ORION

SERVICE DIGEST

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ORION

P-3 TECHNICAL PUBLICATIONS

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FRONT AND BACK COVERS Patrol Squadron Forty-six (VP-46) has the distinction of being the oldest continuously operating patrol squadron in the United States Navy. Commissioned as VP-5S in September 1931 at Coco Solo in the Panama Canal Zone, the squadron was equipped with PM-2, twin-engine biplane flying boats which cruised at about 85 knots — a flying speed somewhat in excess of that recommended for landing. It is interesting to record that in 1933 VP-5S set a new long-distance record for a seaplane formation: Six P2Y-1 aircraft flew non-stop from Norfolk, Virginia to Coco Solo in 25 hours 26 minutes — a distance of 1788 miles.

World War II found the squadron operating in the Caribbean area. Probably the highlight of the wartime service was a two-week period in 1943 when the squadron located and sank 3 enemy submarines off the southern coast of Puerto Rico. When war flamed in Korea, VP-46 had already transferred to the Pacific Fleet. It subsequently became the first seaplane squadron to conduct combat patrols off the China coast and in the Formosa straits, flying a total of 3583 hours in PBM Mariners.

After 30 years, nine different types of seaplanes, and almost as many squadron designations, VP-46 began operations as a land-based squadron with the acquisition of its first P-2V Neptune in May 1961. And, in January 1963, at its new home port of NAS Moffett Field, California, VP-46 became the first squadron on the West Coast to transition to the Navy's latest submarine-hunter-killer aircraft. A far cry from the PM-2 flying boats at Coco Solo, the P-3A Orions of VP-46 should enable the squadron to further enhance their already long and distinguished record.

The front cover shows an Orion, piloted by Commander T. E. Sulick, VP-46's commanding officer, flying toward San Francisco's famed "Golden Gate" bridge — a common and welcome sight to VP-46 crews returning from patrol.

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LOCKHEED SERVICE DIGEST
BURBANK, CALIFORNIA, U.S.A.

Foreword

For some time past, the U. S. Navy has been implementing programs aimed at reorganizing maintenance and flight procedures to improve aircraft operational efficiency; a large and essential element of such programs was the reorganization of all technical publications. The P-3A went into squadron service at a time when these new programs had just progressed beyond the experimental stages and, in fact, the Orion was one of the first major test cases for both the new maintenance system (including the associated publications) and, more recently, the new standardized NATOPS Flight Manuals.

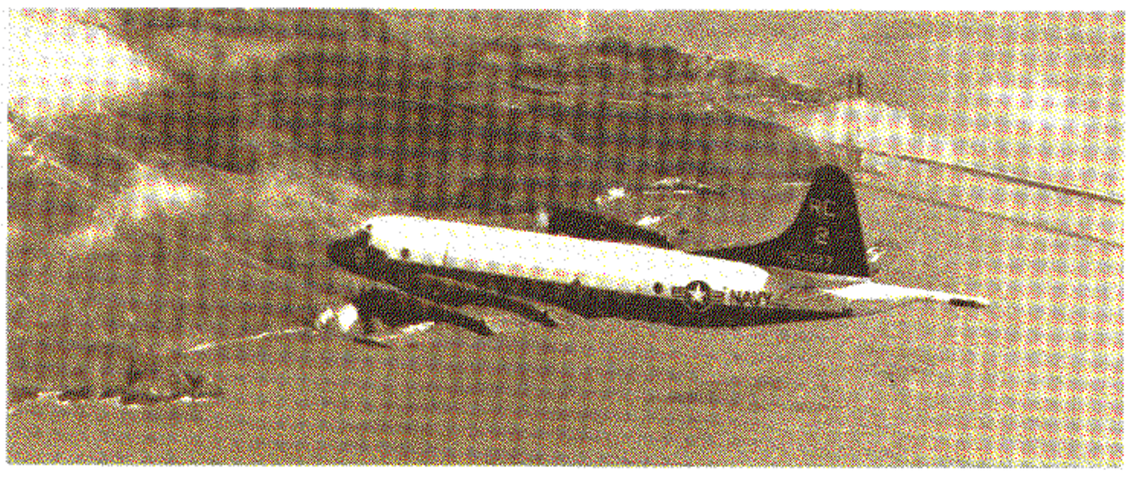
The P-3 Orion is one of the most complex items of equipment in the Navy's inventory of airborne weapons. And it accordingly has more than the usual quantity of maintenance and flight operation publications — as a glance at the contents list on the opposite page will show. Some of these technical publications are as large as encyclopedias consisting of many volumes, and most have undergone recent and extensive changes of format.

The main purpose of this Digest issue is to clarify the present situation. We requested various cognizant persons to briefly describe the official Navy documents applicable to the Orion and originating at Lockheed. Wherever appropriate, we also requested that a few words on any recent changes in approach or format be included.

The resulting article is divided into 3 parts:
Part One serves by way of an introduction to the article as it gives a brief history of the "New Approach to Maintenance," but it also describes certain items which account for the most radical changes from past maintenance practices; Parts Two and Three are concerned with Maintenance and Flight Crew publications respectively.

One publication — the Orion Service Digest — is not described herein. We also serve.

Editor



PART ONE

THE INTEGRATED MAINTENANCE MANAGEMENT PROGRAM

By

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C. E. SAVO
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THE Integrated Maintenance Management program (IMM)* is the most significant forward step made to date by the Bureau of Naval Weapons for managing the development of a maintenance and logistic system for keeping complex modern airplanes ready to carry out their missions.

Years ago, planes were quite simple and could be easily maintained by Aviation Machinists Mates, Metalsmiths, and Radiomen. Naval aviation was manned largely by career sailors who could usually transfer from one airplane model to another with facility, using the basic knowledge of aircraft maintenance they had acquired. Also, since aircraft performance and capability were low compared to today's standards, repairs were not too critical. The ability to innovate, jury-rig, and substitute became the hallmark of a good mechanic.

Unsophisticated systems and limited deployment of operating forces simplified the problem of providing adequate spare parts—most squadrons carried theirs with them in a couple of cruise boxes. Special tools and support equipment requirements were far less than those of today. Even as late as World War II, it was not uncommon to change an engine by using a block and tackle rigged to a coconut palm on a Pacific atoll.

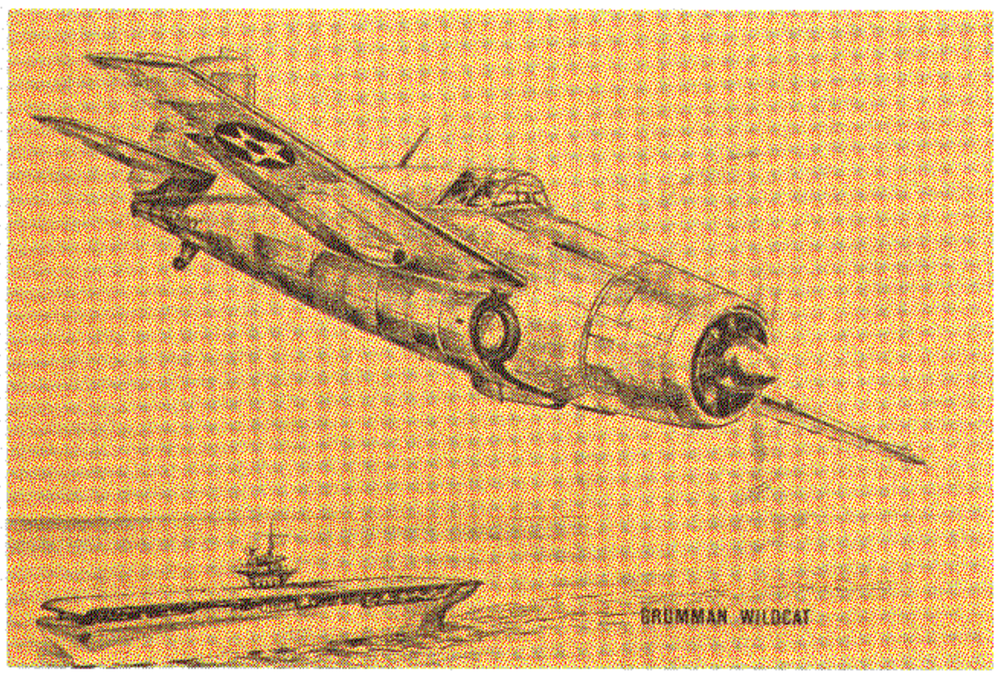
**In its earlier stages of development, the Integrated Maintenance Management Program was referred to as the Weapon Readiness Achievement Program (WRAP).*

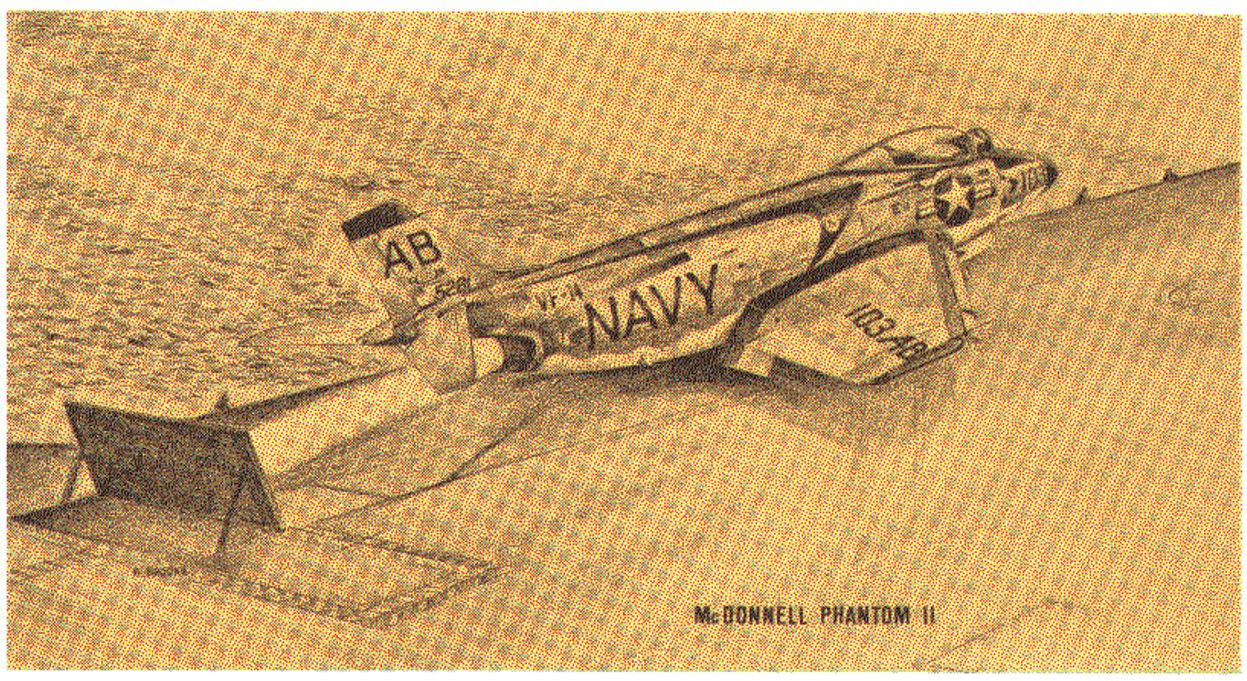
AND THE NEW APPROACH TO MAINTENANCE

During the past twenty years tremendous progress has been made in aviation, and almost invariably this progress has resulted in increased complexity of the airplane. To the mechanic, this complexity was obvious—access to components became more difficult; new types of components required more maintenance; and inspection requirements kept growing. The old "Yellow Sheet" preflight checklist developed into a document of several pages, and the periodic inspection formerly done by memory (change plugs and oil, check the points, and paralketone the control cables) grew into hundreds of items. Just the increase in sheer volume of added components and parts increased the maintenance workload to startling proportions.

As aircraft and systems became more complex, additional specialization of maintenance personnel became necessary. The Radioman could no longer maintain all the electronics equipment. Today we have Aviation Electronics Technicians, Aviation Fire Control Technicians, Aviation Electricians Mates, and Aviation Anti-Submarine Warfare Technicians—and some of these are further specialized into service ratings.

Further specialization also became necessary in the Contractor's plant and in the Navy's departmental and field support organizations. No one man could be expert in all the various support programs to keep an airplane mission-ready. The development





Today's Aircraft Cost 100 Times as Much as Their World War II Counterparts — Much of This Cost is Due to Increased Complexity

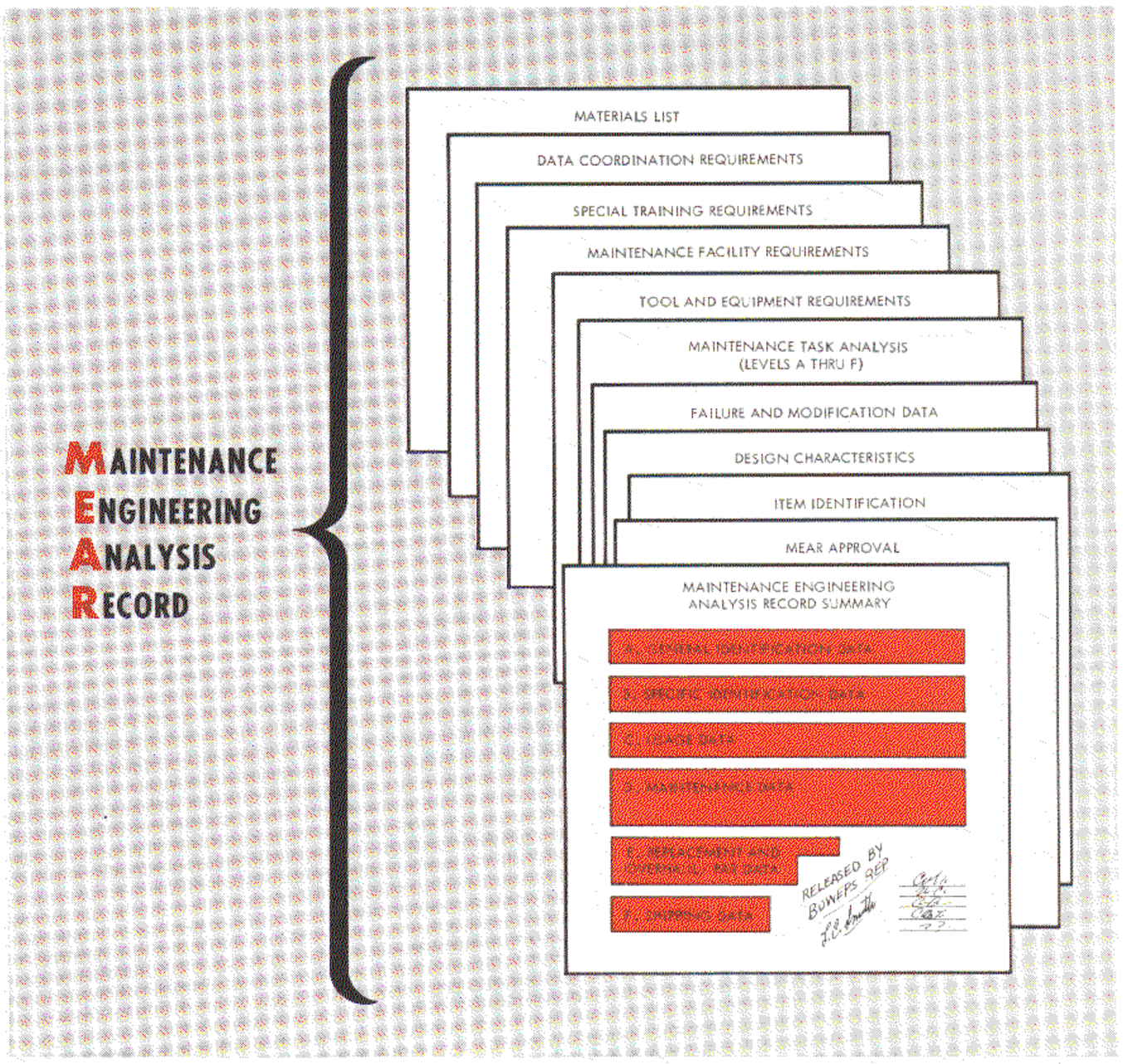


Figure 1 Layout of a Maintenance Engineering Analysis Record

of the maintenance plan for fleet and depot level, the selection and procurement of material and support equipment, and the determination and preparation of publications and their documentation became highly specialized areas within government and industry.

However, it soon became apparent that increased specialization was not the complete solution and that it was also necessary to have an integrated plan for ensuring compatibility of one area to another. Gaps existed between the various elements of the logistic system. As a result, a squadron often lacked necessary spare parts and tools to make a repair, or a squadron that might have the parts often lacked the necessary technical information or support equipment. These problems have been brought out in high-level DOD and Navy discussions, since they represent a considerable portion of the million-dollar-per-hour maintenance costs within the Department of Defense. And it is worthy of note that maintenance alone accounts for more than 25 percent of the defense budget.

