NAVAIR 15-01-500
 2. NAVAIR 01-1A-507
 3. NAVAIR 01-1A-509
 4. NAVAIR 15-02-500
- 4-15. Which of the following publications provides information on the general use of cements, sealants, and coatings used on aircraft?
1. NAVAIR 15-01-500
 2. NAVAIR 01-1A-509
 3. NAVAIR 01-1A-507
 4. NAVAIR 16-1-540
- 4-16. When carrier-based aircraft are transferred to shore activities, what happens to the scope of most corrosion preventive programs?
1. It decreases
 2. It increases
 3. It remains the same
 4. It is canceled
- 4-17. Normally, aircraft squadrons with the best corrosion preventive programs have which of the following benefits?
1. The best safety records
 2. The most use of the aircraft
 3. The lowest operating costs
 4. All of the above

- 4-18. As directed by NAVAIR, aircraft deployed aboard an aircraft carrier will be washed and cleaned a minimum of how often?
1. Every 7 days
 2. Every 10 days
 3. Every 14 days
 4. Every 28 days
- 4-19. Mandatory aircraft cleaning is always required after an aircraft is exposed to which of the following substances?
1. Fire-extinguishing materials splashed on the landing gear
 2. Alkaline cleaning solution splashed on the wings
 3. Exhaust deposits on the aft fuselage
 4. Rocket blast deposits on the forward fuselage
- 4-20. Unpainted surface of struts and actuating cylinder rods should be cleaned or wiped down at what prescribed interval?
1. Daily
 2. Twice weekly
 3. Weekly
 4. Twice monthly
- 4-21. When handling, using, and storing aircraft cleaning materials, what is/are the most serious hazard(s) you will meet?
1. Heat expansion
 2. Flammability only
 3. Toxicity only
 4. Flammability and toxicity
- 4-22. When using hazardous chemicals, you should wear which of the following protective devices?
1. Gloves and aprons only
 2. A face shield only
 3. An approved respirator only
 4. Gloves and aprons, a face shield, and an approved respirator
- 4-23. Solvents must be kept in specially marked containers if they contain more than what percent by volume of chlorinated materials?
1. 8%
 2. 10%
 3. 12%
 4. 24%
- 4-24. When volatile and flammable materials are not being used, they should be stored in which of the following areas?
1. In a metal cruise box inside the corrosion control work spaces
 2. Inside a separate locker in the material control spaces
 3. Inside a separate building or flammable liquids storeroom
 4. Inside a designated hangar space
- 4-25. What solvent is generally used as an all-purpose cleaner in naval aviation maintenance?
1. Methyl ethyl ketone
 2. Aliphatic naphtha
 3. Aromatic naphtha
 4. Dry-cleaning solvent
- 4-26. Which of the following solvents is an alternate compound for cleaning acrylics?
1. Methyl ethyl ketone
 2. Aliphatic naphtha
 3. Aromatic naphtha
 4. Ammonium hydroxide
- 4-27. Safety solvent is intended for use when a high flash point is required. You should NOT use safety solvent to clean which of the following areas of an aircraft?
1. Oxygen systems
 2. Avionic/electrical systems
 3. Disassembled/assembled engine components
 4. Wheel bearing and brake components

4-28. To neutralize the effects of urine and waste products in the lavatories of aircraft, you should use which of the following cleaning agents?

1. Dry-cleaning solvent
2. Aircraft surface cleaning compound
3. Ammonium hydroxide or sodium bicarbonate
4. Sodium phosphate

4-29. In an intermediate maintenance activity, an avionics/electrical maintenance branch that operates a "clean room" should use what type of MIL-C-81302 Freon cleaner?

1. I
2. II
3. III
4. IV

4-30. To produce a high-luster, long-lasting polish on an unpainted aluminum clad surface, you should use what mechanical cleaner?

1. Powdered pumice
2. Fine aluminum wool
3. Aluminum metal polish
4. Abrasive-impregnated cotton wadding

4-31. Which of the following devices should you use to perform a fast and economical cleaning of an aircraft?

1. Cotton mops
2. Conformable applicators
3. Bristle brushes
4. Ajax speed wipes

4-32. There are several steps that you must take before you can actually clean an aircraft. Which of the steps listed below is the first one you should take?

1. Select the correct cleaning agent for the method of cleaning that you will use
2. Ground the aircraft, close the canopy, and secure all doors
3. Park the aircraft in the shade or beneath an overhead shelter, if possible
4. Cover or plug all ducts and openings where cleaning fluid or water could be trapped

4-33. Which of the following cleaning compounds should be used to clean an aircraft that is painted with the tactical paint system?

1. MIL-C-25769
2. MIL-C-43616
3. MIL-C-81309
4. MIL-C-85570

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IN ANSWERING QUESTION 4-34, REFER TO FIGURE 4-6 IN THE TEXTBOOK.

4-34. To ensure complete cleaning and rinsing of all aircraft surfaces, you should use which of the following washing sequences?

1. Upper tail and fuselage sections, upper wing surfaces, lower fuselage and tail, lower wing surfaces
2. Lower surfaces in any sequence followed by upper surfaces in any sequence that will result in adequate rinsing
3. Underside of wings, underside of fuselage and tail, upper wing and fuselage center section, upper surfaces of fuselage and tail section, including vertical stabilizer
4. Underside of wings, fuselage, and tail in that order, spraying water from the wing tips and fuselage ends, inboard to center, followed by the same sequence on the upper surfaces

4-35. Surfaces that are lightly soiled with oil may be spot-cleaned by wiping them with which of the following substances?

1. Dry-cleaning solvent
2. Grade IV paralketone
3. Methyl ethyl ketone
4. Aromatic naphtha

4-36. In an emergency when an aircraft is without a regular waterproof canvas cover, suitable covering and shrouding may be accomplished by the use of which of the following materials?

1. Polyethylene sheet only
2. Polyethylene-coated cloth only
3. Metal foil barrier material only
4. Polyethylene sheet, polyethylene-coated cloth, and metal foil barrier material

4-37. Where should you place the cowling and access panels when they are removed during a maintenance task?

1. On the wings near the fuselage
2. On the deck under the fuselage
3. On a work stand near the aircraft
4. On a pad or secure them to the aircraft

4-38. The size and composition of an emergency reclamation team is determined by which of the following criteria?

1. Location of the squadron
2. Size of the squadron
3. Urgency of the situation
4. Availability of qualified personnel

4-39. Under which of the following conditions is an aircraft most susceptible to a corrosive attack?

