

NOT
MEASUREMENT
SENSITIVE

MIL-DTL-81928C(AS)
26 November 1997
SUPERSEDING
MIL-M-81928B (AS)
4 APRIL 1989

DETAIL SPECIFICATION

MANUALS, TECHNICAL: AIRCRAFT MAINTENANCE INSTRUCTIONS, TECHNICAL CONTENT REQUIREMENTS (WORK PACKAGE CONCEPT)

This specification is approved for use by the Naval Air Warfare Center, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense, within the distribution limitations noted at the bottom of this page.

1. SCOPE.

1.1 Scope. This specification covers the technical content requirements for the preparation of technical manuals in work package concept for the maintenance of aircraft and related systems. The manuals include an integrated illustrated parts breakdown (IPB). The general style and format requirements of technical manuals in work package (WP) format are contained in the general specification (MIL-DTL-81927).

1.2 Classification. The type of manual is a combination of the technical content (functional elements covered) and the assigned level(s) of maintenance to be covered. The maintenance level(s) covered is identified by using a prefix for the applicable functional element(s), as the first part of the publication title, as prescribed in the general specification. The assigned maintenance level(s) and functional elements to be covered should be as prescribed in the contract.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document shall be addressed to Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

AREA TMSS

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-DTL-81928C(AS)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommendation for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

- | | | |
|---------------|---|--------------------------------------------------------------------------------------------------------------------------------------|
| MIL-DTL-15014 | - | Manual, Technical: Separate Illustrated Parts Breakdown, Technical Content Requirements (Work Package Concept). |
| MIL-DTL-81927 | - | Manuals, Technical: Work Package Style, Format, and Common Technical Requirements; General Specification for (Work Package Concept). |
| MIL-DTL-81929 | - | Manuals, Technical: Illustrated Parts Breakdown Figures; Technical Content Requirements (Work Package Concept). |

(Unless otherwise indicated, copies of the above specifications, standards and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.2.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

MIL-DTL-81928C(AS)

PUBLICATIONS

NAVAL AIR SYSTEMS COMMAND

- NAVAIR 00-25-700 - Guide to General Style and Format of Work Package Technical Manuals.
- NAVAIR 00-25-701 - Technical Guide for Organizational Level Aircraft Wiring System Repair Manuals.
- NAVAIR 01-1A-23 - Standard Maintenance Practices for Miniature/Micro-miniature (2M) Electronic Assembly Repair.

NAVAL SEA SYSTEMS COMMAND

- NAVSEA OD 30393 - Design Principles and Practices for Controlling Hazards of Electro-magnetic Radiation to Ordnance (HERO Design Guide).

NAVAL SUPPLY SYSTEMS COMMAND

- NAVSUP 700 - Naval Inventory Control Point Packaging Data. (Note: For Government use only.)
- NAVSUP 701 - Naval Inventory Control Point Packaging Data. (Note: Unlimited distribution.)

(Copies of NAVAIR and NAVSEA manuals are available by request to: Commanding Officer, Naval Air Technical Services Facility (NATSF), 700 Robbins Avenue, Philadelphia, PA 19111-5097. Copies of NAVSUP 700 and 701 are available by request to: Commander, Naval Inventory Control Point, Code 05411, 5450 Carlisle Pike, P.O. Box 2020, Mechanicsburg, PA 17055-0788).

2.3 Non-Government publications. The following document(s) forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

MIL-DTL-81928C(AS)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | | |
|------------|---|--------------------------------------------------------------------------------------------------------------------------------------|
| ANSI C95.1 | - | Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 Ghz. (DoD adopted) |
| ANSI C95.3 | - | Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave. (DoD adopted) |

(Application for copies should be addressed to the American National Standards Institute, 11 W. 42nd St., New York, NY 10036.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General.

3.1.1 Copyrights and advertising. Copyright material shall not be included in any publication prepared in accordance with this specification without written permission of the copyright owner. Proprietary legends shall not be shown. The manual shall not contain advertising matter. All material prepared in accordance with this specification shall be Government property.