The vital importance of the maintenance function in present and future weapon systems was summed up by Rear Admiral F. L. Ashworth in *Naval Weapons of the Seventies*, where he stated that "Reliability and maintainability are characteristics of naval weapons as important to mission capability as traditional measures of performance, such as range, firepower, top speed, etc."

In light of the demand for a better way of doing business and for compelling economic and military considerations, the Bureau of Naval Weapons developed Weapon Requirement 30, *Integrated Maintenance Management for Aeronautical Weapons, Weapon Systems and Related Equipment.* This requirement is the latest refinement and consolidation of several earlier specifications aimed at this objective, including Specification XFMPP-148 which was applied to the P-3A Orion.

The Integrated Maintenance Management program (IMM) provides a plan for achieving the broad objectives of maintainability by careful design, by introducing a maintenance and logistic support plan for the life of the equipment, by using improved material procurement procedures, and by improved utilization of manpower and time. The Maintenance Engineering Analysis is the key element of IMM and provides an approach to the problem by documenting and coordinating all aspects of the program.

MAINTENANCE ENGINEERING ANALYSIS RECORD

MEARs are contractor-prepared documents that provide the means for developing a single, comprehensive maintenance plan; for analyzing and establishing maintenance requirements; and for identifying the necessary resources required — parts, tools, personnel, and manuals. Each MEAR can be divided into two basic parts: Maintenance and Related Data, and Resources.

Within the first part, the Reliability and Design Data page is vital to the development of the analysis and records the "vital statistics" of the item: the operating life, modes of failure, probable results of failure, mean time between failure, effect on flight safety, mission capability, and so forth. The Maintainability Evaluation page documents the design considerations of accessibility, standardization, safety, handling, human factors, and other maintenance considerations. The Maintenance Concept page provides a narrative outline of the maintenance and support plan for the item — what maintenance is planned for each maintenance level, and the reasons (both technical and economic) that justify the plan. The Maintenance Requirements and Tasks pages document the specific "Needs of the machine" which are determined from design, reliability, and maintainability data.

When the "Needs of the machine" have been identified, the Resource Requirements to support these needs are analyzed and documented in terms of Personnel Planning Data, Technical Data Requirements, Support Equipment Requirements, and Material required to accomplish each Maintenance Requirement and Task. The MEAR Summary provides a one page abstract of the elements of information vital to management and assembles them in a manner for efficient review. Upon completion of the MEAR, it is reviewed, modified where necessary, and approved by the Navy.

A separate MEAR is prepared for each major system, sub-system, assembly, and component having maintenance significance, and for selected items of special support equipment. Lockheed prepared over 900 MEARs for the P-3A. Maintenance engineers provided the information needed by the design engineer to ensure that the final design would meet such maintainability targets as maintenance manhours per flight hour, turnaround time required to restore the airplane to an operationally ready condition, and component removal and replacement time.

The key to a successful maintenance engineering analysis is the *identification of only those maintenance requirements that could be justified.* No longer would squadrons be saddled with a requirement to inspect a part merely because "we always have checked it." On the contrary, those items which had historically appeared on check sheets became the most suspect. Maintenance had to be geared to the needs of the airplane, with consideration given to its mission and operating environment.

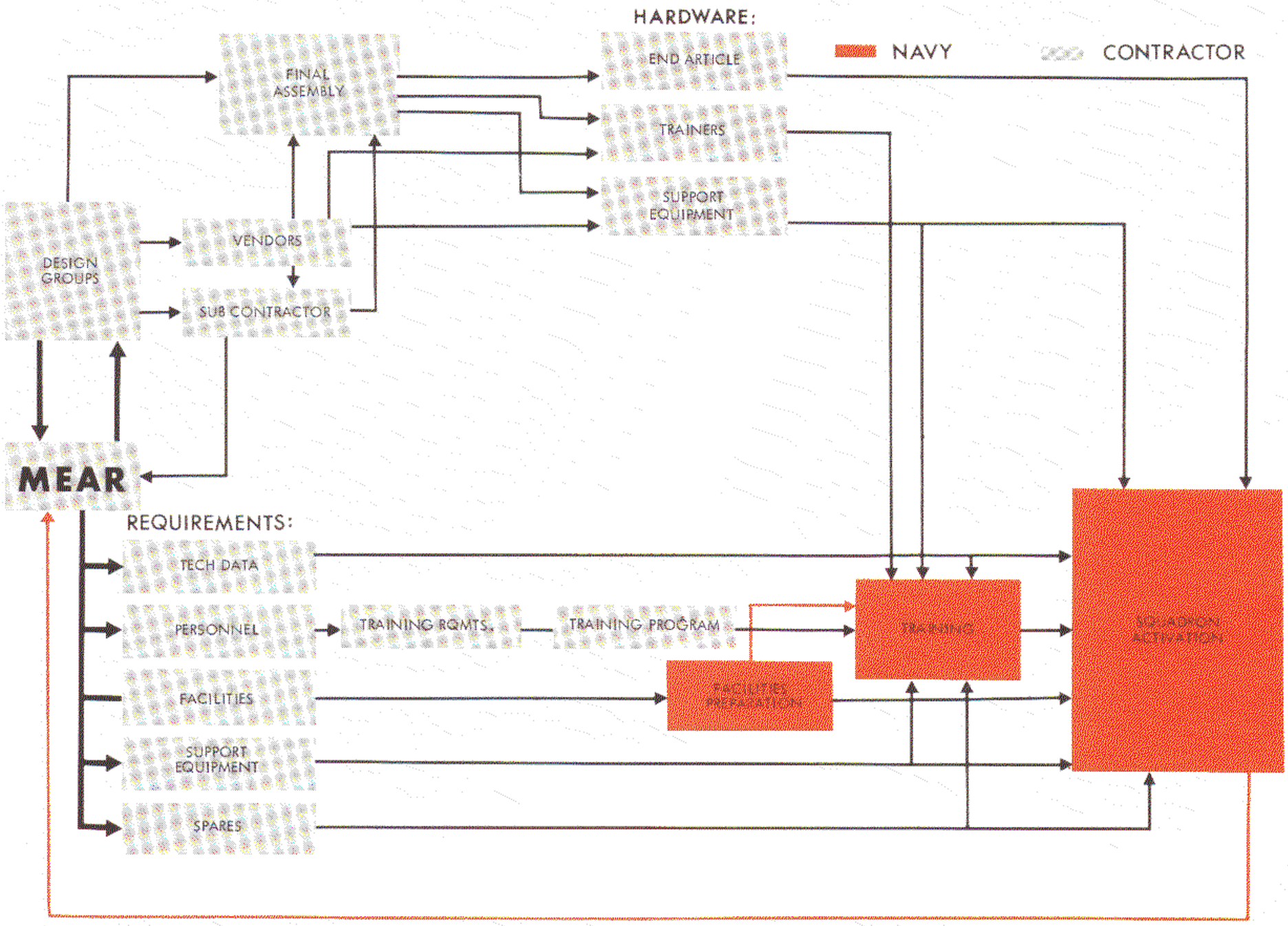


Figure 2 The Role of the MEAR in the Integrated Maintenance Management Program

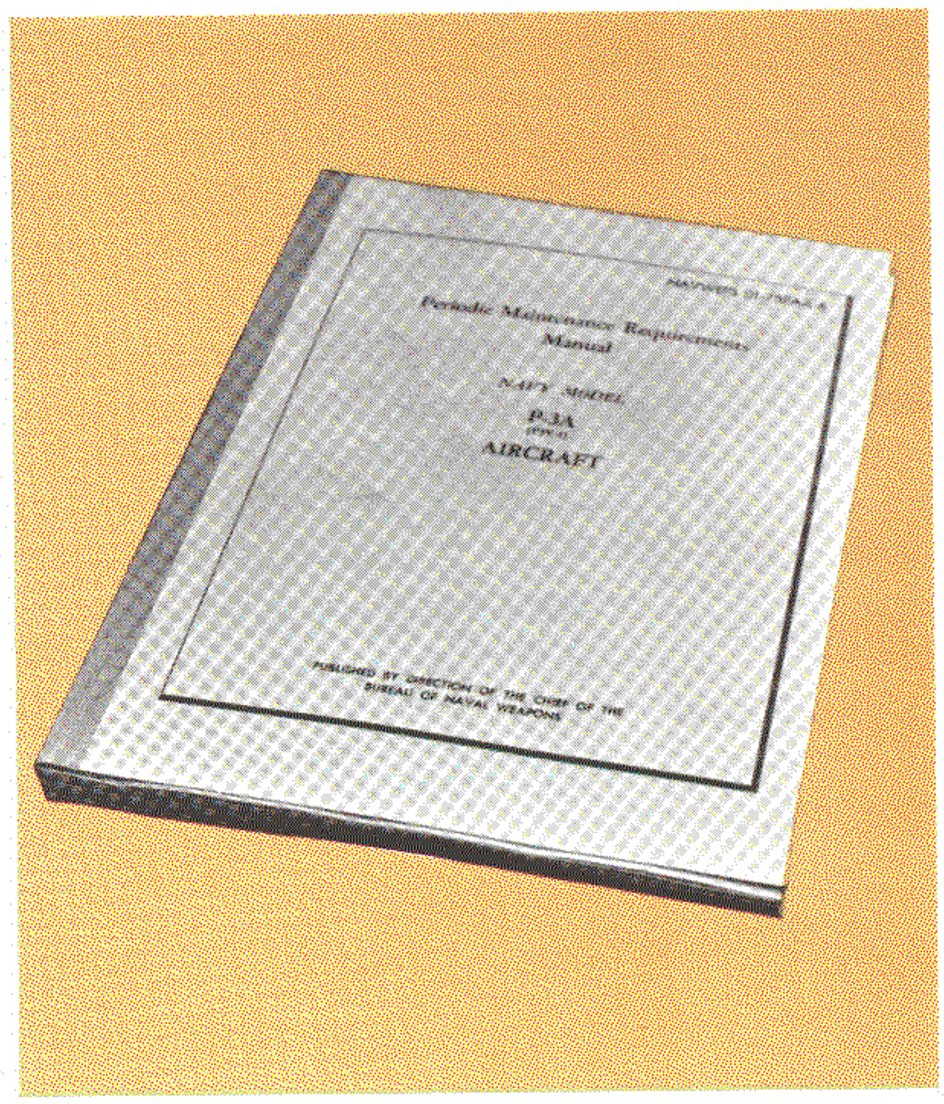
"Has this part ever failed? What if it did? Would it affect flight safety or mission accomplishment? Is it more economical to rework the part before it fails or should the part be allowed to continue in service until failure occurs?" The maintenance engineers turned to the reliability engineers for the facts needed to answer these questions. Where facts existed, and in most cases they did, the maintenance engineer had a fairly solid starting point. He knew about how often the part might fail, how it would fail, and the results of the failure. When the facts didn't exist, he made an "educated guess"; he assembled related data and analyzed it thoroughly to develop conclusions that were somewhere within reason.

The next step was to establish maintenance requirements that could be fully justified in terms of this data when matched against safety, mission, and economics. These requirements then set the pattern for what maintenance had to be done, why and when it had to be done, how long it would take, and—most important—what tools, parts, and instructions were necessary.

When all this information was recorded in the Maintenance Engineering Analysis Records, they became the blueprints for maintaining the airplane in much the same manner as engineering drawings are blueprints for building the airplane. The MEARs provided a justified and well-documented foundation for a maintenance plan that would meet operational use; they provided the basis for a support plan requiring the least expenditure of manpower and support dollars; and they provided the basis for Integrated Maintenance Management of the weapon system.

MAINTENANCE REQUIREMENTS MANUAL AND CARDS

Concurrently with development of the Integrated Maintenance Management program, the Bureau of Naval Weapons developed new and improved methods for accomplishing preventive maintenance. Specification XFMPP-148, which established the initial approach to Integrated Maintenance Management and the Maintenance Engineering Analysis Records, also defined the new inspection system. The long-familiar check sheets and Handbooks of Inspection Requirements were replaced by a Periodic Maintenance Requirements Manual, Maintenance Requirements Cards, and Sequence Control Charts. Not just another "card system," the new inspection system is the direct result of, and is integral with, the previously discussed Maintenance Engineering Analysis pro-



The Periodic Maintenance Requirements Manual Contains All of the Scheduled Maintenance Requirements for the P-3A

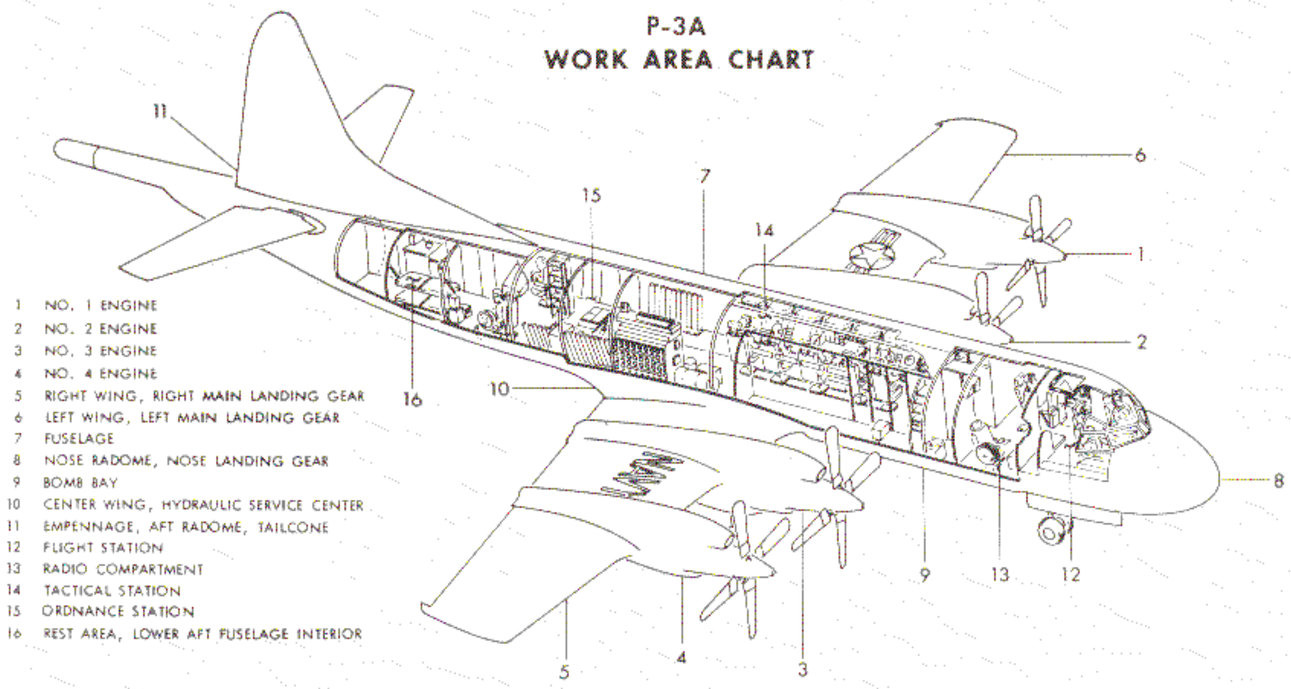
gram. Specification MIL-M-23618 reflects the latest refinements to the inspection requirements program resulting from government and industry evaluation of the "dash 148" specification.

PERIODIC MAINTENANCE REQUIREMENTS MANUAL NAVWEPS 01-75PAA-6 In line with this new concept, squadrons are provided with a Periodic Maintenance Requirements Manual (PMRM). This manual contains under one cover all of the scheduled maintenance requirements for the P-3A aircraft for all maintenance levels, and is the controlling document for the planning and accomplishment of the related work tasks. The manual prescribes what equipment is to be inspected and what conditions are to be sought. Included are Preflight Inspection Requirements, Daily Inspection Requirements, Calendar Inspection Requirements, Progressive Aircraft Rework Requirements, Component Removal Schedule, Accessory Record Card Requirements, and references to all other applicable technical directives.

The fleet maintenance requirements (Preflight, Daily, and Calendar Maintenance Requirements) are reproduced both in the PMRM and on the Maintenance Requirements Cards, and they are arranged in the PMRM by system with the items cross-indexed to the Maintenance Requirements Cards. Thus a ready reference is provided to all the fleet maintenance requirements for a particular system or sub-system.

Where conflict may exist between the information contained in the PMRM and other maintenance directives, the PMRM—with one exception—takes precedence. This exception is the information given on any Maintenance Requirements Card (MRC) with a later date than the latest change date given in the PMRM. Although, in theory, the information given in both these directives should be identical, in practice the cards can be, and usually are, changed before the PMRM—hence the exception. Changes to the PMRM are published at periodic intervals to add, delete, revise, or change the requirements.