1. When it is not being flown only
2. When it is in shipment only
3. When it is not being flown or when it is in shipment
4. When it is being flown

4-40. How many levels of preservation methods are used on naval aircraft?

1. One
2. Two
3. Three
4. Four

4-41. Level III preservation is used to preserve aircraft for what situation?

1. Long-term storage
2. Short-term storage
3. Ocean shipment
4. Periodic maintenance

- 4-42. Level I preservation should be applied to an aircraft when it is out-of-service for more than what minimum number of days?
1. 7
 2. 14
 3. 28
 4. 30
- 4-43. Which of the following publications contains the requirements for Level I preservation?
1. MIM
 2. IPB
 3. Special PMIC
 4. Special MRC
- 4-44. Which of the following is the main disadvantage of grade IV corrosion preventive compound (paraloketone)?
1. It forms an opaque cover
 2. It is difficult to remove by water spray
 3. It forms a dark, hard film
 4. It is easily removed by water spray
- 4-45. What preservative compound should be used to provide protection for shock struts?
1. Preservative hydraulic oil, MIL-H-46170
 2. Corrosion-preventive petroleum, class 3
 3. Lubricating oil, general-purpose preservative, VV-L-800
 4. Corrosion-preventive compound, solvent cutback, grade 1
- 4-46. Piano-wire hinges require lubricating and corrosion protection. What water-displacing, low-temperature, lubricating oil should you use?
1. Preservative hydraulic oil, MIL-H-46170
 2. Lubricating oil, general-purpose, preservative, VV-L-800
 3. Engine preservative oil, MIL-L-23699
 4. General lubricating oil, MIL-L-7870
- 4-47. You should use corrosion preventive compound MIL-C-81309, type III, on which of the following equipment?
1. Avionic and electrical equipment
 2. Hydraulic system equipment
 3. Engine fuel control systems
 4. Ejection seat mechanisms
- 4-48. Which of the following is a laminated metal-foil material used for the protection of acrylics during cleaning?
1. Polyethylene plastic film
 2. Polyethylene coating cloth
 3. Water vaporproof barrier material
 4. Kraft paper
- 4-49. You should check for corrosion and deterioration during which of the following routine inspections?
1. Daily only
 2. Phase only
 3. Postflight only
 4. Daily, phase, and postflight

- 4-50. Corrosion may occur in several forms, depending on which of the following factors?
1. Metal involved only
 2. Atmospheric conditions only
 3. Corrosion-producing agents present only
 4. Metal involved, atmospheric conditions, and corrosion-producing agents present

- A. Direct surface attack
- B. Pitting corrosion
- C. Crevice attack
- D. Intergranular corrosion
- E. Exfoliation corrosion
- F. Fretting corrosion
- G. Fatigue corrosion
- H. Galvanic corrosion
- I. Filiform corrosion
- J. Microbiological corrosion

Figure 4-A

IN ANSWERING QUESTIONS 4-51 THROUGH 4-60, CHOOSE THE FORM OF CORROSION FROM FIGURE 4-A THAT FITS THE DESCRIPTION OF THE CORROSION USED AS THE QUESTION. EACH FORM OF CORROSION IS USED AS AN ANSWER ONLY ONCE.

- 4-51. Threadlike filaments that form under organic substances (such as paint film).
1. A
 2. C
 3. F
 4. I
- 4-52. Fungus growths on the sealing materials of integral fuel tanks.
1. J
 2. F
 3. D
 4. B

- 4-53. Slipping movement between two mating metal surfaces.
1. C
 2. E
 3. F
 4. I
- 4-54. Uniform etching of the metal surfaces.
1. A
 2. B
 3. C
 4. G
- 4-55. Shallow indentations or deep cavities of small diameter that form on metal surfaces.
1. I
 2. H
 3. E
 4. B
- 4-56. Caused by the difference in concentration of the electrolyte or the active metal on the anode and cathode.
1. A
 2. C
 3. G
 4. J
- 4-57. Corrosive attack along the grain boundaries of a metal alloy.
1. C
 2. D
 3. I
 4. J
- 4-58. Metal fractures caused by the combined effects of corrosion and stress applied in cycles to a part.
1. G
 2. F
 3. E
 4. D

- 4-59. Dissimilar metals in contact in a corrosive medium, such as salt water.
1. B
 2. D
 3. E
 4. H
- 4-60. Lifting up of the metal surface caused by the force of expanding corrosion products occurring at the grain boundaries just below the metal surface.
1. E
 2. F
 3. G
 4. H
- 4-61. To identify all the corrosion-prone areas of your squadron's aircraft, you should refer to which of the following publications?
1. Applicable NATOPS manual
 2. Applicable periodic maintenance information cards (PMICS)
 3. Aircraft Cleaning and Corrosion Control Manual
 4. Maintenance requirements cards (MRCs)
- 4-62. When avionic and structural corrosion is compared, which of the following effects is the main difference between avionic and structural corrosion?
1. Avionics systems do not have as many areas in which moisture can be trapped
 2. Corrosion is not as difficult to detect in avionic systems
 3. Small amounts of corrosion can make avionic systems inoperable
 4. Avionic components are more corrosion resistant
- 4-63. Before performing any maintenance on avionic or electrical systems, you should make sure that you have completed which of the following actions?
1. Ground the aircraft
 2. Check and tie down the aircraft
 3. Secure all external electrical power
 4. Install all covers and shrouds
- 4-64. What type of corrosion is usually found around electrical bonding and grounding straps?
1. Filiform
 2. Galvanic
 3. Microbiological
 4. Stress
- 4-65. You are inspecting an aircraft ejection seat. It is very important that even the slightest indication of corrosion be found for which of the following reasons?
1. Corrosion can weaken the structural soundness of the seat
 2. Slight amounts of corrosion may indicate other problems that are not visible
 3. Slight amounts of corrosion may cause the seat to be inoperable
 4. Each of the above
- 4-66. When inspecting engine frontal areas and cooling air vents, what type of discrepancy(ies) are you likely to find?
1. Galvanic corrosion
 2. Stress corrosion cracking
 3. Dirt, dust, gravel, and rain erosion
 4. Intergranular, filiform, and fatigue corrosion

- 4-67. One corrosion-prone area of an aircraft is the bilge area. What condition is the best insurance against corrosion in this area?
1. A good, intact paint system in the bilge area
 2. A clean, dry bilge area
 3. Adequate supply of drain holes in the bilge area
 4. Frequent inspections of the bilge area
- 4-68. Which of the following statement is NOT true regarding the dry honing machine?
1. It is the only approved blasting method of removing corrosion on assembled aircraft
 2. Metal removal can be held to closer limits
 3. May be used on any aircraft skin or surface
 4. May be used in either shipboard or shore-based operations
- 4-69. Corrosion damage limits refer to the amount of metal that may be removed from a corroded part without impairing the strength and function of the part.
1. True
 2. False
- 4-70. What is the purpose of chemically treating a surface after the removal of corrosion products?
1. To protect the metal in place of paint
 2. To increase the surfaces resistance to corrosion
 3. To improve the paint bond to the surface
 4. Both 2 and 3 above
- 4-71. Which of the following statements is true about aircraft painting and touch-up?
1. The primary objective of any paint finish is to reduce the glare by nonspecular coatings
 2. Repainting should not be done for appearance sake only
 3. A faded paint finish indicates poor corrosion prevention and should be repainted
 4. White or light colored, high gloss finishes induce heat absorption

ASSIGNMENT 5

Textbook Assignment: "Line Operations and Special Programs." Pages 5-1 through 5-35.