3.1.2 Proprietary data. The Government shall have unlimited right to the data prepared under this specification. Proprietary legends are not acceptable in technical manuals. The preparing activity shall disclose, in narrative or pictorial display, that information necessary to fulfill the requirements of this specification without disclosing that portion of the manufacturing process that the preparing activity wishes to safeguard.

3.1.3 Conflict between specifications. When conflict exists between the general specification and the technical content requirements described herein, this specification shall take precedence. When conflict exists between the contract and this specification, the contract shall take precedence.

MIL-DTL-81928C(AS)

3.1.4 General style, format, and technical content. Manuals shall be prepared to WP concept. General style, format, and technical content shall be as specified in MIL-DTL-81927 which also provides the common requirements for WP concept manuals in the following areas:

- a. Technical manuals using WP concept.
- b. Style of writing.
- c. Referencing requirements.
- d. General format.
- e. Technical manual arrangement.
- f. Front matter (composite requirements).
- g. Indexes. (composite requirements).
- h. Introduction (composite requirements)
- i. Technical content WP (composite requirements).
 - (1) Title page (composite requirements).
 - (a) Title block.
 - (b) Reference material list.
 - (c) Alphabetical index.
 - (d) Record of technical directives.
 - (2) Support equipment required lists.
 - (3) Material required lists.
- j. Artwork requirements.
- k. Changes/revisions.

MIL-DTL-81928C(AS)

3.1.5 IPB.

3.1.5.1 Relationship between the IPB and the WP concept. The IPB is an integral part of the technical data to be prepared in support of maintenance tasks. Therefore, it is essential that the intent of the WP concept is followed in the development of the supporting IPB. Emphasis shall be placed on the accessibility of data, comprehensibility of supporting illustrations, and the use of the information presented. The IPB data shall be prepared in accordance with the IPB technical content specification (MIL-DTL-15014 or MIL-DTL-81929, as applicable). The IPB figure(s) shall be an integral part of the maintenance element.

3.1.5.2 IPB figures. The format of IPB figures shall be compatible with all reproduction media. This should be accomplished through control of legibility of the Group Assembly Parts List (GAPL), proper line art techniques in the preparation of supporting illustrations, and coordinated GAPL entries with illustrations (see MIL-DTL-81927 and NAVAIR 00-25-700).

3.1.6 Common requirements. Documentation prepared in accordance with this specification shall contain instructions for organizational, intermediate, and/or depot level maintenance. Mandatory compliance standard shop practices and techniques given in general maintenance engineering series manuals shall not be duplicated. Appropriate references shall be made to other manuals when required. Prepared documentation shall follow the approved maintenance plan and level of repair analysis for the end item covered. Only authorized support equipment, at the appropriate level of maintenance, shall be included in the maintenance instructions. Sound engineering principles, performance data, and reliability data shall be used in the preparation of maintenance procedures.

3.1.6.1 Development and presentation. Technical data prepared in WP format is specifically designed to respond to functional work tasks. These manuals shall include Introduction, Operation, Description and Principles of Operation, Testing and Troubleshooting, and Maintenance Instructions with Illustrated Parts Breakdown WPs (see MIL-DTL-81927).

3.1.6.2 Layout and arrangement of maintenance information. Manuals shall be prepared as Maintenance Instructions with IPBs. The criteria for determining technical manual requirements shall be based on the approved Maintenance Plan (MP) or the Level of Repair Analysis (LORA). The analysis of coverage requirements and related task analysis (see NAVAIR 00-25-700) shall determine the depth of coverage, its complexity, information volume (bulk) and environmental usability. The development of the Numerical Index of Part Numbers, Numerical Index of Reference Designations, and the technical content of the IPB shall be in accordance with MIL-DTL-81927. The development of other technical content shall be as specified herein.

MIL-DTL-81928C(AS)

3.1.6.2.1 Repairable assembly maintenance WPs. When the LORA/MP directs, WPs shall be created to provide coverage for the repairable (at manual's maintenance level) assemblies that are contained in the equipment. Repairable assembly/subassembly WPs shall contain principles of operation, testing and troubleshooting, and maintenance instructions with IPB to the bit/piece component. Depending on testing method, internal circuits, their relationship to each other, input and output signals, waveforms, and time-phase relationship of waveforms shall be included. A separate WP should be created to support each repairable assembly/subassembly. When the task analysis requires, selected coverage may be located, as separate coverage, within the WP for the next higher assembly (refer to Task Analysis in NAVAIR 00-25-700).