P-3A
WORK AREA CHART



CARD	PUBLICATION NUMBER	CARD SET DATE	CHANGED
V	NAVWEPS 01-75PAA-6-1	1 January 1964	

TIME IN HOURS AND MINUTES TO ACCOMPLISH ALL TASKS ON CARD
PERSONNEL TITLE OR RATING AND MAN NUMBER (NOT RATE)
INSPECTION FREQUENCY
MRC SET NUMBER
SPECIFIC POWER REQUIREMENTS
ASSISTANT REQUIRED AND CARD NUMBER
CARD NUMBER
SPECIAL EQUIPMENT REQUIRED TO ACCOMPLISH TASKS
TIME IN MINUTES TO ACCOMPLISH TASK
WORK AREA CODE NUMBER

CARD	TIME	RTG. FLT. ENG.		ACCOMPLISH WITH	ELECT. PWR. ON
41	00:11	NO. 1	DAILY 30 DAY	CARD NO. 1	HYD. PWR. ON
MAN MIN.	WORK AREA	PUBLICATION NUMBER NAVWEPS 01-75PAA-6-1		CARD SET DATE 1 January 1964	CHANGED

		SPECIAL EQUIPMENT	ASSISTANT
		NC-12( ) Mobile Electric Powerplant	1(Card No. 43) CR. MAN No. 3
10.0	12	1. Auxiliary Hydraulic Brake Check:	
		CONDITION	REMARKS/RESPONSE
		a. All hydraulic pumps OFF. Deplete system pressure to zero by pumping the brakes. Direct assistant to check hydraulic accumulator gage.	a. Hydraulic accumulator gage reads 800 (±25) psi.
		b. AUX BRAKE NO. 1 B switch ON.	b. System charges to 2900 (±100) psi within 4 minutes.
		c. Pump brakes and deplete system to 2100 psi.	c. System charges to 2900 (±100) psi in 1 minute.
		d. Check emergency air brake reservoir pressure.	d. 1800 psi minimum – 3000 psi maximum. (NAVWEPS 01-75PAA-2-1, Sect. IX for servicing.)

Typical Maintenance Requirements Card and Work Area Card

MAINTENANCE REQUIREMENTS CARDS The Maintenance Requirements Cards (MRCs) are the working documents for squadron inspections and preventive maintenance. These 5 x 8 cards replace the long familiar check-sheets and are arranged by rating and work area to provide the most efficient sequence of accomplishment. Assembled into sets and numbered in sequence, the cards contain pertinent information required by each maintenance man to complete each task. The data for each task includes: a description; the time required to perform the task; the power, tool, equipment, and material requirements; and detailed information on such items as adjustments, pressures, and torque values. Also included, if necessary, is a diagram of the area in which the work is to be accomplished.

These requirements, as established and published by direction of the Bureau of Naval Weapons, are minimum requirements and, as such, are mandatory; however, a temporary waiver of individual requirements may be made locally by the Reporting Custodian or higher operational authority in order to meet priority operational commitments or due to combat necessity. BUWEPS INST 4700.2 contains procedures for obtaining deviations from published inspection schedules and includes more detailed information concerning the calendar inspection philosophy.

Locally established maintenance requirements not covered by the published MRC sets can be added to an existing card. This will necessitate an adjustment to the individual card time, plus a possible adjustment of the Sequence Control Chart if the card is in a Calendar deck.

Preflight Maintenance Requirements Cards, NAVWEPS 01-75PAA-6-2, contain all minimum requirements for performing the preflight inspection. This inspection is accomplished immediately prior to each flight, and verifies that the airplane is ready for flight by specifying visual examination and operational tests to discover defects and maladjustments that, if not corrected, could adversely affect safety or mission

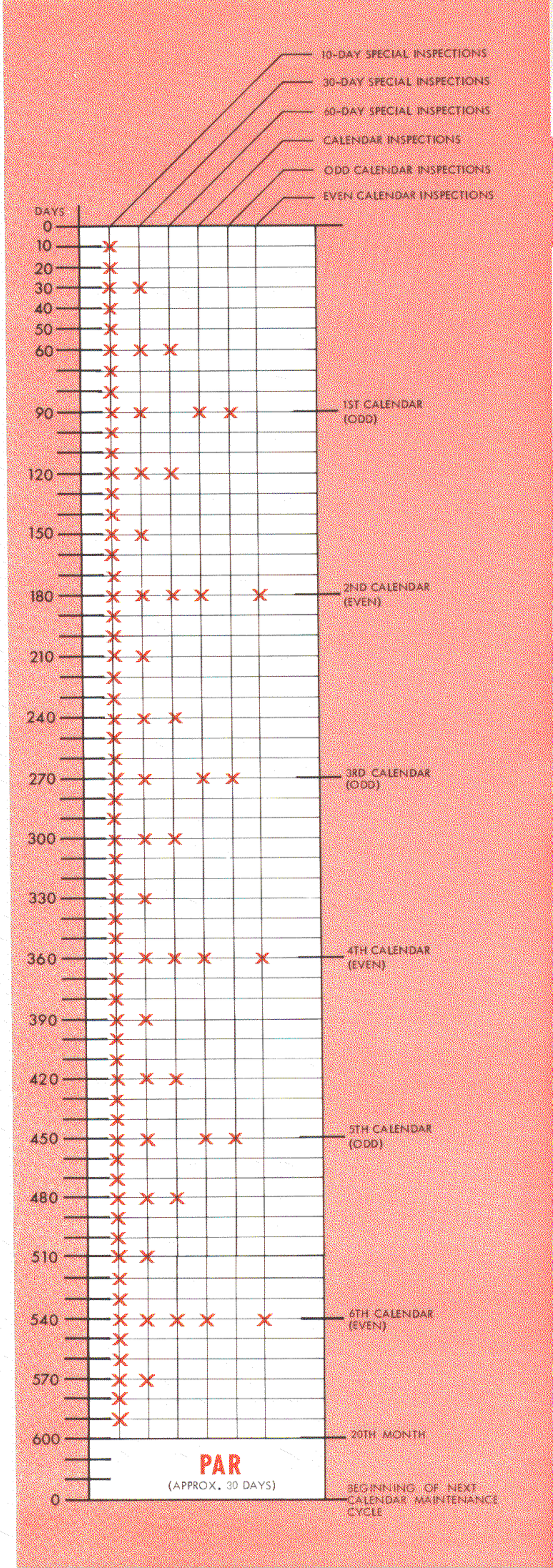


Figure 3
Chart of Scheduled
Calendar Maintenance Inspection
and "Special Daily" Inspections

accomplishment. Also included is a check to determine if the airplane has been properly serviced.

The introductory cards in the Preflight MRC deck contain a list of revised cards issued, a general description of the cards, a statement of their application, the format description, a list of abbreviations and definitions, and a work chart.

Preflight cards are to be used in numerical order within the particular title or rating, and the tasks on the cards are to be accomplished in the sequence in which they appear. It should be noted that those preflight items which were previously in the Flight Manual (up to the time when the engines are started) are now deleted from the NATOPS Flight Manual and are incorporated in the Preflight cards.

Daily Maintenance Requirements Cards, NAVWEPS 01-75PAA-6-1, contain all minimum requirements for performing the daily inspection. The daily inspection is accomplished between the last flight of the day and within 72 hours prior to the next scheduled flight. The purpose of this inspection is to verify that the aircraft and equipment are functioning satisfactorily, and to search for defects apparent as the result of the previous flight or flights.

This set of cards also includes special inspections that are to be performed more frequently than the calendar inspections, such as 10-day, 30-day, and 60-day inspections, plus "conditional" inspections to be performed as circumstances warrant. All inspection items in the Preflight cards were included in the Daily MRCs at the time this article was prepared, but they will be removed with the January 1964 revision of the MRCs.

The introductory cards for the Daily MRC deck include the same type of information as the Preflight introductory cards, with the addition of the "Scheduled Replacement Parts" list.

Daily MRCs are to be used in the numerical order within the indicated personnel rating, and the tasks on the cards are to be accomplished in the sequence in which they appear.

The Calendar Maintenance Requirements Cards, NAVWEPS 01-75PAA-6-3, list the tasks that constitute the minimum requirements for all calendar periodic maintenance, which is a thorough and searching examination of the airplane conducted at 90-day calendar periods. When the tasks need to be accomplished only at every other calendar inspection, they are divided approximately equally between the Odd Calendar inspections (1st, 3rd, and 5th) and the Even Calendar inspections (2nd, 4th, and 6th). This system helps to equalize the workload and the elapsed time of the inspection. Thus, there must be three types of cards to reflect this system—the "Calendar" cards for inspections required every 90 days, and the "Odd Calendar" and "Even Calendar" cards that are used with the "Calendar" cards at alternate 90-day intervals.

Twenty months from the beginning of the above maintenance sequence (two months or so after the 6th Calendar Inspection) the aircraft is inducted into Progressive Aircraft Rework (PAR). Essentially, this is aircraft overhaul. After the aircraft has been returned from PAR, the same sequence of Calendar maintenance is repeated. In this manner, each aircraft has its individual maintenance program that continues throughout its operational life.

The information on the introductory cards for the Calendar MRC includes a list of cards issued, the introduction and application, format description, abbreviations and definitions, work area chart, consumable materials list, replacement parts list, and tools and equipment list. These lists enable the squadron planners to assemble and have ready those items necessary to accomplish calendar maintenance in advance of the aircraft's induction into the check, thereby avoiding unnecessary delays during the inspection.

Each calendar inspection also includes the "special daily" 10-day and 30-day inspection requirements. The 60-day "special daily" items automatically become due and are accomplished during each Even calendar inspection (see Figure 3).

Each Calendar card should be issued in the order prescribed on the Sequence Control Chart and not necessarily in the sequence of the card numbers. However, the tasks on each card are listed in the order that they should be accomplished.

SEQUENCE CONTROL CHARTS, NAVWEPS 01-75PAA-6-4

Two Sequence Control Charts (SCC) provide a management tool for accomplishing the Calendar inspections by controlling the assignment of work and personnel. The first chart (sheet 1) is used during Odd Calendar inspections, while the other chart (sheet 2) is for the Even Calendar inspections.

Figure 4
This Portable Workstand Becomes the Maintenance Director's Control Center During the Calendar Inspection

These charts enable the supervisor to control the assignment of work during periodic inspections by providing him with information on work that has been done, work that remains to be done, when it is scheduled to be done, and who will accomplish it. The SCC provides a simple and effective method for rescheduling work when required due to unforeseen circumstances, and presents the overall effect of such rescheduling. Work performance can be measured by tracking the progress of the inspection against the time allocated, manpower concentration in work areas is controlled, and quality control inspections can be properly scheduled. Furthermore, unscheduled maintenance can be scheduled into the respective work areas when the areas are clear and personnel are available.

A portable workstand has been developed (see Figure 4) to provide a local work control center for the accomplishment of calendar maintenance. This stand consists of four stowable legs, a deck tiedown assembly, plastic chart holder, and a partitioned carrying case for MRC control and storage. A center storage section is provided for reference maintenance manuals. This stand, with the Sequence Control Charts, becomes the control center for the Maintenance Director for the entire Calendar inspection.

Service Engineer Bob Franks (c.) and Flight Test Mechanic Al Harvey (l.) Verify Orion MIM Instructions — CDR William L. Hinkle, Navy P-3A Maintenance Team Chairman, Observes Verification

EDITORS NOTE In reviewing the original drafts of Parts One and Two, which were written by different authors, it became apparent that the article might benefit at this stage by the addition of a transitional note. This would serve the dual purpose of achieving better continuity and eliminating some of the material which was common to both parts, and was inevitably repeated.

In Part One we have described some of the more significant improvements introduced by the new maintenance concept. The Maintenance Requirements Cards system, implemented by calendar intervals rather than by flight or operation time, is perhaps the most obvious change from past practice. It should however be noted that the MRCs are largely concerned with the routine scheduled maintenance tasks and necessarily contain a minimum of information in order to accomplish these tasks. Effective and intelligent use of the cards depends upon maintenance personnel having a prior comprehensive knowledge of the aircraft and this information is largely contained in the Manuals described in Part Two of this article. In particular the P-3A Maintenance Instruction Manual, as well as giving information on all unscheduled maintenance, also gives detailed information on the scheduled maintenance tasks so that the MIM can, in effect, be regarded as a back up for the Maintenance Requirements Cards.

Inspection Verification Program Any maintenance system — no matter how streamlined — must be founded on the accuracy and lucidity of the information presented in the various maintenance documents. In this regard an inspection verification program was conducted at Lockheed during April and May 1962 prior to delivery of the first operational Orions. The maintenance procedures given in the Maintenance Requirement Cards and the Maintenance Instruction Manual were physically checked on two production aircraft and corrections made to the text and illustrations wherever necessary. Contractor personnel were organized into crews to duplicate actual squadron crews as closely as possible, while Navy personnel participated as technical observers.

Removal and installation of components, checkouts of complete systems, and scheduled maintenance tasks were all carried out by referring line by line to the MRCs and the MIM. At the same time the adequacy and usefulness of all ground support, special support, and test equipment, was checked. Verification of the sequence control charts was given special attention: Navy Inspection Requirements Branch observers reviewed task times and sequencing in order to achieve the optimum arrangement of maintenance tasks, and thus minimize the "down" time of the Orion during calendar inspections.

The verification program was the culmination of a goal to produce, for the Navy, tried and proved maintenance publications and support equipment before actual deliveries of aircraft began. The program also exemplified the determination of the Navy and Lockheed to get the utmost in efficiency from both men and machines to reduce maintenance costs and to improve aircraft mission readiness.

PART TWO

MAINTENANCE MANUALS AND RELATED PUBLICATIONS

By

R. A. ERWIN
Group Engineer

H. C. HICKS
Service Engineer Specialist

C. P. REED
Service Engineer Specialist

with "Illustrated Parts Breakdown" By

R. L. HUGHES
Patrol/Transport Group Supervisor

H. H. TALLEY (Retired)
Patrol/Transport Group Supervisor

and "Technical Directives" By

E. H. HUGHES
Service Engineer Specialist

BRIEFLY, the P-3A technical manuals provide complete servicing, maintenance, replacement, and repair information for the basic airframe, its systems, and their components. Spares and repair parts are illustrated, coded, and identified; and special support equipment is also given manual coverage as to its use, maintenance, and repair. The manuals present this data in an organized manner to help personnel keep the aircraft operating in a state of combat readiness and, as such, they should always be readily available to maintenance personnel and maintained in an "updated" condition. It should also be noted that, in addition to this primary function, the technical manuals also serve as textbooks in Navy classrooms. The P-3A technical manuals and other data prepared by or under the surveillance of the Lockheed-California Company are listed in Figure 5.

MAINTENANCE LEVELS The transition from simple flying machines to sophisticated weapons systems has revolutionized maintenance concepts by shredding out personnel skills to particular areas of "know-how", and these areas have been classified into realistic levels of accomplishment that take into consideration the facilities and skills available for the particular job at hand. The maintenance levels have a marked effect on the content and layout of the technical manuals and a brief description of each level is included here. Although well known in Navy circles, they are probably not so familiar to contractor personnel as they should be.

Presently the Navy divides aircraft maintenance into six levels: Class A—Overhaul Maintenance, Class B—Special Maintenance, Class C—Component Repair, Class D—Shop Maintenance, Class E Hangar Maintenance, and Class F—Line Maintenance.

Overhaul Maintenance (Class A) facilities support all other levels of maintenance. These are industrial facilities capable of performing the most extensive repair or modification to non-operating aircraft, their equipment, or their support equipment, and they provide technical assistance to lower levels of maintenance. These facilities perform the 20-month Progressive Aircraft Rework (PAR).

Special Maintenance (Class B) has similar responsibilities to those of Overhaul Maintenance, but the scope is not as extensive. Facilities of this level are usually assigned to support a geographical logistic area. Both Class A and B maintenance are performed at major overhaul bases.

Component Repair Maintenance (Class C) is performed by the Aircraft Maintenance Department (AMD) of the supporting Naval Air Station and is the highest level of Fleet Maintenance. This involves repair or replacement of internally installed parts, calibration, bench testing, and inspection. This is the highest level of support provided at the squadron's base or Air Station.

Shop Maintenance (Class D) is performed by Navy Fleet Squadrons on their own assigned aircraft and equipment. This level of maintenance consists of minor repair or replacement, bench testing, and inspection. Class D maintenance is the highest level of Fleet Maintenance performed on avionics equipment even though it may be performed at a Class C activity.

Hangar Maintenance (Class E) is a function of the Hangar Division of each squadron, and is preventive maintenance by nature. Periodic, special, and preservation inspections are performed, along with minor repairs or replacements and functional testing.