- 5-1. When you are assigned to the line division, what person becomes your department head?
1. The line division officer
 2. The commanding officer
 3. The aircraft maintenance officer
 4. The line division chief petty officer
- 5-2. A troubleshooter must possess which of the following skills and/or knowledges?
1. Skill as a technical advisor to the plane captain only
 2. Knowledgeable in line operations only
 3. Knowledgeable in flight line safety only
 4. Skill as a technical advisor to the plane captain and be knowledgeable in line operations and flight line safety
- 5-3. Normally, what percentage of the total personnel assigned to the line division are assigned to the plane captain branch?
1. Between 15 and 35 percent
 2. Between 35 and 55 percent
 3. Between 55 and 75 percent
 4. Between 75 and 95 percent
- 5-4. What is the final step in becoming a qualified plane captain?
1. Be designated in writing by the commanding officer
 2. Be in the line division for the specified time interval
 3. Pass a written test
 4. Pass an oral test
- 5-5. Whenever a technician other than the plane captain performs portions of a daily/turnaround inspection on an aircraft, the plane captain is relieved of all responsibility for that aircraft.
1. True
 2. False
- 5-6. Which of the following is a list of the qualities that a plane captain must possess?
1. Technical competence, a sense of responsibility, and personal integrity
 2. Mechanical aptitude, personal integrity, and motivation
 3. Technical competence, personal integrity, and mathematical aptitude
 4. Mechanical aptitude, mathematical aptitude, and motivation
- 5-7. Smoking is not permitted within how many feet of an aircraft during fueling operations?
1. 25 ft
 2. 50 ft
 3. 75 ft
 4. 100 ft
- 5-8. Only approved explosion proof lights can be brought within what specified distance of the refueling operations?
1. 10 ft
 2. 20 ft
 3. 30 ft
 4. 50 ft

- 5-9. During fueling operations, a small amount of fuel is accidentally spilled. What action should be taken?
1. The spill should be contained, and then removed once fueling is completed
 2. The spill should be contained and removed immediately
 3. A fire guard should be posted near the spill with fire- extinguishing equipment
 4. Fire authorities should be notified of the spill at once
- 5-10. A plane captain gets fuel in his eyes during fueling operations. What action should the plane captain take?
1. Get medical attention immediately
 2. After fueling operations are completed, get medical attention
 3. Flush his eyes with water, then get medical attention
 4. After fueling operations are completed, notify his or her immediate supervisor
- 5-11. How are aircraft wings and stabilizers marked in areas that should NOT be used as walkways?
1. They are painted black
 2. They are painted yellow
 3. They are marked "NO STEP"
 4. They are marked "DO NOT WALK"
- 5-12. An aircraft is being refueled by truck. What is the minimum distance from the truck that a radar set may be operated?
1. 25 ft
 2. 50 ft
 3. 75 ft
 4. 100 ft
- 5-13. A refueling crew consists of what minimum number of persons?
1. One
 2. Two
 3. Three
 4. Four
- 5-14. The type of fuel contained in the tank of a fuel truck is displayed across the side of the tank. What color and what size lettering is used on the tank?
1. 8-inch-high blue lettering superimposed on 6-inch-high red reflective tape
 2. 5-inch-high orange lettering superimposed on 7-inch-high gray reflective tape
 3. 4-inch-high green lettering superimposed on 6-inch-high gray reflective tape
 4. 6-inch-high red lettering superimposed on 8-inch-high white reflective tape
- 5-15. What are the two types of systems used to fuel naval aircraft?
1. Automatic and manual
 2. Gravity and pressure
 3. Automatic and gravity
 4. Manual and pressure
- 5-16. Which of the following is/are (an) advantage(s) of pressure fueling?
1. Fueling can be done from a single point only
 2. Aircraft can be given a faster turnaround time only
 3. Fueling and defueling can be done from a single point only
 4. Fueling and defueling can be done from a single point, which gives the aircraft faster turnaround time

- 5-17. To find the fueling instructions for an aircraft, you should refer to what publication?
1. IPB
 2. MIM
 3. PMIC
 4. MRC
- 5-18. What is the last step you should take when fueling an aircraft?
1. Apply electrical power to the aircraft
 2. Position the vent monitors on the aircraft according to the applicable MIM
 3. Check the aircraft for leaks
 4. Replace the safety cap on the aircraft receptacle
- 5-19. What device or devices is/are used to drain residual fuel?
1. Fuel cell water drain valves
 2. A defueling hose
 3. A fueling hose
 4. The engine CSD drain
- 5-20. In some cases, engine oil is identified by a four-digit number. What does this number tell you about the oil?
1. Its viscosity only
 2. Its use and viscosity
 3. Its part number only
 4. Its part number and its viscosity
- 5-21. What is the viscosity rating of aircraft engine oil No. 2085?
1. 208
 2. 2
 3. 85
 4. 20
- 5-22. What type of oil is used in most turbojet engines?
1. MIL-L-23699
 2. MIL-L-24699
 3. MIL-L-25699
 4. MIL-L-26699
- 5-23. Hydraulic fluid MIL-H-83282 is what color?
1. Clear
 2. Red
 3. Blue
 4. Orange
- 5-24. You should use hydraulic fluid MIL-H-46170 in which of the following instances?
1. The hydraulic systems of naval aircraft only
 2. In the hydraulic systems of Air Force aircraft only
 3. The hydraulic systems of naval and Air Force aircraft
 4. When preserving hydraulic systems and components in naval aircraft
- 5-25. A can of hydraulic fluid has been opened and partially used. When should this open can be disposed of?
1. Within 24 hours only
 2. Within 48 hours only
 3. Within 72 hours
 4. Immediately
- 5-26. When an aircraft lacks a tire inflation chart plate, a plane captain should obtain tire inflation pressure data from what source?
1. The applicable IPB
 2. The applicable MIM
 3. The maintenance requirements card
 4. OPNAVINST 4790.2

IN ANSWERING QUESTION 5-27, REFER TO FIGURE 5-6 IN THE TEXTBOOK.