3.1.6.2.2 Foldout illustrations (multiple WP application). When a foldout schematic diagram (functional block, signal flow, electrical or electronic diagrams, etc.) or other foldout is used by more than one WP, placement in the last WP of a manual or in a separate manual will greatly improve the usability of the data. A foldout illustration shall follow any related text or usage, e.g., description, principles of operation, testing, and troubleshooting. A foldout illustration shall also follow related data required to be used with the foldout illustration, e.g., test point identification, including the IPB when used for test point identification and related wire lists.

3.1.7 Multimanual coverage. (Refer to "Multivolume and Multimanual Sets" in MIL-DTL-81927). The coverage may be provided as a combined manual or divided into a set of manuals. This division may be required for reasons of data element usability, or if the anticipated page count of the resultant manual requires such a division.

3.1.8 Multilevel maintenance coverage. More than one level of maintenance may be addressed in a manual or a set of manuals. Manual division shall be by subject matter or levels of maintenance or as specified in the contract. The maintenance procedures shall reflect the approved MP and parts provisioning data at the appropriate maintenance level coverage. (See 3.1.5.2.)

3.1.9 General technical content.

3.1.9.1 Standard shop practices and techniques. Mandatory compliance with standard shop practices and techniques available in general maintenance series manuals should not be included. When applicable, appropriate reference should be made to these manuals in accordance with MIL-DTL-81927.

MIL-DTL-81928C(AS)

3.1.9.2 Maintenance level coverage. When two or more levels of maintenance coverage are presented in a single manual or in a set of manuals, the coverage shall be as directed by the requiring activity. Maintenance level coverage may be presented as follows:

- a. When the aircraft system or equipment is provisioned for organizational level repair;
 - (1) The manual shall contain complete organizational maintenance procedures without reference to the intermediate or depot maintenance manuals for continuation or completion of the procedure.
 - (2) Organizational level authorized minor repair actions that do not affect the integrity of the item should also be included, e.g., fuse, lamp, or knob replacement. Minor repair actions of this type are not considered "complete" repair actions and as such do not justify assignment of a Source, Maintenance and Reliability (SM&R) code (see NAVAIRINST 4423.11). Other references required shall be prepared in accordance with MIL-DTL-81927.
- b. When repair actions (tasks) for the aircraft are authorized for more than one level of maintenance, e.g., aircraft structural repair, nondestructive inspection, etc.;
 - (1) The differences in maintenance level coverage shall be noted in the text or by separate WP.
 - (2) Normally this option will be exercised when either one or both levels of maintenance covered are limited in scope.
 - (3) When a few items of support equipment are not authorized for the organizational and/or intermediate level maintenance, the restriction shall be annotated in the "Support Equipment Required" listing.
 - (4) When the basic support equipment is not approved at all levels, the coverage shall not be contained in the same manual.

3.1.10 Task development. The task development phase of the technical manual preparation is critical because it will establish the arrangement and organization of the technical information and together with the task analysis will establish the depth and scope of the coverage. Based on the requirements identified by the task analysis, all tasks for end item operation (if required) and the testing, troubleshooting, and maintenance coverage requirements at the appropriate maintenance level(s) can be established. Once the basic operation and maintenance tasks are established, the depth and scope of the supporting data can be identified, e.g., description,

MIL-DTL-81928C(AS)

principles of operation, local assembly and manufacturing procedures, wiring data, etc. The final output of the task development phase is the technical manual outline (see NAVAIR 00-25-700 and MIL-DTL-81927).