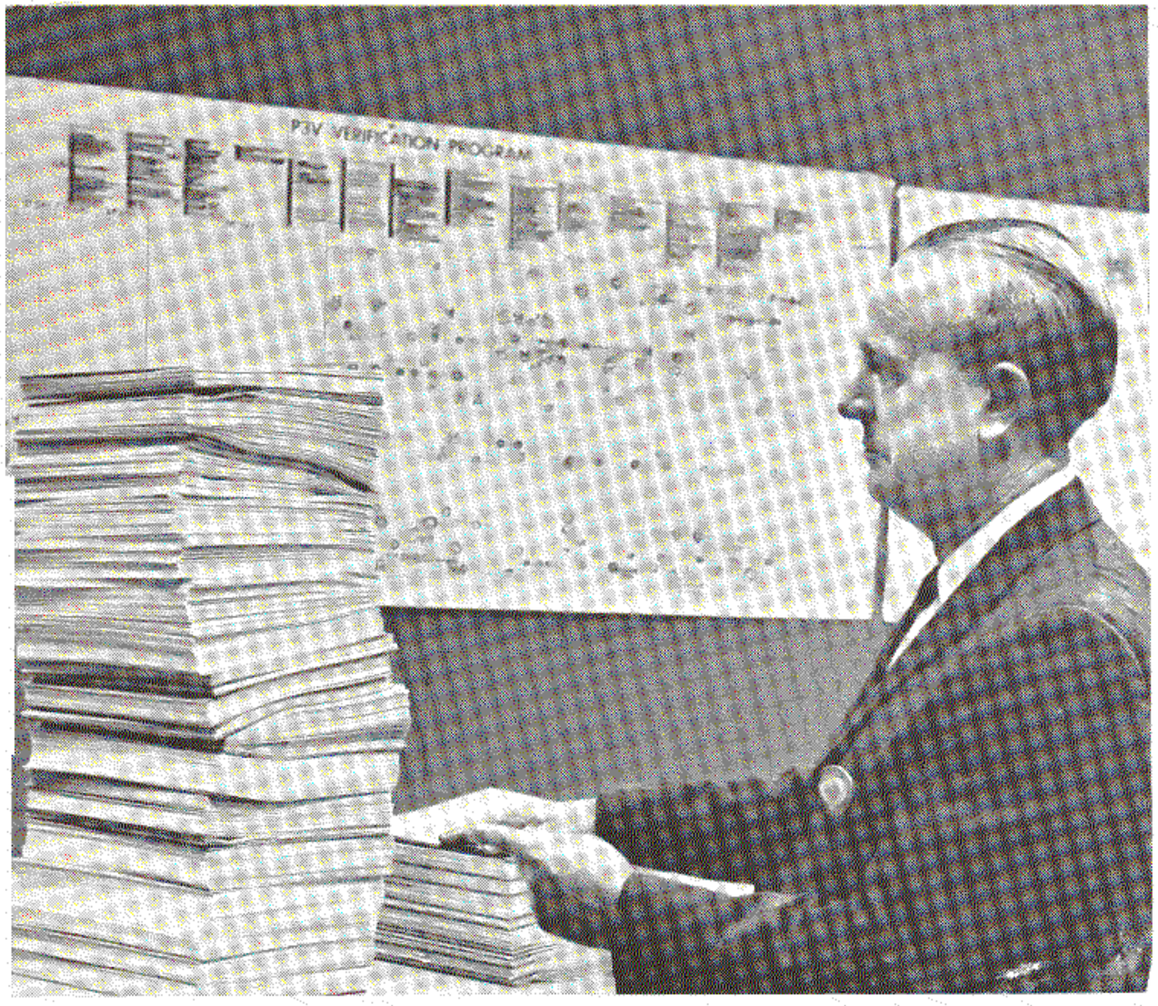
Line Maintenance (Class F), as the term implies, is performed on the flight line. This consists of servicing, preflight and daily inspections, ground tests, trouble shooting and adjustment, and minor replacement of parts. More extensive work such as removal of units, subassemblies, or assemblies may be done on the line, but this is considered Class E maintenance.

In Summation, maintenance classes A and B are performed at major overhaul bases, while classes C, D, E, and F (referred to collectively as fleet-level maintenance) are performed at a squadron's base or Air Station; of these, levels D, E, and F are performed by operational squadron personnel.

P-3A MAINTENANCE INSTRUCTION MANUAL

The P-3A manuals are among the first in the airframe industry to comply with the new Navy Specification XFMTD-156 and there are several unique but significant improvements fed into the P-3A Maintenance Instruction Manual (MIM) as a direct result of meeting the specification requirements.

Foremost among these is the requirement for verification of maintenance instructions prior to delivery of the aircraft; this was described earlier in the Editors Note, but it might be interesting to readers to learn that a total of 330 removal/installation instructions and checkouts were refined as a result of verification experience.



R. A. Erwin, Author and Group Engineer, Compares the Comprehensive P-3A Maintenance Instruction Manual with the Pre-IMM Handbooks of the P-2H

FORMAT The MIM is comprised of 27 volumes under the basic publication code of NAVWEPS 01-75PAA-2. Each individual volume is identified by adding a dash number to the basic publication code (see Figure 5).

The General Information and Servicing volume (-1) contains a general description of the airplane, all necessary information which is not included in the other specialized manuals, and all information pertaining to servicing the airplane. It should be noted that some servicing information was previously included in the Maintenance Requirements Cards; however, this practice has now been discontinued.

Volume -2.1 is unique in that it is the first time a manual on corrosion control, cleaning, painting, and decontamination has been prepared for a specific aircraft. Corrosion prone areas are located and described along with the proper treatment in case

Figure 5 List of Principal P-3A Maintenance Publications

01-75PAA-1 NATOPS FLIGHT MANUAL

01-75PAA-1C CREW ELECTRONIC AND ARMAMENT OPERATING INSTRUCTION MANUAL

01-75PAA-2-( ) MAINTENANCE INSTRUCTION MANUAL

-1 General Information and Servicing
-2 Airframe Group
-2.1 Corrosion Control, Cleaning, Painting and Decontamination
-2.2 Landing Gear
-2.3 Safety and Survival
-2.4 Utility Systems
-3 Hydraulic Power Supply System
-4 Powerplant and Related Systems
-4.1 Powerplant Buildup
-5 Armament and Photographic Systems
-6 Communication and Radio Navigation Systems — Theory of Operation
-6.1 Communication and Radio Navigation Systems — Maintenance Procedures
-7 Navigation System — General — Theory of Operation and Maintenance Procedures
-7.1 Navigation System — Doppler Radar and Doppler/Air Mass — Theory of Operation
-7.2 Navigation System — Doppler Radar and Doppler/Air Mass — Maintenance Procedures
-7.3 Navigation System — Inertial — Theory of Operation
-7.4 Navigation System — Inertial — Maintenance Procedures
-7.5 Navigation System — Attitude Heading Reference and True Airspeed
-8 Anti-Submarine Warfare System — Theory of Operation
-8.1 Anti-Submarine Warfare System — Maintenance Procedures
-9 Radar and IFF Systems — Theory of Operation
-9.1 Radar and IFF Systems — Maintenance Procedures
-10 Electronic Countermeasures Systems
-11 Autopilot and Instrument Groups
-12 Electrical Systems
-13.1 Electronic and Armament Wiring Data
-13.2 Electrical Wiring Data

01-75PAA-3-( ) STRUCTURAL REPAIR MANUAL

-1 Class C, D, E and F Maintenance Levels
-2 Class A and B Maintenance Levels

01-75PAA-4-( ) ILLUSTRATED PARTS BREAKDOWN

-1 Airframe
-2 Landing Gear
-3 Hydraulic Power Supply System
-4 Utility Systems
-5 Powerplant and Related Systems
-6 Instruments
-7 Armament and Photographic Systems
-8 Electrical Systems
-9 Electronic Systems
-10 Inertial Navigation System
-11 Automatic Flight Control System
-12 Safety and Survival
-13 Special Support Equipment
-14 Numerical Index

NAVWEPS 01-75PAA-6 PERIODIC MAINTENANCE REQUIREMENTS MANUAL

corrosion is detected. Painting instructions are provided for the aircraft exterior, as well as for spares surfaces which are received in the bare condition.

Each of the so-called hardware volumes (-2, -2.2, -2.3, -2.4, -3, and -4) is divided into four sections:

Section I is the same in all these volumes and provides an introduction to the manual, in addition to supplying a list of Aircraft Service (or Airframe) Changes which are applicable to the particular volume concerned.
Section II describes the system and components as well as their operation.
Section III provides maintenance coverage for D, E, and F levels.
Section IV provides coverage for C maintenance levels, and also D levels where class C equipment is required.

Figure 6 is a good example of an MIM page showing the basic layout of the maintenance-coverage sections of the "hardware" type manuals. Each component maintenance procedure is identified by a bold-face heading (Item A) for ease in locating the material on the page. All removal and installation procedures provide a recommended manpower requirement (Item B) for the crew chief's use in assigning personnel to perform a job. All tools and equipment, other than standard tools appearing in the Section "U" Allowance List, are noted ahead of the maintenance procedure (Item C), so that these items may be drawn from the tool locker prior to starting the operation.

When consumable materials such as lubricants, lock-wire, and cotter pins are required during an installation procedure, a listing of these items is made ahead of the procedural steps (Item D). Miscellaneous small parts (other than standard AN and MS hardware) which could be lost between a removal and an installation also appear in the materials list.

NAVWEPS 01-75PAA-6-1 DAILY MAINTENANCE REQUIREMENTS CARDS

NAVWEPS 01-75PAA-6-2 PREFLIGHT MAINTENANCE REQUIREMENTS CARDS

NAVWEPS 01-75PAA-6-3 CALENDAR MAINTENANCE REQUIREMENTS CARDS

NAVWEPS 01-75PAA-6-4 CALENDAR INSPECTION SEQUENCE CONTROL CHART

NAVWEPS 01-75PAA-12-( ) IN-FLIGHT MAINTENANCE MANUAL

-1 Electrical Systems
-2 Intercommunication Systems
-3 HF Radio Communication Systems
-4 VHF Radio Communication System
-5 UHF Radio Communication System
-6 Inertial Navigation System
-7 Radio Navigation Systems
-8 Radar Navigation Systems
-9 Navigation Display Systems
-10 Radar Systems
-11 IFF Systems
-12 ECM Systems
-13 Sonobuoy Receiving and Indicating Systems
-14 Integrated Display Group
-15 Submarine Detecting Systems
-16 Automatic Flight Control System
-17 Armament System

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.

Materials 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 MS24665-300 cotter pin.

E *c. Inspect installation of upper and lower bearing brackets to 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 lockwiring of lower bolt head.*

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 lockwiring 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

C

Truck, Fork Lift	TC-200
Hoist	HSKS-1551B
Elevator Sling Assembly	551241-1

Manpower Requirements

B

Two men are required.

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 bolts 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 93.84.

h. Disconnect, roll, tape and stow elevator trim tab cables 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.

Figure 6 Typical Page of Maintenance Instruction Manual

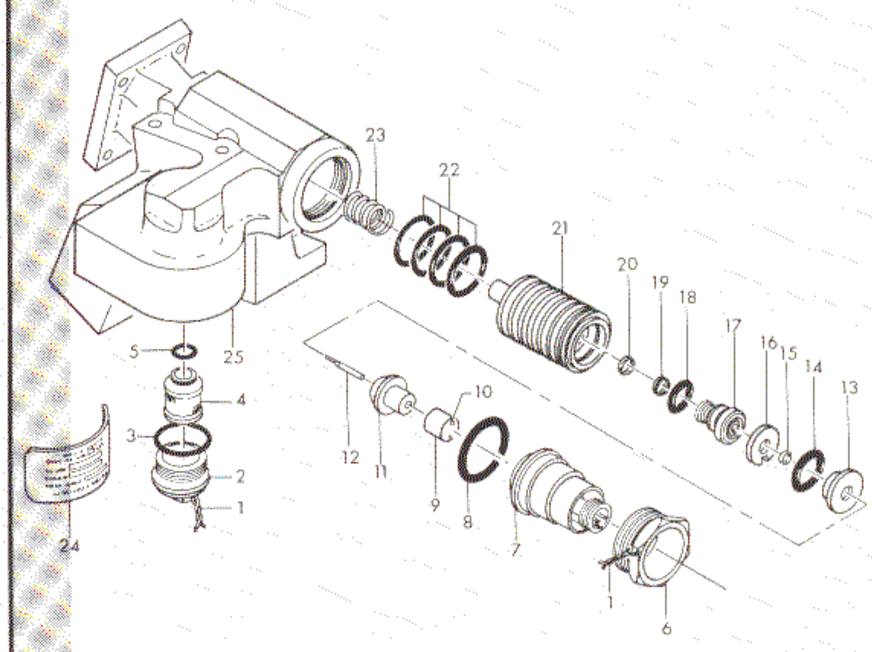
Table 4-7. Test Procedure Chart

Test No.	To Test	Pressure (PSIG)	Apply At	Valve Position	Block Ports	Time (Min)	Requirements
1			Check For Free Flow According To Flow Diagram, Figure 2-44				
2a	EXTERNAL LEAKAGE & PROOF	2-5	P1	POS 1	ALL OTHERS	5	THERE MUST BE NO EVIDENCE OF EXTERNAL LEAKAGE, FAILURE, DISTORTION OR PERMANENT SET
2b			P2	POS 2			
2c		7500	C11	Pos 1			
2d			C21	Pos 2			
3a	INTERPORT LEAKAGE	2-5	P1	Pos 1	B1		LEAKAGE OUT ANY SINGLE OPEN PORT SHALL NOT EXCEED 5 DROPS PER MINUTE AFTER SEATING PERIOD.
3b		5000					
3c		2-5	P2	Pos 2	B2		
3d		5000					
3e		2-5	C11	Pos 2	C12		
3f		5000	C21		C22		
4	OPERATING TORQUE & N.I.F. (NON-INTERFLOW) FEATURE	5000	P1 P2 C11 C21	SEE REQUIREMENTS			PLACE DOWNSTREAM RESTRICTORS ON B1, B2, C12 AND C22, ADJUST FOR VERY LOW FLOW FROM RESTRICTED PORTS IN BOTH POSITIONS. MOVE VALVE FROM POS. 1 TO POS. 2 AND RETURN SEVERAL TIMES. THE TORQUE REQUIRED TO OPERATE THE VALVE BETWEEN THE TWO POSITIONS SHALL NOT EXCEED 60 LB IN. FLOW FROM B1 AND B2 SHALL CEASE ABRUPTLY AS THE VALVE MOVES INTO THE N.I.F. RANGE TOWARD POS. 2. THERE SHALL BE NO FLOW FROM ANY OPEN PORT. LEAKAGE FROM ANY SINGLE OPEN PORT SHALL NOT EXCEED 5 DROPS PER MINUTE

Table 4-8. Trouble Shooting Booster Autopilot Engagement Valve

Trouble	Probable Cause	Remedy
External leakage	Defective packings	Replace packings
Slow action	Clogged filter element	Replace and/or clean filter element (see cleaning procedure)
	Weak coil assembly	Replace coil assembly
	Defective sleeve assembly	Replace sleeve assembly
Erratic	Defective sleeve assembly	Replace sleeve assembly

4-28



1	LOCK-WIRE	7	COIL ASSEMBLY	13	SEAT	19	LOCKRING
2	CASE	*6	PACKING	*14	PACKING	20	FILTER
*3	GASKET	9	ARMATURE	15	SLUG	21	SLEEVE ASSEMBLY
4	FILTER ELEMENT	10	STOP	16	WASHER	*22	PACKING
*5	GASKET	11	POLE	17	SEAT	23	SPRING
6	NUT	12	PIN	*18	PACKING	24	IDENTIFICATION PLATE
						25	BODY ASSEMBLY

* ITEM FURNISHED IN CURE DATE KIT, PART NO. 216631-5

M140-8-2-385

Figure 4-12. Autopilot Engagement Valve Details

4-29

Figure 7 Section IV of MIM Hardware Volumes Covers Troubleshooting, Testing, and Presents Kit Data

As an aid to Quality Control Inspectors, those steps in a procedure which require an inspection are set in italics (Items marked E). These italicised steps are a very important feature and are summarized at the end of each procedure (Item F).