- 5-27. An aircraft is land based and has a gross weight of 19,000 pounds. What is the proper tire pressure for this aircraft?
1. 280 psi
 2. 290 psi
 3. 300 psi
 4. 310 psi
- 5-28. What equipment should you always use when inflating aircraft tires?
1. A portable air bottle
 2. An air servicing trailer
 3. A nitrogen servicing trailer
 4. A remote inflator unit
- 5-29. Which of the following is a safety precaution you should follow before you remove a wheel from an aircraft?
1. Inflate the tire
 2. Deflate the tire
 3. Check the tire for proper inflation
 4. Disassemble split-type tires
- 5-30. What personnel have the responsibility for refilling liquid oxygen converters?
1. Plane captains
 2. Aircrewmen
 3. AMEs
 4. AMHs
- 5-31. Of the following parts of high-pressure air valve MS 28889-1) which one presents a FOD hazard and is normally removed?
1. The dust cover
 2. The pin
 3. The valve stem
 4. The O-ring
- 5-32. A total of how many gas cylinders are carried on an air or nitrogen servicing trailer?
1. Eight
 2. Six
 3. Three
 4. Four
- 5-33. You need to determine the remaining amount of oil in the preoiler (PON-6). What device should you use?
1. A float gauge
 2. A sight glass
 3. A direct-reading gauge
 4. A dipstick
- 5-34. What device should be used to catch the overflow oil when the preoiler (PON-6) is used?
1. A bucket
 2. A specially designed drain pan
 3. A drain bottle assembly
 4. A waste oil rag
- 5-35. What type of filtration system is used in an HSU-1 to make sure that clean hydraulic fluid is delivered to an aircraft system?
1. A 1-micron filtration system
 2. A 2-micron filtration system
 3. A 3-micron filtration system
 4. A 4-micron filtration system
- 5-36. What is the exact capacity of the reservoir on the HSU-1?
1. 1 gal
 2. 2 gal
 3. 3 gal
 4. 4 gal

5-37. While an HSU-1 is not in use, what method is used to make sure that the hose end remains clean?

1. It is covered with a MAF bag
2. It is covered with bubble wrap
3. It is connected to an external fitting
4. It is connected to a fitting on the base of the HSU-1

5-38. In the Navy, you are responsible for your own safety as well as the safety of your shipmates.

1. True
2. False

5-39. What device should be used on or around jet intakes during ground maintenance turnup of jet aircraft?

1. Protective struts
2. Protective covers
3. Protective screens
4. Protective stands

5-40. After operation, personnel should not work on the exhaust section of a jet engine for what minimum period?

1. 15 min
2. 30 min
3. 45 min
4. 60 min

5-41. Personnel working around jet aircraft should take which of the following precautions to protect their hearing?

1. Wear the proper ear protection
2. Complete work within exposure time limits
3. Have periodic checks on hearing ability
4. Each of the above

IN ANSWERING QUESTION 5-42, REFER TO FIGURE 5-13 IN THE TEXTBOOK.

5-42. When the aircraft shown is at military power, in what zone would you be exposed to a maximum of 112 dB of engine noise?

1. Contour A
2. Contour B
3. Contour C
4. Contour D

5-43. Which of the following is either a safety precaution or a safety attitude that you should follow when you are working with or around ejection seats?

1. Always consider an ejection seat system as loaded and armed
2. Only authorized personnel may work on ejection seats
3. Ejection seats must be treated with the same respect as a loaded gun
4. Each of the above

5-44. From what direction should personnel approach an overheated wheel?

1. At a 45° angle
2. From the right side
3. From the left side
4. From the fore or aft direction

5-45. What is the recommended procedure for cooling an overheated wheel?

1. Spray the wheel with CO₂
2. Spray the wheel with cool water
3. Spray the wheel with AFFF
4. Park the aircraft in an isolated area for 45 to 60 minutes

- 5-46. If operational necessity dictates that a wheel be cooled immediately, a plane captain should get supervision from personnel who are in what rating?
1. AM
 2. AD
 3. AE
 4. AT
- 5-47. If you have to handle liquid oxygen, you should wear what type of gloves?
1. Tight-fitting rubber
 2. Loose-fitting rubber
 3. Tight-fitting leather
 4. Loose-fitting leather
- 5-48. You are handling liquid oxygen. Which of the following is a description of the way you should wear your clothing?
1. Wear cuffless trousers
 2. Tuck your trousers into your shoes
 3. Roll up your sleeves
 4. Roll up your trousers
- 5-49. Which of the following is a safety precaution that you should follow when working with liquid oxygen?
1. Do not carry matches in liquid oxygen handling areas
 2. Keep tools free from oil and grease
 3. Do not permit smoking in liquid oxygen handling areas
 4. Each of the above
- 5-50. Predeployment training lectures for personnel associated with the flight deck should include which of the following topics?
1. Flight deck and hangar deck safety precautions
 2. Tie-down requirements and techniques
 3. Special shipboard maintenance procedures
 4. Each of the above
- 5-51. During the launching and recovery of aircraft, all personnel that are not required by such operations should stand clear of 'personnel involved in the launch and recovery operations.
1. True
 2. False
- 5-52. Plane captains are required to wear (a) what color helmets and (b) what color flotation vests?
1. (a) Brown (b) green
 2. (a) Brown (b) brown
 3. (a) Green (b) brown
 4. (a) Green (b) green
- 5-53. What person has the authority to approve aircraft jacking?
1. The maintenance chief
 2. The maintenance officer
 3. The shop supervisor
 4. The aircraft handling officer