3.2 Review of existing related technical manuals. Upon completion of the task analysis, a review of existing related documentation, including commercial manuals, shall be conducted to determine if the coverage requirements of the task analysis can be met by reference to NAVAIR manual (including the manual(s) being developed, or adding selected commercial manuals to the NAVAIR technical manual inventory). Documents that are considered part of the related hardware (such as Test Program Instructions) that contain all or part of the testing and troubleshooting instructions shall be referenced. If all or part of the minimum requirements determined by the task analysis are not included in the referenced material or other related documentation, the contractor shall notify the requiring activity. The contractor shall advise the requiring activity of any commercial manuals meeting the coverage requirements of the task analysis. The requiring activity will determine if the selected commercial manual will be procured and/or the missing data will be added to the referenced material or the manual under preparation.

3.3 Aircraft Maintenance Instructions Manuals (MIMs).

3.3.1 Breakout and arrangement of maintenance information. The initial step in the preparation of a set of organizational maintenance manuals shall be the identification of the technical manuals required for support of the aircraft at the organizational maintenance level (refer to NAVAIR 00-25-700).

3.3.1.1 Division of existing manuals. When specified in the contract, existing maintenance manuals shall be divided as described in MIL-DTL-81927. Division shall be performed when segregation of data by system or functional element is mandatory to improve usability. When such division is required, the two or more manuals shall be rearranged and prepared as another manual within the set. The existing data should be used, as far as feasible, in the new manual. WPs shall be renumbered as required.

3.3.2 Aircraft systems and equipment MIMs.

3.3.2.1 Operation instructions for aircraft systems and equipment. Operation instructions for aircraft systems and installed equipment should be provided in NATOPS manuals and shall not be covered in the aircraft MIMs. General operating procedures performed by squadron organizational maintenance personnel should be provided in the aircraft general instructions manuals (refer to 3.3.3).

MIL-DTL-81928C(AS)

3.3.2.2 Description and principles of operation. The description and principles of operation WP shall contain two primary paragraphs, "Description" and "Principles of Operation." The description and principles of operation may also be divided into separate WPs "Description" and "Principles of Operation", depending on the complexity of the equipment.

3.3.2.2.1 Description. This element shall cover a general physical description of the system or component. Locator illustrations showing access panel location and arrangement of the assemblies or components shall be provided. Nomenclature shall remain consistent throughout this data element and all other data elements of the manual. The description shall contain the functional element of "controls and indicators." A separate operation instruction manual shall not be referenced for "controls and indicators."

3.3.2.2.1.1 Controls and indicators. The functional element of "Controls and Indicators" shall provide the purpose, use, and function of all operating controls and auxiliary equipment, or attachments furnished with the equipment. The coverage shall also provide interpretation of typical instrument readings (with acceptable limits stated) and indicator presentations to inform the operator what recognizable results he or she should expect to observe during each mode of operation. The data should be presented by an illustration and related table, referenced from a brief paragraph explaining the purpose and scope of the coverage, as required:

- a. Illustration. (See MIL-DTL-81927.) The purpose of the illustration is to identify each control and indicator, placard data, and location. The figure title shall identify the end item nomenclature and "Controls and Indicators." Each control or indicator shall be identified by an index number (with leader line) identifying the location and related placard data. Index numbers shall be assigned in logical sequence related to location of the item. The illustration may be a partial-page, full-page, multiple view, or foldout illustration, as best suited to the combined presentation requirements.
- b. Table. (See MIL-DTL-81927.) The purpose of the table is to provide the required data for each control and indicator. The table shall be prepared as a full-page-width numbered table in accordance with MIL-DTL-81927. The table title shall identify the end item nomenclature and "Controls and Indicators" (identical to the figure title). The table shall provide, but not be limited to the following coverage:
 - (1) "Figure (*)/ Index No." column. (The * represents the figure number of related illustration.) This column establishes the content of the table. Each index number contained on the illustration shall be listed in numerical sequence.
 - (2) "Ref Des" column. The item's reference designation shall be entered.