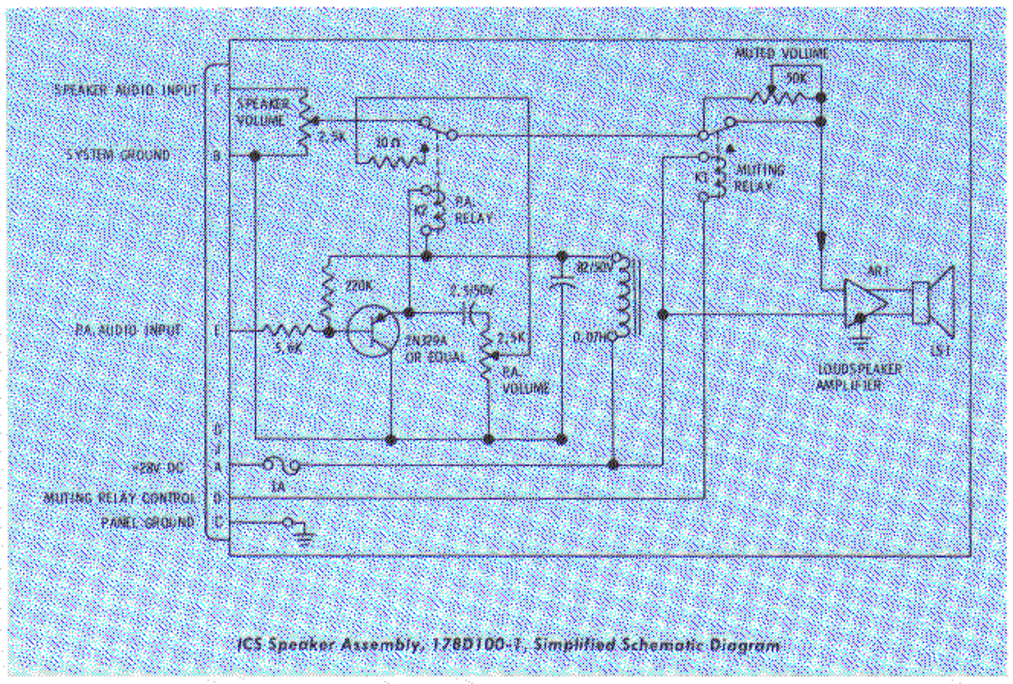
Figure 6, of course, actually shows a section III page of the MIM but section IV of the "hardware" manuals has a similar layout. Section IV covers troubleshooting, disassembly, cleaning, inspection, assembly, and testing of components which can be either partially or completely repaired in the field. Service wear limits, cure-date kits, field kits, and the parts which make up these kits (see Figure 7) are typical of the types of data presented.

The Powerplant Buildup volume (-4.1) differs from the other volumes in that extensive use is made of photographs — a method of presentation well suited to the subject.

The Wiring Data volumes (-13.1 and -13.2) also differ in their approach from the other volumes of the MIM inasmuch as the wiring diagrams, of which they largely consist, are small-scale reproductions taken from the actual master blueprints. Since copies of these blueprints are used to build the airplane, the possibility of errors occurring due to copying these complex diagrams is eliminated.

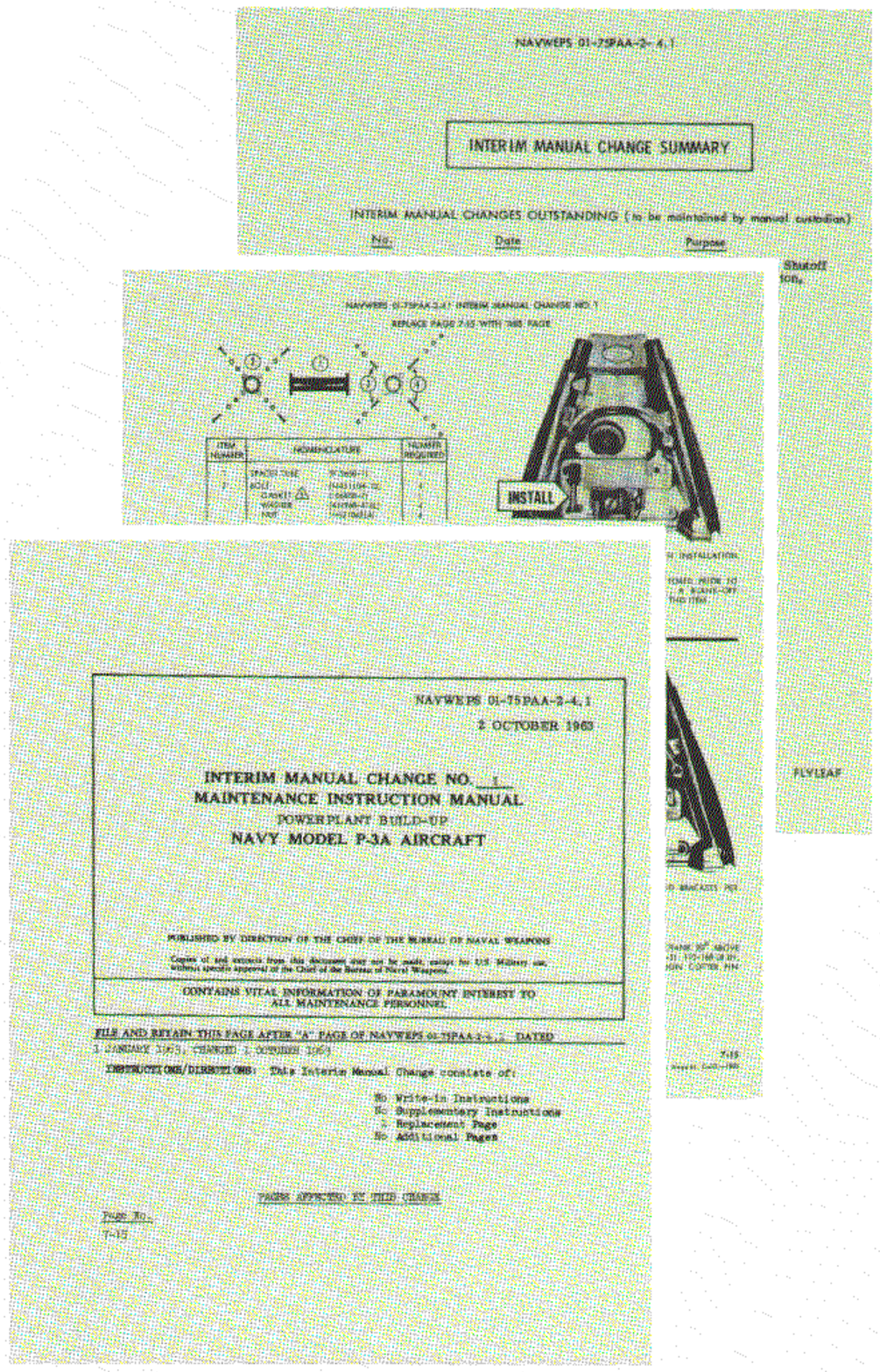
Not discussed so far, are those volumes (-5 through -12) which are generally classified as avionics volumes. The number of volumes used to cover a particular avionics system or subsystem may be either one or two, depending upon the quantity of material to be presented. However, regardless of the number of volumes used, each subject is broken down into two main categories: first, description and theory of operation; second, maintenance procedures.

All of the description and theory of operation sections include unit schematics (see Figure 8) and signal flow diagrams to augment the text. Each maintenance procedures section of the avionics volumes is further divided into two parts; the Class E and F levels are covered in the first part of the section while the Class D material appears in the second part. Part 1 coverage is based primarily on system level checks using system-type test equipment, and component removal and installation procedures. Part 2 includes bench checks, disassembly, assembly, module and component adjustments, and exploded views of the system components and modules.



ICS Speaker Assembly, 178D100-1, Simplified Schematic Diagram

Figure 8 Example of Unit Schematic Diagram Used to Augment Text in MIM



Interim Manual Changes Get Important Information into the Field as Rapidly as Possible

CHANGES AND REVISIONS With the 1 October 1963 change to the MIM, the regular 90-day change program was replaced by a scheme whereby changes to the various volumes are issued only if the information is considered critical maintenance data or affects safety of flight.

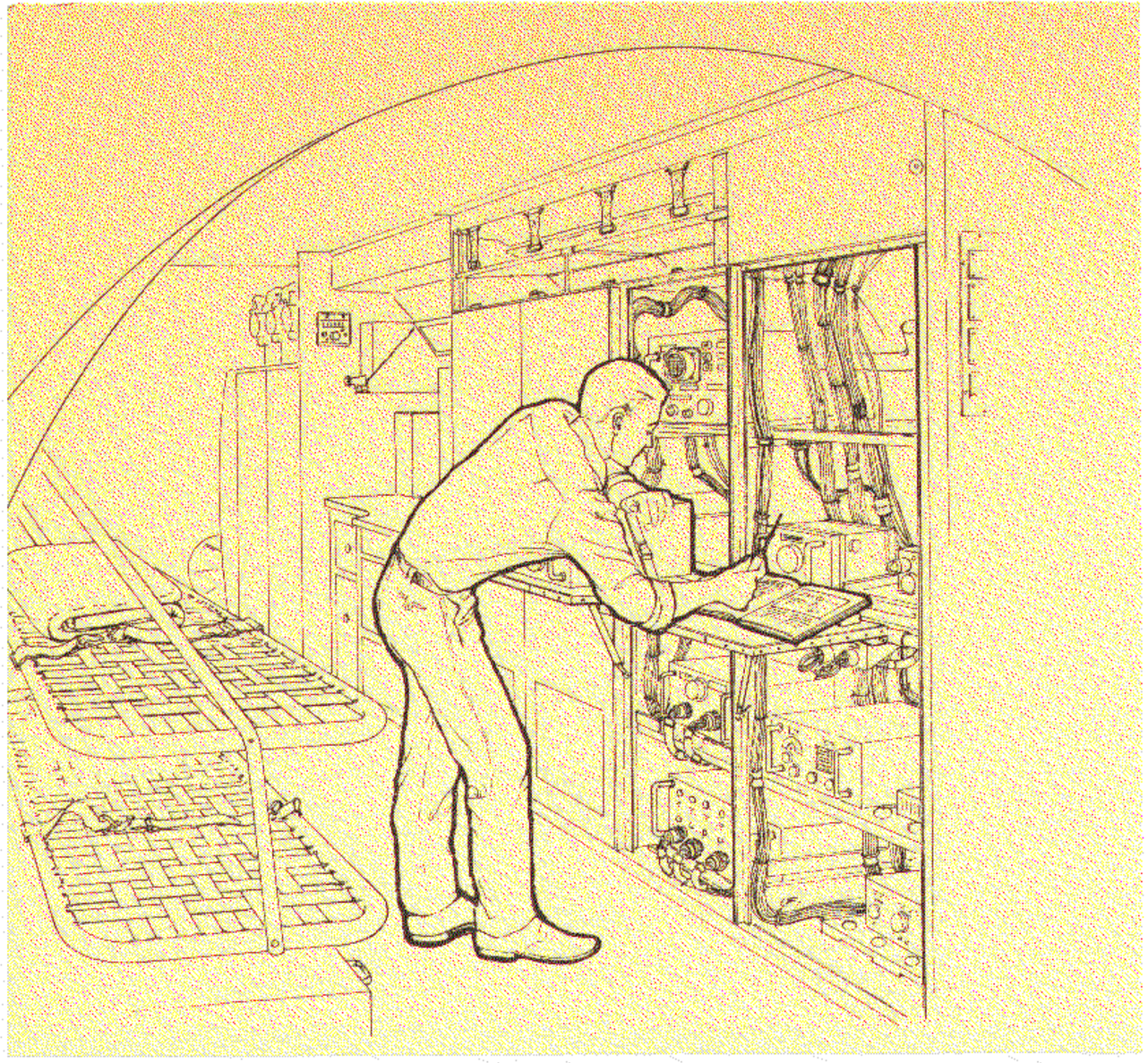
Interim Manual Changes, as such changes are called, were introduced for two principal reasons: The first and foremost was the necessity for getting important information into the field as rapidly as possible; the second reason for the new system was to reduce costs. Interim Manual Changes are prepared in accordance with NAVWEPS 00-51C-500 to a somewhat relaxed format which stipulates typewritten text pages and pencil artwork. Final printed copies are on *green* paper to alert using activities to the importance of the data, which can be in the form of write-in instructions, supplementary pages and replacement, or additional pages. These instructions and pages can be supplied individually or in any combination to make up the manual change.

Manual Revisions. Concurrent with the issue of Interim Manual Changes, a store of less-urgent information is kept against each volume of the MIM for eventual incorporation by the revision procedure. A Revision is a complete re-issue and updating of any volume, and it incorporates all the less-urgent material as well as all the previously issued Interim Manual Changes. Publication of a complete revision to a manual volume is subject to NATSF approval.

P-3A MAINTENANCE PLANNING MANUAL

This manual is a planning guide for use by Squadron Maintenance Officers. Like the Maintenance Instruction Manual, it is also prepared in accordance with Spec XFMTD-156. It tells the Squadron Maintenance Officer what resources are available in terms of support material, technical information, technical assistance, and training. The following specifics are included in the manual:

1. One section is devoted to describing the facilities required to support a P-3A squadron at C through F maintenance levels. Recommended personnel requirements and their ratings are listed to assist the Maintenance Officer in planning his organization.
2. Lists of the Support Equipment and Consumables required for deployment of a squadron of aircraft are supplied. The consumables list provides the quantity of material required to support a ninety-day deployment period.
3. To assist in special mission preparation, equipment requirements are listed together with the



Artist's Concept of Technician Performing In-Flight Maintenance

volume number of the maintenance manual where the pertinent detail installation instructions can be found.

4. Repair kits, parts repairable on a supply rotation basis (rotables), and technical manuals are listed.
5. A status report on all Aircraft Service (or Airframe) Changes is provided.
6. Finally, the Maintenance Officer is provided with a list of those items in specific areas of the aircraft that require especially close or continued maintenance attention.

P-3A IN-FLIGHT MAINTENANCE MANUAL

The In-Flight Maintenance Manual, currently in preliminary form, consists of 17 volumes. This manual is provided as an aid for in-flight trouble shooting and repair of the electrical and electronic equipment and systems. Each volume of the manual is identified by a dash number suffixed to NAVWEPS 01-75PAA-12 (see Figure 5).

The In-Flight Maintenance Manual (IFM) provides the necessary technical information to enable the airplane flight crew to perform electrical and electronic maintenance while the airplane is on station. The information presently contained in the manual is intended to be used in conjunction with, and to complement, that contained in the Maintenance Instruction Manual (MIM) and the Crew Electronic and Armament Operating Manual. The In-Flight Maintenance Manual, in conjunction with the other manuals aboard the aircraft, enables the flight crew to maintain the in-flight accessible electrical and electronic equipment at a level of performance limited only by the availability of replacement parts and the skill and initiative of the individual crew members.

The premise of this manual is that all the systems, groups, sets, and equipment have been checked out prior to flight, and that they are operating at the minimum performance levels specified by the equipment service and maintenance instructions. Once airborne, however, it should be assumed that the equipment is operating properly until the equipment efficiency no longer permits the satisfactory completion of the assigned tactical mission.

The test equipment, which is provided aboard the aircraft to facilitate in-flight trouble shooting of the electrical and electronic systems, groups, sets, and equipment, is listed below:

IN-FLIGHT MAINTENANCE TEST EQUIPMENT

Quantity	Nomenclature
1	Oscilloscope
1	Multimeter
1	Vacuum-Tube Voltmeter (VTVM)
2	Maintenance Tray (922886-1)
1	Adapter Assembly (922901-1)
1	Maintenance Tray (923043-1)
1	Tube Assembly (923067-1)
14	Component Patch Cable
15	Module Patch Cable

Some test equipment and various required spare parts are stowed in the forward in-flight maintenance locker—one of three lockers which are latched to the floor under the crew rest bunks. The middle locker provides stowage for the patch cables, the three in-flight maintenance trays, and the tube assemblies used in mounting the trays (see Figure 9). The aft locker, consisting of one large drawer, provides storage space for the manuals and other publications that need to be stowed aboard the aircraft.

It is premised that the In-Flight Maintenance (IFM) Manual will ultimately present data on electrical, electronic, and armament equipment to the extent that the manual will be independent of all other manuals that may or may not be stored aboard the aircraft. This proposed basic manual will consist of one volume with a confidential supplement, and will contain all of the data necessary to maintain the airborne equipment covered in the manual during flight. Where spare parts are not provided in the in-flight spares kit, the data in the manual will be used only to isolate faults within the equipment to a replaceable component, module, tube, or fuse so that the aircraft "down" time for maintenance (turnaround time) will be greatly reduced.

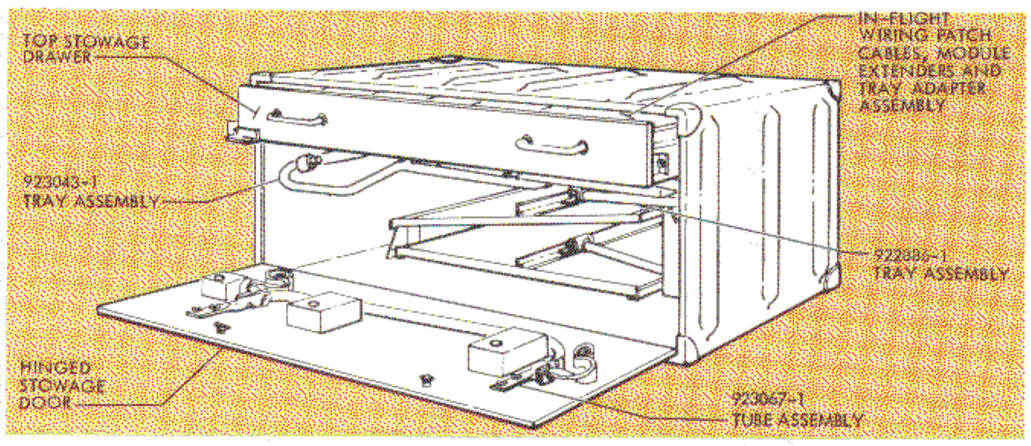


Figure 9 Middle In-Flight Maintenance Locker

In addition to completion and updating of the IFM Manual, the basic issue will contain coverage of additional armament (ordnance) and electrical systems not previously planned for coverage. The additional systems will include: the Sono Data Display System, Retrolauncher, Sono Chutes, Search Stores Relay Box with related in-flight maintainable ordnance equipment, Electrical Power Distribution System, Lighting, Anti-ice System, Propeller Synchrophaser, Anticollision Lights, and Air Conditioning and Pressurization System.