- 5-54. Which of the following publications should you consult to find the details of special programs?
1. NAVAIR 01-1A-509
 2. NAVAIR 15-1-540
 3. OPNAVINST 4790.2
 4. OPNAVINST 5000.3
- 5-55. What causes the largest percentage of premature engine removals?
1. Faulty manufacturing
 2. Foreign object damage
 3. Faulty maintenance
 4. Pilot error
- 5-56. Which of the following is/are (a) major cause(s) of FOD?
1. Poor housekeeping only
 2. Improper maintenance practices only
 3. Carelessness only
 4. Poor housekeeping, improper maintenance practices, and carelessness
- 5-57. The Tool Control Program is based upon which of the following concepts?
1. Preventive maintenance
 2. Instant inventory
 3. Tool replacement
 4. Tool usage
- 5-58. Which of the following is an outcome of the Tool Control Program?
1. Greater initial outfitting and tool replacement costs
 2. More tool pilferage
 3. More man-hours required to complete each maintenance task
 4. Increased availability of proper tools for specific maintenance tasks
- 5-59. During a daily/turnaround inspection, a plane captain discovers a piece of hydraulic equipment is out of calibration. What action(s) should the plane captain take?
1. Complete the inspection, and then notify his or her supervisor
 2. Notify his or her supervisor immediately
 3. Use the unit because the calibration is not important
 4. Notify his or her supervisor at the end of the shift
- 5-60. What form should you use when requesting oil analysis on an oil sample?
1. VIDS/MAF
 2. DD Form 2024
 3. DD Form 2027
 4. DD Form 2026
- 5-61. Detailed information concerning maintenance requirements and acceptable contamination levels of hydraulic fluid can be found in which of the following publications?
1. OPNAVINST 4790.2
 2. NOAP manual
 3. NAVAIR 01-1A-17
 4. NAVAIR 01-1A-509
- 5-62. Under normal conditions, at what interval will a plane captain take a fuel sample?
1. Before the first flight each day
 2. Before and after each flight
 3. Every 72 hours
 4. When directed by maintenance control

- 5-63. An egress system checkout for personnel working on or around aircraft must be given by a qualified individual who is in what rating?
1. AD
 2. AE
 3. AME
 4. AMH
- 5-64. After the initial egress system checkout, maintenance personnel must receive an additional checkout a minimum of how often?
1. Every 12 months
 2. Every 9 months
 3. Every 3 months
 4. Every 6 months
- 5-65. Personnel removed from maintenance responsibilities for over what minimum period must receive a new egress system check out?
1. 60 days
 2. 90 days
 3. 30 days
 4. 120 days
- 5-66. What action(s) help(s) prevent the improper use of SE?
1. Ready availability of the equipment
 2. Effective supervision of personnel only
 3. Training of personnel only
 4. Effective supervision and training of personnel
- 5-67. After the appropriate signatures have been obtained, an SE license is good for what maximum period?
1. 1 yr
 2. 2 yr
 3. 3 yr
 4. 4 yr
- 5-68. What type of inspection is performed when an aircraft returns from SDLM?
1. Conditional
 2. Acceptance
 3. Periodic
 4. Special
- 5-69. What type of inspection divides the total scheduled maintenance concept into small packages?
1. Special
 2. Phase
 3. Preflight
 4. Turnaround

ASSIGNMENT 6

Textbook Assignment: "Work Center Management and Quality Assurance." Pages 6-1 through 6-23.

- 6-1. Which of the following is NOT a concern of the work center supervisor?
1. Know your personnel and their limitations
 2. See that the job is done correctly and safely
 3. Conduct the Monthly Maintenance Plan meeting
 4. Train your personnel to do the best job possible
- 6-2. Which of the following is NOT considered a typical duty or responsibility of a supervisor?
1. Promote teamwork
 2. Inspect every task upon completion
 3. Maintain liaison with other work centers
 4. Ensure personnel and equipment safety
- 6-3. The operational efficiency of a work center is dependent to a large extent upon what factor?
1. The number of people assigned
 2. The backlog in workload
 3. The arrangement of the work spaces and equipment
 4. The experience level of the division officer
- 6-4. Which manual is used as a guideline for the establishment of an effective training program?
1. OPNAVINST 4790.2
 2. OPNAV NOTICE 4790
 3. SECNAVINST 4790.2
 4. SECNAV NOTICE 4790
- 6-5. Which of the following factors add to your expenses and cut down on overall efficiency?
1. Broken tools
 2. Misdirected efforts
 3. Injured personnel
 4. All of the above
- 6-6. Other than tracking test equipment, updating files/publications, and ensuring tools are safe, how can functions of the work center be further enhanced?
1. Request more frequent Q/A audits
 2. Allow the division officer to care for the administrative details
 3. Judicious delegation of authority to other responsible petty officers
 4. The supervisor must oversee every detail in the work center
- 6-7. Which of the following types of maintenance is required by hours, calendar periods, or starts?
1. Unscheduled maintenance
 2. Scheduled maintenance
 3. Phase maintenance
 4. Intermediate level maintenance
- 6-8. What is considered one of the best tools for ensuring a smooth flow of maintenance information between shifts and other supervisors?
1. Daily maintenance meeting
 2. NALCOMIS
 3. Intercom system
 4. Work center supervisor

- 6-9. Which of the following responsibilities is a function of the QA division?
1. Determining deficiencies
 2. Analyzing discrepancy trends
 3. Determining the quality of maintenance
 4. Each of the above
- 6-10. What is the concept of quality assurance?
1. Training of maintenance inspectors
 2. Prevention of the occurrence of defects
 3. Ensuring that quality maintenance is performed
 4. Ensuring that quality inspections are performed
- 6-11. The achievement of effective quality assurance within a maintenance activity depends upon what factors?
1. Knowledge and prevention only
 2. Special skills and prevention only
 3. Knowledge and special skills only
 4. Knowledge, special skills, and prevention
- 6-12. A periodic or special evaluation of details, plans, and policies is known as a/an
1. QAR inspection
 2. audit
 3. special inspection
 4. EI request
- 6-13. What determines the success or failure in achieving high standards of quality?
1. Local instructions
 2. Frame of mind of all personnel
 3. Abundance of CDIs/QARs
 4. Up-to-date test equipment
- 6-14. When, if ever, can CDI personnel certify inspection of their own work?
1. When on a detachment
 2. When in duty status and no other CDI is around
 3. When authorized by the work center supervisor
 4. Never
- 6-15. QA division personnel will occasionally accompany plane captains during inspections. This accompaniment will occur at what minimum interval?
1. Once a month
 2. Once a quarter
 3. Semiannually
 4. Annually
- 6-16. Completed check flight checklists are retained for what minimum period of time?
1. 3 months or one phase cycle, whichever is greater
 2. 6 months or one phase cycle, whichever is greater
 3. 9 months or one phase cycle, whichever is greater
 4. 12 months or one phase cycle, whichever is greater
- 6-17. What factors determine the number of personnel assigned to a QA division?
1. Size of the unit and number of work shifts
 2. Size of the command and type of aircraft
 3. Size of the work spaces and number of aircraft
 4. Size of the work spaces and number of work shifts