BUWEPS is currently reviewing the proposals, recommendations, and specification changes which will allow the completion of the IFM Manual to the format, concept, and depth presented above. At present this manual is still in the preliminary form with a 1 January 1963 change incorporated. The Fleet has evaluated the manual and compiled usage and feedback data. The concept and extent of maintenance capable of being performed in flight has been determined and recommended.

P-3A STRUCTURAL REPAIR MANUAL

Structural repair manuals have been around for years in one form or another but, as in the case of other technical publications in the P-3A series, a few new twists have been added to improve the efficiency and utilization of this most basic and vital repair guide. For the benefit of newcomers, the Structural Repair Manual provides instructions for the repair and maintenance of the airframe structure. It contains general information such as: airframe cleaning and finishing, airframe sealing, control surface rebalancing, general shop practices, damage evaluation and support of structure, and a description of the structure through the medium of index illustrations and repair illustrations.

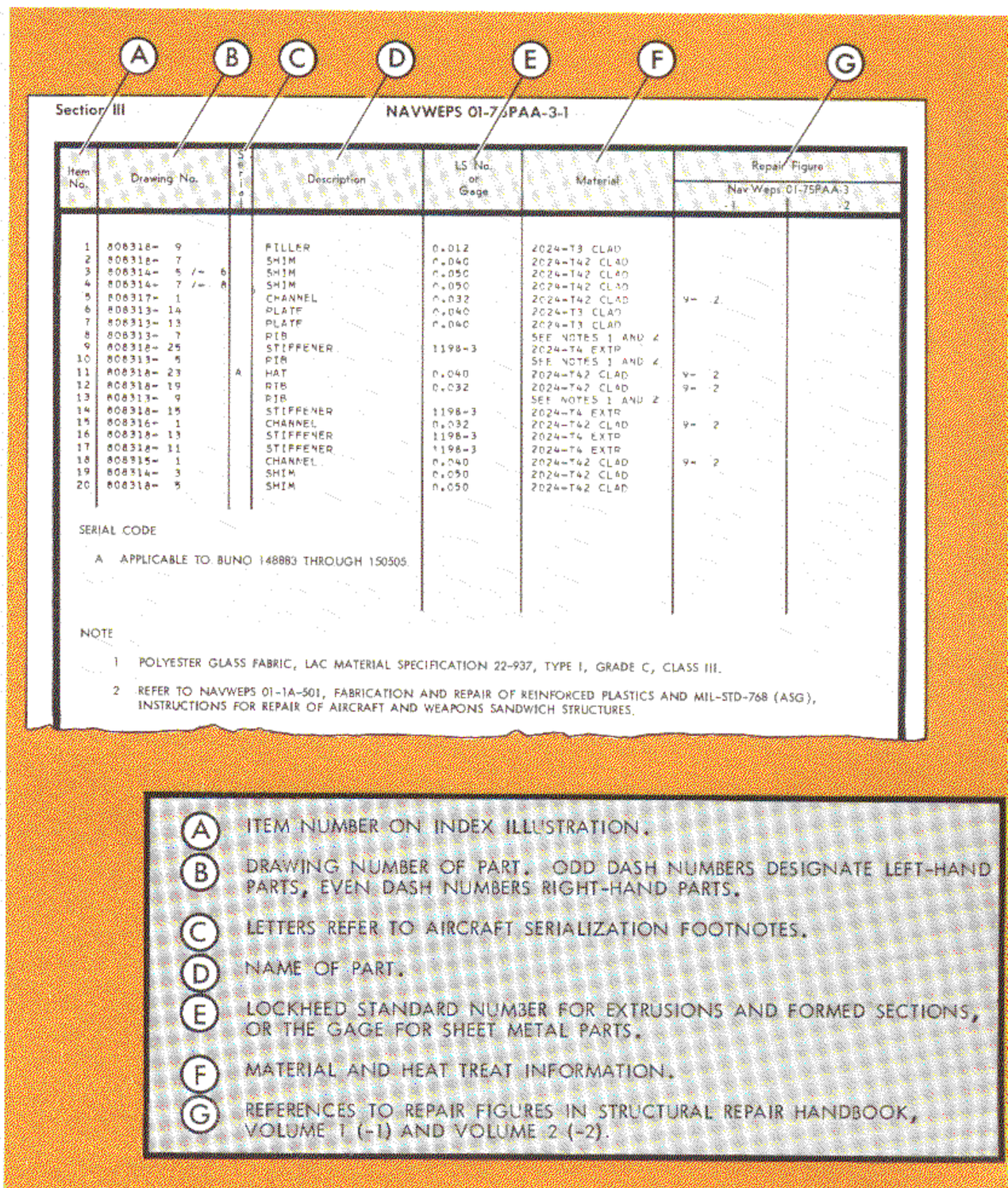
The P-3A Structural Repair Manual is somewhat different from repair manuals that have been prepared in the past. It is in two volumes, not just because of physical size (although we expect it to grow considerably as aircraft service time increases), but mainly to suit its usage by different facilities. Volume 1 is for use at *all* levels of maintenance. Volume 2 supplements volume 1 and contains information to be used at Class A and B facilities.

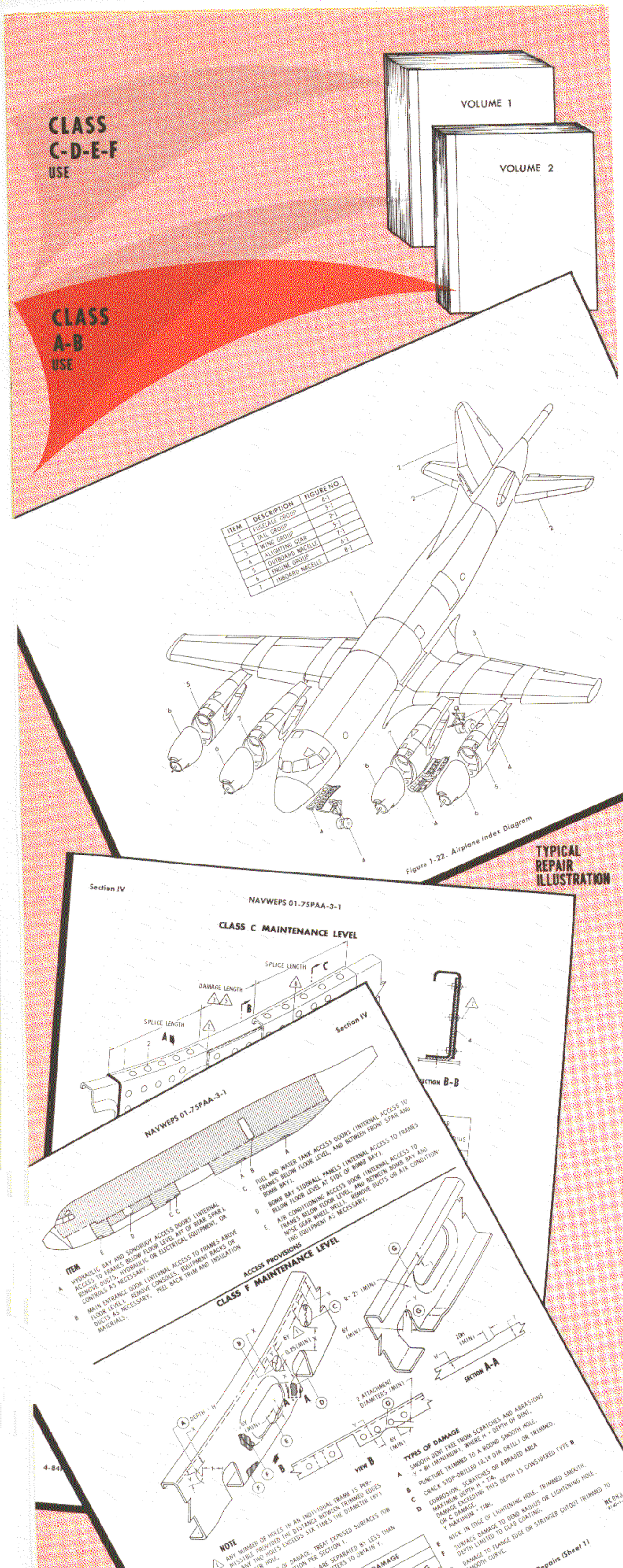
All repair schemes have been designed to suit a specific maintenance facility and the appropriate maintenance level has been noted on the illustration.

The following notes are included to draw attention to those areas where readers often experience difficulty, although it should be pointed out that most of these difficulties would not exist if readers would take the extra time to read the introduction to the first volume wherein is described the "Method of Using the Manual." Briefly, assuming information is required regarding a particular structural member, it is first located on the Master (Airplane) Index diagram. The key to this diagram then refers to the applicable Component Index diagram which, in turn, refers to the pertinent repair illustrations. An attempt has been made to make the repair illustration complete in itself by incorporating access provisions, negligible damage, and the actual repair all in the one illustration (see Figure 11).

It will be noted that many of the illustrations are accompanied by key diagrams which include part numbers (drawing numbers). Normally, the left-

Figure 10 Typical Structural Repair Manual Key





hand part number is shown and the dash number of the righthand part is given following the slant or slash mark. However, it should be emphasized that these part numbers are given as an *aid* in effecting repairs and are *not* to be used for ordering parts. The authority for ordering parts is NAVWEPS 01-75PAA-4, the Illustrated Parts Breakdown Manual. Figure 10 shows a typical Structural Repair Manual key, with explanatory notes.

A major difference from previous practice is in the section on special tools. We have taken a much broader interpretation of what constitutes a special tool than we have previously. Therefore, a number of tools have been included that are not essential for the repair of P-3A aircraft, but which shop personnel might wish to fabricate for themselves to make their jobs easier. There are many special tools of this nature buried in various personal tool boxes, and we are desirous of bringing such tools to light. If Navy personnel having such tools will submit a rough sketch and description of the tool usage to us, we will consider them for addition to the manual so that everyone may have the advantage of these time savers. Such information may be submitted through Lockheed Customer Service Representatives.

P-3A ILLUSTRATED PARTS BREAKDOWN

GENERAL The purpose of the Illustrated Parts Breakdown (IPB) is to assist Supply, Maintenance, and Overhaul personnel in the identification, requisitioning, storing, and the issuing of parts for the P-3A. Included in the supply and maintenance information for each individual part, are codes which give the source, kit, and the material accountability recoverability (MARC). Federal Stock Numbers, when furnished by the procuring agency, are also listed.

Source Codes are symbols which indicate to maintenance personnel a source of supply for an item required to maintain or repair a component part of the aircraft. Specifically, these codes indicate whether the item is to be requisitioned from the supply system; to be manufactured; to be obtained from salvage; not to be replaced since the next higher assembly is to be installed; or, due to failure, is in need of complete overhaul or retirement of the assembly or equipment from service.

Kit Codes are symbols that reflect the supporting line items which will be procured, stocked, requi-

Figure 11 The Structural Repair Manual is in Two Volumes — Each Repair Illustration is a Combination of Access Provisions and Repair Procedures

sitioned, accounted for, and used on a kit basis for maintenance and overhaul of selected type end items.

MARC Codes are assigned only to aeronautical provisioned items to reflect the accountability, recoverability, and repair policy determined for an item of equipment or material required for maintenance, repair, or rework of an end article.

Federal Stock Numbers. Public Law 436, established within the Department of Defense, was the authorization for the development of a single catalog system and related supply standardization program. The system adopted by the Department of Defense was the Federal Cataloging Program (FCP). The basic concept of the FCP is to name, describe, classify, and number each item respectively that is used, purchased, stocked, or distributed. This would be done in such a manner that only one distinctive combination of letters and/or numbers would identify the same item either within or between Bureaus, Services, or Departments. Accordingly, this single item identification would be used for all functions of supply from its original purchase to its final disposal. A result of the FCP was the establishment of the Federal Stock Number (FSN) which replaces the previously-used Navy Stock Number.

FORMAT The IPB comprises fourteen volumes, twelve of which correspond to the MIM volumes insofar as the title and the equipment covered (see Figure 5). The IPB contains complete information with regard to the part number, vendor code, description, supply, and maintenance code for each individual part that is covered. Each volume of the IPB (excluding volume fourteen) is divided into two sections: Section I, Introduction; and Section II, Group Assembly Parts List.

The Introduction contains an explanation of the contents of each volume, and how to use the information contained therein, as well as a list of all Aircraft Service Changes applicable to the equipment covered. The Group Assembly Parts List section includes illustrations of all parts of the P-3A and its systems, equipment, and special support equipment capable of separate maintenance.

Produced in accordance with a new specification (MIL-M-8910), the P-3A Illustrated Parts Breakdown includes many improvements for the using command in comparison with similar manuals which have served for the past thirty years. This new specification has been applied for the first time at Lockheed on the P-3A and sets forth the following new features which expand the usefulness and stature of the IPB as a technical manual.

Wherever possible, all parts listed in the IPB are listed in the order of disassembly sequence, so that the presentation, insofar as illustrations and sequence of listing, is compatible with that of the Maintenance Instruction Manual.

For the first time the IPB features a separate volume (volume 13) which lists and illustrates all government approved special support equipment used in conjunction with the P-3A. The special support equipment is arranged in categories, such as Special and Non-standard Tools, Ground Handling Equipment, and Test Equipment.

The IPB includes coverage of all GFP (Government Furnished Parts) and coverage of all CFE (Customer Furnished Equipment) parts. An exception occurs when the procuring activity has indicated procurement of a separate IPB for a piece of Customer Furnished Equipment. Then, only the item proper, its attaching parts and those parts replaceable at organizational and intermediate levels of maintenance are listed and illustrated in the P-3A Illustrated Parts Breakdown.

Items requiring special attention in the IPB include: parts which are oversize or undersize; parts which have electrical tolerances; parts which are undrilled or untrimmed; parts which are matched sets (mechanical and electrical); parts which are Government Standards; parts which are altered, selected, or source controlled; parts which are commercial hardware; parts which are articles without part numbers; and parts which have been redesigned. In addition, when repair parts for any article or repairable units within the article are to be supplied in the form of kits, the kit part number is listed and all components of the kit are listed, coded, and illustrated.

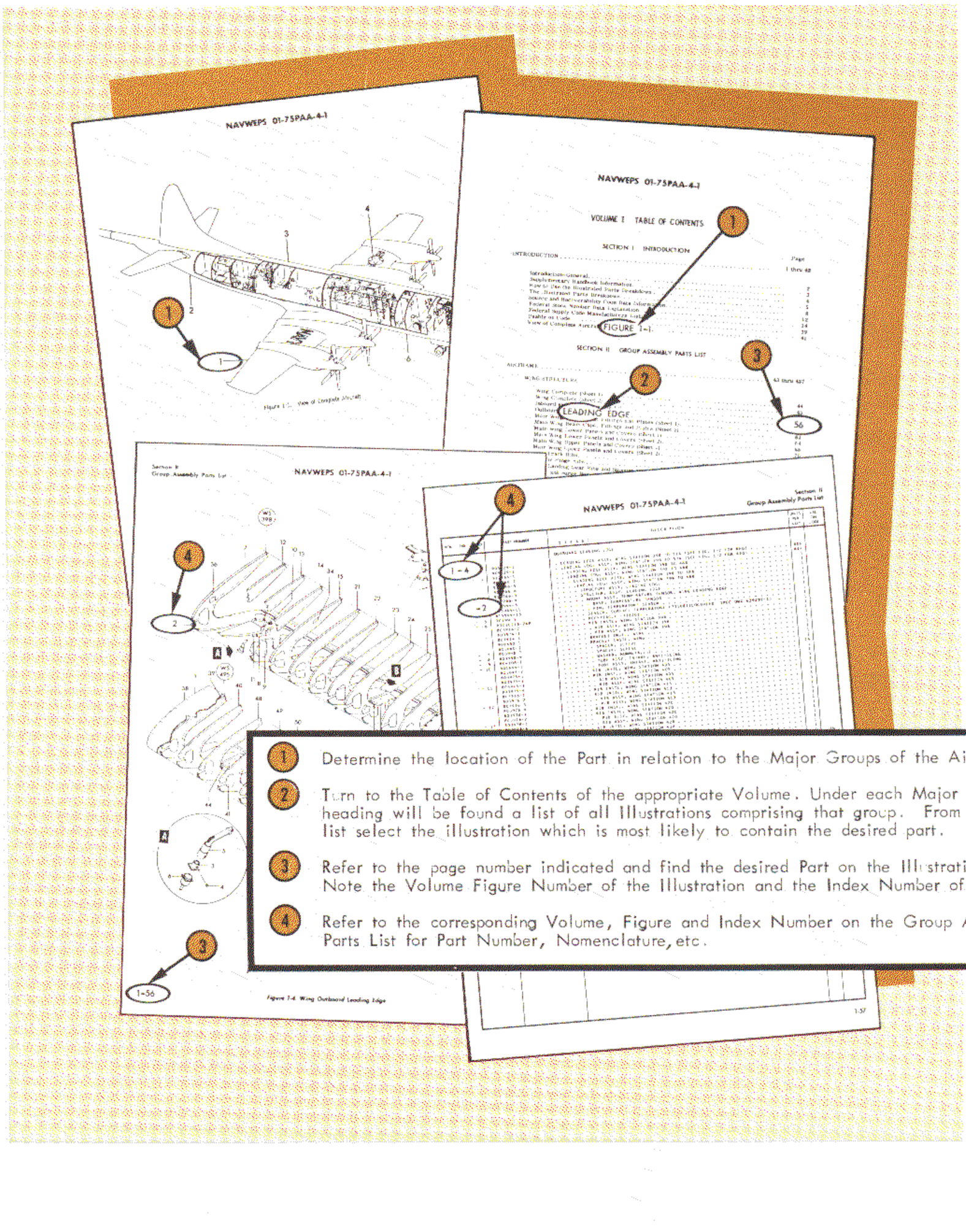
Volume 14 of the IPB is the Numerical Index. The Numerical Index is divided into three sections: the Introduction, the Numerical Index, and the Reference Designation Index.

The Introduction contains all pertinent information concerning use of this volume, and contains the definitions for all source codes, maintenance and repair codes, and stock numbers. The Numerical Index section lists some 120,000 parts used on the P-3A which are removable or capable of separate maintenance. In addition to locating these parts in the individual volumes for reference to next higher assemblies and location within the aircraft, the Numerical Section furnishes all known supply and maintenance information for each part. The Reference Designation Index pertains to electrical/electronic parts only, and assists the using command in determining the part number and supply/maintenance information when a part number is not known but the reference designation number is known.

A feature not required by specification, but applied for the first time in the preparation of the P-3A Illustrated Parts Breakdown, is the use of Electronic Data Processing Equipment. In this cost avoidance program, all material with the exception of the Introduction is transmitted onto magnetic tape where it undergoes constant updating, and can be printed out in the format of text and numerical index pages in a few hours when required for submittal to the customer.

Briefly, the Illustrated Parts Breakdown has a new look; it has become a much more useful and comprehensive Technical Manual and is well integrated with the complete Maintenance and Logistic support picture.

The Introduction Section of the Illustrated Parts Breakdown is an Excellent Guide and Timesaver



AIRBORNE EQUIPMENT AND SPECIAL SUPPORT EQUIPMENT MANUALS

ESTABLISHMENT OF REQUIREMENTS The initial publications requirements for airborne and special support equipment were established at P-3A provisioning conferences. Navy provisioning teams as well as Contractors and Subcontractors representatives reviewed the logistic needs of this equipment and recommended the type of manual coverage required. Prime factors used in determining types of manuals were:

1. Maintenance level at which each airborne component was provisioned.
2. Maintenance level at which special support equipment was provisioned.
3. Repair and overhaul capability of the Navy facilities.
4. Anticipated service life of airborne equipment.

Basic Equipment Lists for airborne equipment and special support equipment, commonly called BEL cards, are generated by each provisioning conference. Each card deals with one item of equipment (airborne or support) and, by predetermined code number, indicates the type of publication(s) to be prepared. The BEL is sent to the Navy for evaluation and is the basis for contractual authority to be granted for publication preparation.

AIRBORNE EQUIPMENT MANUALS The airplane Maintenance Instruction Manual covers the Class C, D, E. and F level maintenance procedures for airborne equipment, but separate overhaul manuals are prepared to furnish data for Overhaul Maintenance (Class A) and Special Maintenance (Class B).

These overhaul manuals contain the data necessary for the complete overhaul and testing of airborne equipment. Required tools, test equipment, and special support equipment are listed in each manual, and their usage is defined and made a part of the functional test procedure. Only those items of equipment procured or approved by the Navy are referenced in these manuals. Preparation of overhaul and illustrated parts breakdown manuals is closely coordinated to maintain a common presentation by way of exploded view disassembly and assembly sequence indexing.

Periodic revisions to manuals are processed as required to reflect changes to the basic equipment or to add new configurations which have been procured since the initial procurement of the basic design.

SPECIAL SUPPORT EQUIPMENT MANUALS Depending on the complexity of the equipment, special support equipment manuals may or may not include overhaul instructions, but always include operation and service instructions together with an illustrated parts breakdown of the support equipment. Instructions for the actual use of the support equipment are provided in the applicable airborne equipment overhaul manual or the airframe publication (MIM).

It is sometimes necessary to issue preliminary operating and service instruction manuals in order to support the equipment at the time of delivery. Preliminary manuals are superseded when the basic manual for the equipment is issued.

TECHNICAL DIRECTIVES — CHANGES AND BULLETINS

Recently there have been changes to the system controlling technical directives in recognition of the need for uniformity. Aircraft Service Changes (ASCs) have been used for many years to direct the accomplishment or recording of one-time changes to delivered aircraft, but these and the instructions for the modification of related aeronautical material and equipment were all issued in different formats and were prepared to different specifications. Instructions for inspection and rework of aircraft and equipment emanated from numerous sources and were frequently issued without assigned numbers for control purposes. Lack of proper control, distribution, and indexing created serious problems in assuring uniformity, adequate safety, and effective logistic support.

To correct these conditions, a centralized system for control and issuance of technical directives has been established, and one immediate result has been standardization of the format of all directives. In particular, it will be noted that the Aircraft Service Change has been discontinued and is replaced by the Airframe Change and Airframe Bulletin.

NEW DIRECTIVE SYSTEM The letter-type technical directive system established by BuWeps Instruction 5215.8, effective 15 March 1963, establishes two basic types of technical directives, "Changes" and "Bulletins", and each of these is further broken down into ten title subjects: airframe, powerplant, propeller, avionics, accessory, support equipment, aviation armament, air crew systems, photographic, and clothing and survival equipment. It should be noted that these title subjects are generally related to the manufacturer of the part or parts affected by the Change or Bulletin. Thus, a Change modifying a

generator would be classified as an Accessory Change and would originate at the company which manufactures the generator, while a modification to the wiring going to the generator would be an Airframe Change and would originate at the company which installed the wiring in the airplane — usually the airframe manufacturer.

A Change is a formal technical directive containing instructions to accomplish a modification, repositioning, alteration in the physical appearance of, or installation of different parts in subassemblies, assemblies, or components of aircraft or equipment.

A Bulletin is a formal technical directive containing directions to accomplish inspections, calibrations, tests, and adjustments which will not result in replacement of parts of different physical appearance or identity. Compliance with a Bulletin should not require a reidentification of the parts or equipment. The Bulletin directive covers the type of instruction previously issued by wire or letter which did not have a sequence number or other indexing control.

Interim Changes and Bulletins are also provided for in the new directive system. They are issued by message (some convenient fast method), and define the action to be taken to correct a safety or operational condition which embodies risk calculated to be intolerable or tolerable within narrow time limits. Interim directives are only used when the action classification is "Immediate" or "Urgent", and may or may not contain the final solution to the condition. Interim changes and those interim bulletins requiring continuing action must be superseded by a regular change or bulletin (in standard format) within 90 days from date of issue. Interim bulletins requiring a single action are not superseded by a formal bulletin.

Effectivity All technical directives authorized after 15 March 1963 are to be prepared in accordance with MIL-T-23336 (WEP) which supersedes the ASC specification MIL-C-18216 (Aer). Airframe Changes (ACs) will be numbered in sequence with ASCs previously issued or in state of preparation. Airframe Bulletins will however begin a new sequence of numbers.

The format of all the new directives is similar and, in particular, it will be noted that the content of the Airframe Change directive is essentially the same as that of the old Aircraft Service Change, although the supply data now precedes the detailed instructions.

However, all directives are categorized as "Routine Action", "Immediate Action" with a border of red X's on the first page, or as "Urgent Action", which have a border of red diagonals.

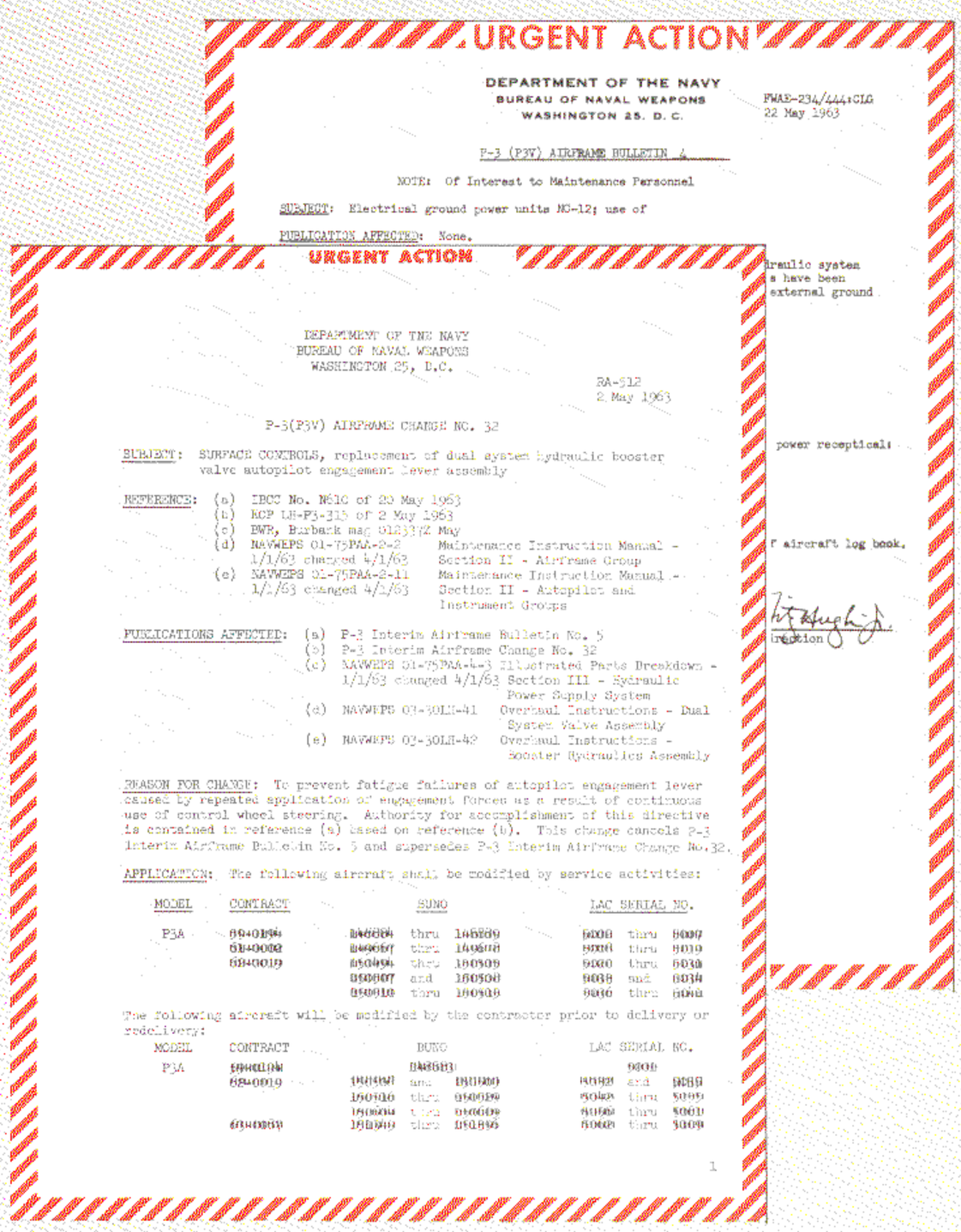
ADDITIONAL INFORMATION Although the new directives should pose no new questions, inquiries occasionally received in the past with respect to ASCs indicate the need for clarification in some areas.

Authorization All changes and bulletins, including interim changes and bulletins, are issued by or at the direction of the Chief, Bureau of Naval Weapons, except in cases where the time delay involved in obtaining Bureau approval is intolerable. Then the

major controlling custodians may issue "Immediate Action" interim directives. Major controlling custodians are Commander, Naval Air Forces, U. S. Pacific Fleet (COMNAVAIRPAC); Commander, U.S. Atlantic Fleet (COMNAVAIRLANT); Chief of Naval Air Training (CNATRA); and Chief of Naval Air Reserve Training (CNARESTRA).

Action Classification The Bureau of Naval Weapons or the major controlling custodian (in the case of Immediate Action interim directives) assigns the action classification, and obtains the number of the change or bulletin from the Technical Services Facility.

Immediate Action is the classification used for safety conditions which, if uncorrected, could result in fatal or serious injury to personnel, extensive damage, or destruction of property. It involves discontinuing the use of the aircraft or equipment in the operational employment under which the adverse condition exists, pending incorporation of the required corrective action. If use of the aircraft or equipment will not involve using the affected component or system in either normal or emergency situations, compliance may be deferred, but no later than the next periodic inspection.



URGENT ACTION

DEPARTMENT OF THE NAVY
BUREAU OF NAVAL WEAPONS
WASHINGTON 25, D. C.

FWAE-234/444:CLG
22 May 1963

P-3 (P3V) AIRFRAME BULLETIN 4

NOTE: Of Interest to Maintenance Personnel

SUBJECT: Electrical ground power units MC-12; use of

PUBLICATION AFFECTED: None.

URGENT ACTION

DEPARTMENT OF THE NAVY
BUREAU OF NAVAL WEAPONS
WASHINGTON 25, D.C.

RA-512
2 May 1963

P-3(P3V) AIRFRAME CHANGE NO. 32

SUBJECT: SURFACE CONTROLS, replacement of dual system hydraulic booster valve autopilot engagement lever assembly

REFERENCE: (a) IBCC No. N61C of 20 May 1963
(b) NCP LH-P3-315 of 2 May 1963
(c) PWR, Burbank msg 012317Z May
(d) NAVWEPS 01-75PAA-2-2 1/1/63 changed 4/1/63 Maintenance Instruction Manual - Section II - Airframe Group
(e) NAVWEPS 01-75PAA-2-11 1/1/63 changed 4/1/63 Maintenance Instruction Manual - Section II - Autopilot and Instrument Groups

PUBLICATIONS AFFECTED: (a) P-3 Interim Airframe Bulletin No. 5
(b) P-3 Interim Airframe Change No. 32
(c) NAVWEPS 01-75PAA-4-3 Illustrated Parts Breakdown - 1/1/63 changed 4/1/63 Section III - Hydraulic Power Supply System
(d) NAVWEPS 01-30LH-41 Overhaul Instructions - Dual System Valve Assembly
(e) NAVWEPS 01-30LH-42 Overhaul Instructions - Booster Hydraulics Assembly

REASON FOR CHANGE: To prevent fatigue failures of autopilot engagement lever caused by repeated application of engagement forces as a result of continuous use of control wheel steering. Authority for accomplishment of this directive is contained in reference (a) based on reference (b). This change cancels P-3 Interim Airframe Bulletin No. 5 and supersedes P-3 Interim Airframe Change No.32.

APPLICATION: The following aircraft shall be modified by service activities:

MODEL	CONTRACT	BUNO	LAC SERIAL NO.
P3A	6840[illegible]	[illegible] thru 148889	9000 thru 9007
	6840002	[illegible] thru 149078	9008 thru 9019
	6840019	150491 thru 150509	9020 thru 9033
		150807 and 150808	9033 and 9034
		150810 thru 150909	9036 thru 9060

The following aircraft will be modified by the contractor prior to delivery or redelivery:

MODEL	CONTRACT	BUNO	LAC SERIAL NO.
P3A	6840[illegible]	[illegible]	9006
	6840019	150807 and 150809	9033 and 9059
		150910 thru 150939	9060 thru 9089
		150954 thru 150959	9090 thru 9095
	6840039	150960 thru 150995	9096 thru 9099

1

power receptical

f aircraft log book.

irection

Typical Airframe Change and Airframe Bulletin — Note that "Urgent Action" is Denoted by Border of Red Diagonals

Urgent Action is the classification used for safety conditions which, if uncorrected, could result in personnel injury or property damage, and may or may not necessitate the imposition of operating restrictions. This classification may also be used for mission capability changes of major importance. Urgent directives are further broken down as follows:

1. Urgent Interim Directives. Compliance is required within sixty days from date of issue in those aircraft employed under conditions in which the hazard exists. If use of the aircraft will not involve use of the affected component or system in either normal or emergency conditions, compliance may be deferred but no later than 180 days from the date of issue.
2. Urgent Formal Directives. Compliance is required no later than the next Progressive Aircraft Rework (PAR) period or overhaul.