- 6-18. When a small OMD elects to organize a QA division, which of the following personnel should be permanently assigned?
1. All QARs
 2. The QA officer only
 3. The QA supervisor only
 4. The QA officer and QA supervisor
- 6-19. OMDs with only one work center in the maintenance department may have qualified inspectors with what designation?
1. CDI
 2. NDI
 3. CDQAR
 4. QAR
- 6-20. QARs have which of the following functions?
1. Reviewing incoming technical directives
 2. Assisting in preparation of engineering investigation (EI) reports
 3. Both 1 and 2 above
 4. Inspecting their own work
- 6-21. Which of the following is a requirement to become a QAR?
1. Be assigned to the work center the longest period of time
 2. Be senior in grade and experience
 3. Have prior experience as a work center supervisor
 4. Have prior experience as a CDI
- 6-22. Under certain specific conditions, CDQARs may be assigned in work centers where they are used in the same capacity as QARs who are assigned to the QA division.
1. True
 2. False
- 6-23. The minimum qualifications for personnel selected for CDI are established by what activity or person?
1. Work center involved
 2. Division officer involved
 3. QA division
 4. Maintenance officer
- 6-24. Under which of the following circumstances can an officer in charge of a detachment designate QA personnel?
1. When the CO of the squadron grants this authority in writing to the officer in charge
 2. When the deployment is in excess of 90 days
 3. When all procedures and requirements for designating QA personnel are accomplished by the detachment
 4. Both 2 and 3 above
- 6-25. What officer is authorized to designate CDQARs in an activity?
1. The CO
 2. The AMO
 3. The QA officer
 4. The aircraft division officer
- 6-26. At an AIMD maintenance activity, what personnel may use a QA stamp in place of a signature?
1. QARs only
 2. CDIs only
 3. QARs and CDQARs only
 4. CDIs, QARs, and CDQARS
- 6-27. If organizational activities desire to use QA stamps, what personnel may use them?
1. CDIs and QARs only
 2. CDIs and CDQARs only
 3. CDQARs and QARs only
 4. CDIs, CDQARs, and QARs

- 6-28. What is the time requirement before a QA stamp may be reassigned?
1. 12 months
 2. 9 months
 3. 3 months
 4. 6 months
- 6-29. If QA appears on an MRC, what person performs the inspection?
- 1. The CDI in the work center
 2. The QAR in the work center
 3. Either 1 or 2 above, depending on the workload
 4. The QAR, CDQAR, or CDI that is annotated on the master and work center decks
- 6-30. In an organizational maintenance activity, a final inspection by a QAR/CDQAR is required for which of the following situations?
1. A task that requires a functional check flight
 2. A task that will require in-flight maintenance
 3. A task that requires a toolbox to be checked before starting
 4. A task that the work center supervisor has never performed
- 6-31. During in-flight maintenance, what person is authorized to sign as inspector if a designated QA inspector is not available?
1. The senior aircrew maintenance person
 2. The flight engineer
 3. The pilot
 4. The person who performed the maintenance
- 6-32. After an in-flight discrepancy has been signed off, what other inspection, if any, is required when the aircraft has returned to home base?
1. A CDI must inspect the aircraft
 2. The QA supervisor must inspect the aircraft
 3. A QAR must inspect the repairs if the discrepancy involves safety of flight
 4. None
- 6-33. Which of the following is NOT a management responsibility of the QA division?
1. QA audits
 2. Technical publications
 3. Tool Control Program
 4. Maintenance department safety
- 6-34. Work center audits are conducted at what minimum intervals?
1. Monthly
 2. Quarterly
 3. Semiannually
 4. Annually
- 6-35. Upon completion of an audit, a report of the findings is submitted to the cognizant division and what official?
1. The administration officer
 2. The QA officer
 3. The AMO
 4. The MMCO
- 6-36. Audits are maintained on file for what minimum period of time?
1. 6 months
 2. 1 year
 3. 18 months
 4. Until the next audit is completed

- 6-37. Investigations and reports of naval aircraft mishaps that are not reported under OPNAVINST 4790.2 are reported under what instruction?
1. OPNAVINST 5100.19
 2. OPNAVINST 3120.32
 3. OPNAVINST 3750.6
 4. OPNAVINST P-5100
- 6-38. Safety meetings are required to be held at what minimum intervals?
1. Weekly
 2. Monthly
 3. Quarterly
 4. Semiannually
- 6-39. The QA division is required to report deficiencies according to the OPNAVINST 4790.2 under the NAMDRP. What does NAMDRP denote?
1. Naval Assessment Manager's Discrepancy Reporting Plan
 2. Navy Air Maintenance Department Discrepancy Reporting Program
 3. Navy Air Maintenance Discrepancy Reporting Plan
 4. Naval Aviation Maintenance Discrepancy Reporting Program
- 6-40. In addition to EIs and ADRs, what reports are required under the NAMDRP?
1. HMR, QDR, and TPDRs only
 2. HMR, EMR, QDR, and TPDRs
 3. HRM, ER, QAR, and TDRs
 4. HRM, EMR, QAR, and TDPRs
- 6-41. What officer, with assistance from QA, reviews all correspondence relating to aircraft flight mishaps?
1. The aviation safety officer
 2. The aircraft maintenance officer
 3. The assistant aircraft maintenance officer
 4. The maintenance material control officer
- 6-42. Changes or corrections to NATOPS manuals are reported by using procedures found in which of the following publications or types of message?
1. OPNAVINST 3710.7
 2. OPNAVINST 3510.12
 3. Both 1 and 2 above
 4. TPDR message
- 6-43. Which of the following instructions contains procedures used by supply activities to report deficiencies that result from incorrect preservation, packing, marking, or handling?
1. OPNAVINST 4790.2
 2. NAVSUPINST 3750.2
 3. NAVAIRINST 3510.12
 4. NAVSUPINST 4440.179
- 6-44. What type of report is used when a deficiency is discovered in materials that, if not corrected, could result in death or injury?
1. EI
 2. ADR
 3. HMR
 4. TPDR

- 6-45. An HMR priority message must be submitted within a maximum of how many hours after the discovery of the discrepancy?
1. 12
 2. 24
 3. 36
 4. 48
- 6-46. An explosive incident is reported in accordance with what instruction?
1. OPNAVINST 5100.7
 2. OPNAVINST 5215.1
 3. OPNAVINST 8100.3
 4. OPNAVINST 8600.2
- 6-47. The term *TFOA* should be used on an HMR report that involves which of the following incidents?
1. A fuselage panel that falls off an aircraft while it is in flight
 2. A request is made for technical information from NADEP
 3. A safety of flight defect is discovered on a reworked aircraft
 4. An item of material does not conform to specification requirements
- 6-48. Engineering investigations consist of which of the following types of actions?
1. Disassembly and inspection
 2. Material analysis
 3. Engineering assistance
 4. Each of the above
- 6-49. Unless combined with an HMR, within what maximum period of time after you discover a deficiency must the EI request be submitted?
1. 24 hours
 2. 5 working days
 3. 10 working days
 4. 30 calendar days
- 6-50. What is the purpose of a Quality Deficiency Report (QDR)?
1. To improve the quality assurance inspector's performance
 2. To improve the quality of parts that are removed for high time
 3. To report deficiencies in quality during the rework or manufacturing process to improve the quality of work
 4. To report on the quality of work performed at the intermediate maintenance level
- 6-51. Technical Publication Deficiency Reporting (TPDR) should NOT be used when you report deficiencies in which of the following documents?
1. Maintenance Requirements Cards
 2. Work Unit Code Manuals
 3. Illustrated Parts Breakdowns
 4. OPNAV instructions
- 6-52. What activity manages the ADR program?
1. NAVAVNDEPOTOPSCEN
 2. COMNAVAIRSYSCOM
 3. NATSF
 4. OPNAV
- 6-53. The requirement for submission of the initial ADR Form (SF 368) is within how long after the acceptance flight?
1. 5 working days
 2. 10 working days
 3. 15 days
 4. 30 days

6-54. When a misuse of equipment is witnessed and reported, which of the following personnel may submit the Support Equipment (SE) Misuse/Abuse forms?

1. SE division officer
2. Safety officer
3. QA personnel
4. The witness to the misuse

6-55. Which of the following procedures is used by QA for a successful monitoring program?

1. Training quality QA representatives
2. Maintaining an up-to-date library
3. Maintaining up-to-date MIs
4. Conducting audits

6-56. Which of the following is NOT a program monitored by QA?

1. FOD
2. Tool Control
3. Ordnance Loading/Handling Safety
4. Tire/Wheel Maintenance Safety

6-57. QA should use which of the following aids to monitor the different programs under its cognizance?

1. Safety posters
2. Accident reports
3. MIs or NAMPSOPs
4. The experience of the work center supervisor

ASSIGNMENT 7

Textbook Assignment: "Maintenance and Production Control," Pages 7-1 through 7-23.

- 7-1. "Actions taken to retain material in a serviceable condition or to restore it to serviceability" defines which of the following terms?
1. Management
 2. Production
 3. Maintenance
 4. Inspection
- 7-2. Which of the following statements defines management?
1. The efficient attainment of objectives
 2. The coordination of the departmental workload
 3. To ensure the entire capability of the department is utilized
 4. To control the daily workload
- 7-3. Which of the following statements is a responsibility of maintenance control?
1. Coordinate and monitor the workload of the maintenance department
 2. Establish procedures to monitor the Subsystem Capability and Impact Report (SCIR)
 3. Validate NMCS/PMCS supply status listings each day
 4. Each of the above
- 7-4. What work center, division, or department is responsible for establishing procedures for controlling cannibalization within a squadron?
1. Material control
 2. Maintenance control
 3. Supply support center
 4. Aviation support division
- 7-5. If you need to perform maintenance on an aircraft that requires "no electrical power," what must you do?
1. Post someone outside the aircraft to inform others
 2. Request quality assurance place the aircraft in a "no power" status
 3. Request maintenance control place the aircraft in a "no power" status
 4. Nothing, just go to work
- 7-6. What is the best tool for ensuring a smooth flow of maintenance information?
1. A passdown log
 2. Daily maintenance meetings
 3. Assign an administrative assistant to the LPO
 4. NALCOMIS
- 7-7. What report enables supporting commanders to assess current material conditions and mission capabilities of squadron aircraft?
1. QDR
 2. MDR
 3. AMRR
 4. TPDR
- 7-8. By what means is the Aviation Material Readiness Report normally submitted?
1. Naval letter
 2. Unclassified immediate message
 3. Unclassified routine message
 4. Classified immediate message

- 7-9. Where can maintenance and aircrew personnel find an accurate, comprehensive record of all outstanding maintenance requirements on a specific aircraft?
1. The aircraft logbook
 2. The Aviation Material Readiness Report
 3. The Maintenance Data Report
 4. The Aircraft Discrepancy Book
- 7-10. As a minimum, how long must completed MAFS be retained in the Aircraft Discrepancy Book?
1. 10 months
 2. 12 months
 3. 10 flights
 4. 12 flights
- 7-11. What form is used to designate an aircraft "safe for flight"?
1. OPNAV 4790/141
 2. OPNAV 4790/26A
 3. OPNAV 4790/60
 4. OPNAV 4790/113
- 7-12. The Aircraft Inspection and Acceptance Record is signed by what person or persons?
1. The aircraft maintenance officer (or designated representative) only
 2. The pilot only
 3. The plane captain only
 4. The aircraft maintenance officer (or designated representative), the pilot, and plane captain
- 7-13. Detailed procedures for maintaining aircraft historical files can be found in what volume of OPNAVINST 4790.2?
1. Volume I
 2. Volume II
 3. Volume III
 4. Volume V
- 7-14. Activities using NALCOMIS must store current MAFs on the host computer. How many preceding months of completed MAFS must be stored?
1. 1
 2. 2
 3. 3
 4. 6
- 7-15. For squadrons operating with VIDS/MAFs, which historical file should include engine-related VIDS/MAFs?
1. Aircraft general file
 2. Miscellaneous file
 3. Aircraft inspection file
 4. Aircraft engine file
- 7-16. In the TD compliance historical file, at a minimum, how long must VIDS/MAFs be retained.
1. 3 months from completed date
 2. 3 months from date of issue
 3. 6 months from completed date
 4. 6 months from date of issue
- 7-17. What reporting method was designed to reveal an equipments mission capability.
1. MDRs
 2. NALCOMIS
 3. VIDS
 4. SCIR
- 7-18. SCIR reports are generated from what codes on the VIDS/MAFs or in NALCOMIS?
1. Equipment Operational Capability codes
 2. Type Equipment codes
 3. Malfunction codes
 4. Work Unit Codes