Routine Action is the classification used for conditions which, if uncorrected, could, under prolonged operation, result in personnel injury or property damage, or have an adverse effect on the operation, maintenance, or support of the aircraft. Compliance is not normally delayed beyond one PAR or overhaul if accomplishment would seriously interfere with operational or deployment commitments.

Issue Date For airframe changes which require kits or parts, the "issue date" is the firm date that kit shipments are scheduled to begin. If kits are not required, the "issue date" is the date that the bulk quantity of the Airframe Change is forwarded to the Naval Air Technical Services Facility for distribution.

Preparation Each directive includes a statement indicating the name of the organization responsible for its preparation. This information appears near the left margin, below the signature data line on the last page. The service bulletin number assigned for internal control and used on the manufacturer's engineering drawings is included in parentheses. The statement is omitted if the directive is prepared by the same Bureau of Naval Weapons organizational code listed in the upper right corner of the first page.

PART THREE

FLIGHT CREW TECHNICAL PUBLICATIONS

IN THE past, Naval flight crews have been endowed with two different types of handbooks for a single type of aircraft. The contractor-prepared manual is called the Flight Manual, while the other publication, prepared by Naval personnel, is called the NATOPS Manual (Naval Air Training and Operating Procedures Standardization Manual). When a condition like this exists, it is inevitable that at some time the flight crew will be placed in the uncomfortable position of having to choose between two different sets of instructions on one procedure.

Flight Manuals have been written to specification MIL-M-7700A with the theory that the manual be used as a textbook and study guide by pilots prior to their checkout, and thereafter it would serve as a refresher-reference book.

NATOPS Manuals are an outgrowth of Squadron SOPs. They have been developed to share squadron experience and standardize procedures fleetwide in order to improve training-standards and combat-readiness while substantially reducing accident rates.

The Flight and NATOPS manuals of a number of aircraft are now being combined in order to eliminate duplication of effort, and to avoid any conflict between the two. Conferences of fleet and contractor representatives were held at New Orleans in January 1962, Minneapolis in September 1962, and Dallas in September 1963 for the purpose of establishing the format and treatment. Several experimental NATOPS Flight Manuals, published by other contractors, were discussed at the conferences, and the major problems now seem to be pretty well worked out. The new NATOPS Flight Manual, distributed in December, 1963, is the first edition of the P-3A combined NATOPS Flight Manual.

Henceforth, the NATOPS Flight Manual program is expected to work as follows: Twice a year at the manufacturer's facility the Model Manager will preside at a meeting attended by representatives from all squadrons that use the airplane. The chairman will appoint committees to go through the manual and decide what changes are to be made. The manufacturer will furnish technical experts on the airframe, engine, systems, armament, etc. (as

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R. P. BOAL
Flight Manuals Engineer, Senior

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Flight Manuals Engineer, Senior

well as on publishing) for consultation. After the close of the conference the contractor will proceed to publish and distribute new books, revised in accordance with the decisions made at the meeting.

Procedural information in NATOPS Flight Manuals will be expanded to include more general training information, but, as far as method of description is concerned, the new manuals are still being written to specification MIL-M-7700A. This means that every piece of equipment, control, switch, switch position, and indicator available to the crew in flight will be mentioned, illustrated, and described to the extent of explaining what it does, how to operate it, and whence it receives its power. How it *works* may not be explained unless such knowledge can influence the operating methods.

The new NATOPS Flight Manuals will contain standardization procedures, ground training requirements, and operational policy in addition to the information which was contained in the old Flight Manual such as flight characteristics; operational limitations; performance data; and the normal, emergency, and extreme weather operating procedures.

NATOPS FLIGHT MANUAL (NAVWEPS 01-75PAA-1)

The organization of the NATOPS Flight Manual is considerably different from the old Flight Manual.

Section I is bound with separate covers so that it can be removed from the operational portion of the book. This is the study book. It contains most of the descriptive material about the airplane, the systems and equipment, servicing procedures, and operating limitations. It contains all the material formerly found in Sections I, IV, V, and VII of the Flight Manual.

Section II General is typical of NATOPS manuals rather than of the old Flight Manuals. Included are ground training, flight training, flight crew requirements, personal flying equipment, line operation, briefing, debriefing, mission planning, and flight test requirements.

Section III Normal Procedures is practically the same as the former Section II of the Flight Manual. There is a difference because the "T" in NATOPS stands for training. NATOPS manuals do not necessarily presume, as the old Flight Manuals did, that all readers are experienced pilots. Section III is still written in checklist form with numbered procedural steps telling control, action, and who does it, followed by amplification as necessary in the succeeding paragraph.

Section IV Flight Characteristics is merely renumbered. It was Section VI in the Flight Manual. It briefly compares the characteristics of the P-3A in the various phases and conditions of flight with those of other aircraft with which the flight crew may be familiar.

Section V Emergency Procedures corresponds to Section III of the old Flight Manual.

Section VI All Weather Operation is more complete than the old Section IX because the CNO operational authority behind NATOPS permits inclusion of fairly detailed instrument and weather procedures, whereas the old Flight Manuals could only contain operation peculiar to the aircraft model.

Section VII Communications Procedures is a section new to the NATOPS Flight Manual. It covers the general operating procedures for communications which would not be appropriate in the discussion of specific equipment in Sections I and V of the NATOPS Flight Manual.

Section VIII Weapons Systems contains only the description for camera and searchlight equipment because, as Lockheed's contract is written, most of the material which would ordinarily appear in this section is to be covered in the Crew Electronics and Armament Operating Instructions Manual (NAVWEPS 01-75PAA-1C).

Section IX Crew Duties refers to the flight crew and corresponds to the old Section VIII. It lists duties which for one reason or another are not appropriate to Sections III, V, VIII, or to the -1C Manual.

Section X Standardization Evaluation is a completely new section. It establishes operating standards, lists evaluation methods, and includes forms for use by standardization evaluation instructors and crews.

Section XI Performance Data was the Appendix in the old book and is largely unchanged except for the addition of data on performance in mine layer configurations. This is the reference portion of the book. It is divided into eight parts, each with brief explanatory text followed by charts for use in all phases of flight planning. The eight parts are as follows:

Part 1, Introduction, explains the arrangement of Section XI and includes the standard correction and conversion charts.

Part 2, Engine Performance Data, presents the data pertaining to power prediction and fuel flow.

Part 3, Takeoff, gives the various speeds and definitions, such as minimum control, rotation, liftoff, refusal, decision, minimum for engine failure, etc.

Part 4, Approach and Landing, covers landing distances and wind correction.

Part 5, Climb and Descent, gives ceilings and rates of climb and descent in the various engine and store configurations.

Part 6, Flight Planning, presents the data on maximum range and loiter speeds, maximum range and fuel planning in the various configurations, loiter speed performance summary and time predictions, miles per pound charts, composite power required charts, and performance summary charts.

Part 7, Operating Tables, shows maximum operating range and loiter speeds in various store and engine configurations.

Part 8, Mission Planning, presents a short discussion on forecast and actual performance, and use

of a "how-goes-it" chart. It includes an explanation of a typical mission planning problem.

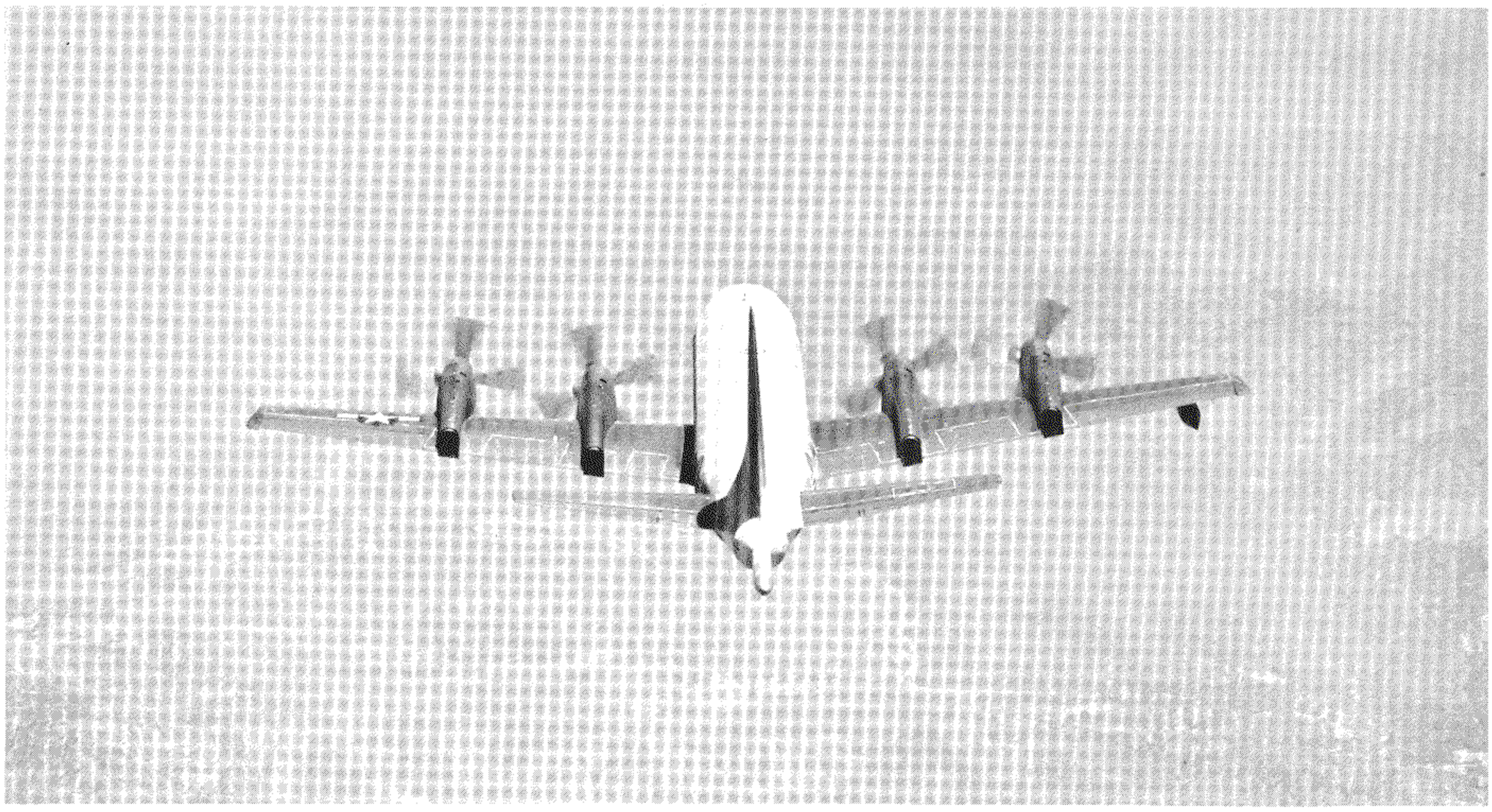
THE CREW ELECTRONICS AND ARMAMENT OPERATING INSTRUCTIONS MANUAL, NAVWEPS 01-75PAA-1C, retains its former format with a separate section for each tactical crew member which he can remove and put into his own notebook. Description and operating procedures for all pieces of equipment to be found at the particular station are included. Also, charts are included showing procedures for coordinating with other pieces of equipment and other crewmembers in order to accomplish the tactical mission.

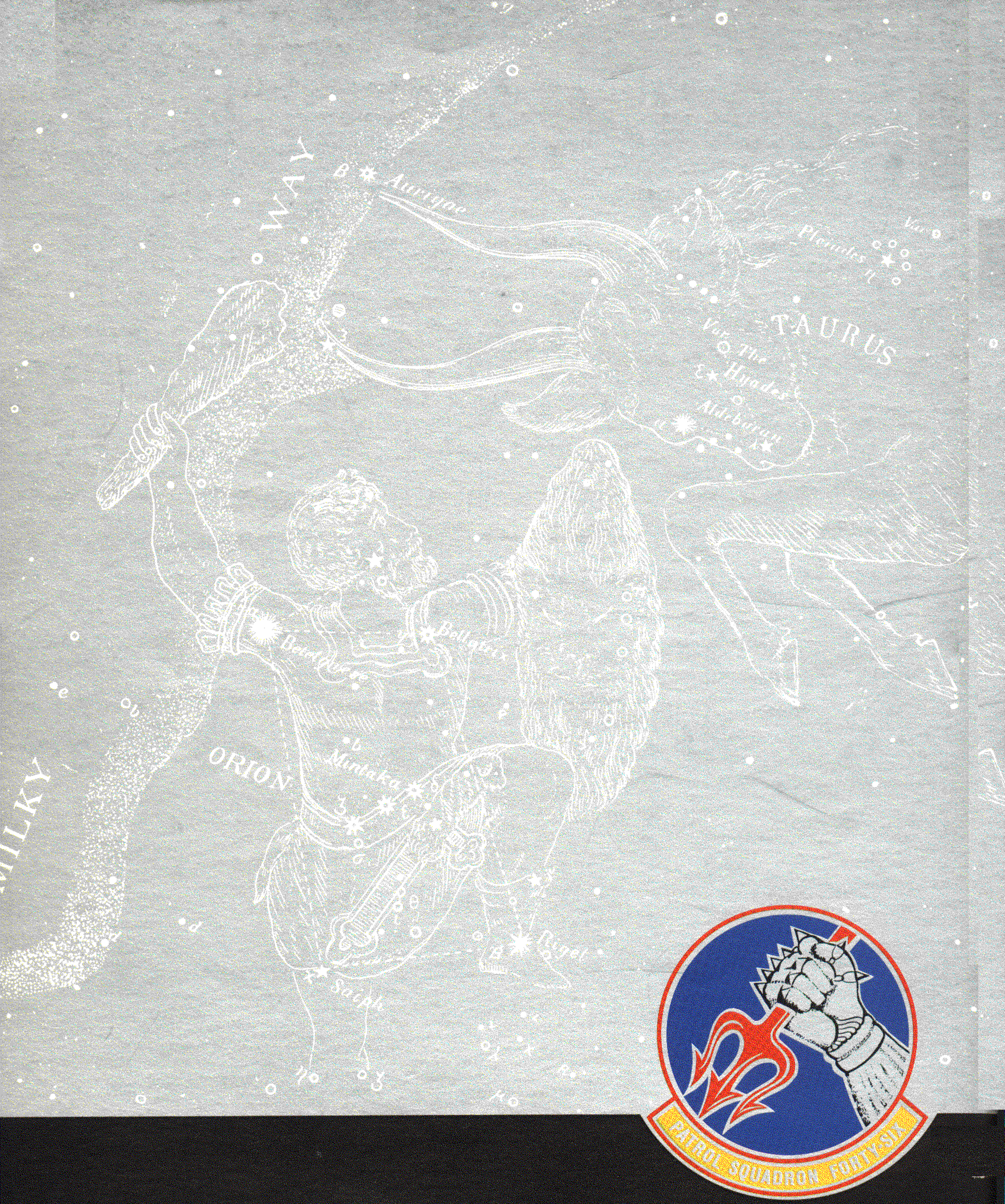
THE POCKET CHECKLIST NAVWEPS 01-75PAA-1B was not republished with the 1 December 1963 issue because relatively few changes were requested. Most of the suggestions for change pertained to format rather than content, and the format is fixed quite rigidly by specification MIL-P-21552 (AER). Many Lockheed and Navy people believe this specification should be rewritten to establish an alternate format better suited to patrol and transport airplanes.

There are two principal schools of thought as to what this alternate format should be: some favor a scroll-type arrangement with detailed procedural information, while others favor a single laminated sheet with abbreviated procedures — emergency on one side and normal procedures on the other. From a publisher's standpoint we have found the existing MIL-P-21552 (AER) books workable, and the laminated single sheet format, which was supplied with our commercial transports, has also proved to be workable. We suspect the scroll-type, with detailed information, would be difficult to keep current.

In the 1 December 1963 issue of the NATOPS Flight Manual, a single-sheet abbreviated Normal and Emergency Procedures checklist will be found in Section III. Thus, if users prefer the single-sheet format, individual squadrons can reproduce the checklist pages in this issue.

SUMMARY At Lockheed, we are enthusiastic about the NATOPS Flight Manual program because we anticipate that the review conferences will give us the inputs we need to enable us to publish really useful books. Squadron representatives should come to the review conference prepared with a thorough knowledge of the Manual format and content. Such preparation will expedite the resolution of any operational or training difficulties that are encountered. In this manner, the NATOPS Flight Manual will continually reflect the experiences of those men most vitally interested in the operation and performance of the airplane — the flight crew.




WAY
Betelgeuse
Aldebaran
Pleiades
Vega
The Hyades
Altair
ORION
Alnilam
Rigel
Sirius
PATROL SQUADRON FORTY-SIX