- 7-19. The first position of the EOC code is derived from what source?
1. The Work Unit Code manual
 2. OPNAVINST 4790.2
 3. MESM, OPNAVINST 5442.4
 4. Local maintenance instruction
- 7-20. When an aircraft is delivered to the Navy, the Aircraft Logbook, OPNAV 4790/19, is initiated by what activity or office?
1. Manufacturer
 2. OPNAV
 3. Original accepting activity
 4. NADEP
- 7-21. Aircraft logbooks are normally kept in what location?
1. In the aircraft
 2. In the line shack
 3. In the operations office
 4. In the maintenance control office
- 7-22. What activity generates the Structural Life Limits Form, OPNAV 4790/142, for the aircraft logbook?
1. NADEP
 2. NAVAIR
 3. The squadron
 4. The functional wing
- 7-23. The Inspection Record is identified by what OPNAV number?
1. OPNAV 4790/22A
 2. OPNAV 4790/24A
 3. OPNAV 4790/26B
 4. OPNAV 4790/28A
- 7-24. The Repair/Rework Record is identified by what OPNAV number?
1. OPNAV 4790/24A
 2. OPNAV 4790/23A
 3. OPNAV 4790/21A
 4. OPNAV 4790/18A
- TO ANSWER QUESTION 7-25, REFER TO FIGURE 7-7 IN THE TEXT.
- 7-25. In figure 7-7, what block is used to document remarks about a technical directive?
1. 2
 2. 5
 3. 7
 4. 8
- 7-26. What type of technical directives are issued in greater numbers and require careful screening to ensure accuracy?
1. PPBs and PPCs
 2. AFBs and AFCs
 3. SEBs and SECs
 4. AVBs and AVCs
- 7-27. Which of the following actions requires an entry in the Miscellaneous/History section of an aircraft logbook?
1. The aircraft is damaged in an in-flight mishap
 2. The aircraft is exposed to a large quantity of salt water
 3. Dye is added directly to the aircraft fuel tanks to determine the location of a leak
 4. Each of the above

- 7-28. On the Aeronautical Equipment Service Record, oil analysis results are documented on what form or record?
1. OPNAV 4790/136A
 2. OPNAV 4790/27A
 3. OPNAV 4790/24A
 4. OPNAV 4790/25A
- 7-29. Explosive devices installed in personnel parachutes are recorded on what form or record?
1. Installed Explosive Device Record
 2. Inventory Record
 3. Parachute Record
 4. Miscellaneous History Record
- 7-30. What items should NOT to be listed on the Inventory Record, OPNAV 4790/27A?
1. Components requiring an AESR
 2. Components requiring an EHR
 3. Components requiring an SRC
 4. Components requiring an MSR
- 7-31. Where is the hardback copy of the Parachute Record kept?
1. A permanent file designated by the AMO
 2. In the logbook of the aircraft in which the parachute is installed
 3. Maintenance Control
 4. In the aircraft where the parachute is installed
- 7-32. What officer designates the maintenance of all original aviation life support systems (ALSS) records?
1. MMCO
 2. AMO
 3. XO
 4. CO

- 7-33. Which of the following equipment does NOT require an AESR?
1. Aircraft engine
 2. Aircraft propeller
 3. Aircraft engine turbine assembly
 4. Auxiliary power unit
- 7-34. What record is used to record maintenance data for modules replaced by an intermediate maintenance activity?
1. ASR
 2. EHR
 3. MSR
 4. SRC
- 7-35. What record is used to record TD compliance on a quick engine change kit (QECK)?
1. ASR
 2. EHR
 3. MSR
 4. SRC

IN ANSWERING QUESTIONS 7-36 AND 7-37, REFER TO FIGURE 7-19 IN THE TEXT.

- 7-36. On a Scheduled Removal Component Card (SRC), in which section is the serial number of the component documented?
1. I
 2. II
 3. III
 4. IV
- 7-37. On a Scheduled Removal Component Card (SRC), in what section would you document the bureau number on which a component is installed?
1. I
 2. II
 3. III
 4. IV

- 7-38. What is done with an EHR when the component is removed and turned into supply as a retrograde?
1. The EHR is destroyed
 2. The EHR is put into a suspense file
 3. The EHR is forwarded to the manufacturer
 4. The EHR accompanies the component
- 7-39. Once the NAVFLIRS is signed certified for completeness by the aircraft commander, where does it go next?
1. ECAMS operator for entry of ECAMS data
 2. Maintenance control for screening and entry of pertinent aircraft information into logbooks
 3. Operations for entry of flight information in aviators logbooks
 4. Analyst for forwarding to the data services facility (DSF)
- 7-40. Which of the following persons or offices has responsibility for ensuring validity of the Naval Flight Record Subsystem (NAVFLIRS)?
1. Analyst
 2. Maintenance control
 3. Operations department
 4. Each of the above
- 7-41. What work center is considered the “nerve center” of the Intermediate Maintenance Activity?
1. Production control
 2. Aeronautical material screening unit (AMSU)
 3. Quality assurance
 4. Maintenance administration
- 7-42. Production control is directly responsible to what officer for the overall production effort?
1. The aircraft maintenance officer
 2. The supply officer
 3. The maintenance material control officer
 4. The assistant aircraft maintenance officer
- 7-43. Which of the following is NOT considered a responsibility of Production Control personnel?
1. Periodically accompany CDIs to observe their proficiency
 2. Maintain liaison with the supply department
 3. Maintain VIDS display boards
 4. Ensure maximum use of material resources
- 7-44. When you order parts for a component inducted into an I-level work center, what work center assigns the Project/Priority code to your request?
1. Aviation support division (ASD)
 2. Aeronautical material screening unit (AMSU)
 3. Production control
 4. Component control section (CCS)
- 7-45. Priorities 2, 5, and 12 requisitions can be submitted by activities with what force activity designator (FAD)?
1. FAD I
 2. FAD II
 3. FAD III
 4. FAD IV

- 7-46. Project codes are mandatory entries on all requisitions.
1. True
 2. False
- 7-47. At a minimum, how often should a joint awaiting parts validation be performed with the AWP unit in supply?
1. Quarterly
 2. Monthly
 3. Weekly
 4. Daily
- 7-48. What priority is assigned to the repair of salvaged material?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-49. What priority is assigned to the repair of material for non-mission capable aircraft?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-50. What priority is assigned to the repair of critical local repair cycle assets (LRCAs)?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-51. What priority is assigned to the repair of assets belonging to an activity within 30 days of deployment?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-52. What priority is assigned to the repair of non-critical local repair cycle assets?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-53. What priority is assigned to the repair or manufacture of material that is nonaeronautical?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-54. What priority is assigned to the repair or manufacture of material for non-fixed allowance stock?
1. Priority 1
 2. Priority 2
 3. Priority 3
 4. Priority 4
- 7-55. Priorities may be adjusted either higher or lower by IMA maintenance and supply officers to meet local support requirements.
1. True
 2. False