MIL-DTL-81928C(AS)

- (3) "Nomenclature" column. The complete item nomenclature shall be listed. Complete placard data shall be listed below the nomenclature in parenthesis. Complete placard data includes the appropriate functional (section and/or group) prefix(s).
- (4) "Position/Mode" column. When the item has more than one position or mode of operation, each position and mode shall be listed and the specific function aligned to the appropriate combination of mode and position. When the specific function is controlled by the mode, and the mode is controlled by a different control, the related mode with the controlling data may be entered in the "Function" column and the "Position/Mode" entry should be aligned with the related function. If necessary for clarification, a notation may be made in the column and provided below the table or by reference to text with appropriate illustration(s), including a matrix of the modes and positions to function.
- (5) "Function" column. The purpose, use, and function of all operating controls and auxiliary equipment, or attachments furnished with the equipment shall be entered. The coverage shall also provide interpretation of typical instrument readings (with acceptable limits stated) and indicator presentations to inform the operator what recognizable results he or she should expect to observe during each mode of operation. When the item has more than one function (position or mode), the function should be aligned by the position and/or mode entry and provide only the related data. If necessary for clarification, a notation may be made in the column and provided below the table or by reference to text with appropriate illustration(s), including a matrix of the modes and positions to function.

3.3.2.2.2 Principles of operation. This element shall cover the functional description of the system or component.

3.3.2.2.2.1 Depth of coverage. The functional description shall include the purpose, type, content, and main features of each system or component. Major characteristics, capabilities, and limitations shall be included. Detailed component functional description, common circuitry and wiring diagrams are not required unless necessary to understand system or component function. Each ancillary system contained in an integrated system should be covered individually. Normally, the integrated system coverage is placed in a separate manual.

3.3.2.2.2.2 Method of presentation. The functional description shall be presented in paragraph form supported by block diagrams. The data shall be presented in a manner to acquaint the qualified technician (with adequate background) information required to perform the maintenance task, and to support on-the-job training of less qualified personnel. Presentation

MIL-DTL-81928C(AS)

of systems and subsystems should be supported by program listings and functional flow, logic, or other diagrams required to ensure clarity of presentation. Logic diagrams may include system operational modes.

3.3.2.2.2.3 Integrated systems. The principles of operation of the several systems that make up the integrated system shall be contained in each system manual. The depth of the text and illustrations placed in the various systems manuals shall be sufficient that the maintenance technician will be able to understand the makeup and operation of each system, as an individual unit. In the integrated systems manual, the operational dependency of each individual system shall be defined in sufficient detail to support basic integrated system training, ease understanding and comprehension and satisfy the explanation of relationships required for integrated troubleshooting and maintenance between systems. The descriptive material shall be supported by schematics, functional block diagrams, and signal flow charts. Modes and submodes of operation shall be identified, as applicable. This shall include systems interdependency. The various operational modes shall be described and highlighted as closed loops.

3.3.2.3 Testing and troubleshooting. These functional elements shall provide procedures for detection, isolation, and correction of failures or malfunctions.

3.3.2.3.1 Depth of coverage. The tasks shall include methods of determining the cause of the fault and isolation to the appropriate adjustment, a replaceable part, interface wires, or mechanical linkage. Troubleshooting procedures shall include steps required to enable the technician to isolate equipment failures. Instructions shall direct adjustment, repair or replacement of parts. Schematics are required as backup data and shall be referenced or contained in the same WP. The schematics shall integrate fluid, mechanical, electrical, and electronic components. The schematics shall include both a visual description of the system and technical backup information for troubleshooting procedures.

3.3.2.3.2 Method of presentation. (Refer to MIL-DTL-81927.) Operational check procedures, combined with troubleshooting data, shall guide the technician to the cause of the equipment failure or malfunction and its repair. All information required to perform these tests and evaluations shall be incorporated, including all modes of operation. Troubleshooting diagrams shall be prepared to support testing procedures. These diagrams shall be referenced in the applicable troubleshooting WPs. The procedures shall be based on the following assumptions:

- a. Testing and troubleshooting procedures shall include all elements of pretest setup and post-test shutdown.

MIL-DTL-81928C(AS)

- b. Successful completion of an operational checkout verifies system operation. Procedures shall concentrate on fault isolation and the identification of failures and malfunctions.
- c. Procedures will normally trace one malfunction at a time. However, multiple failures are possible and shall be considered in the testing processes.
- d. If several components are suspected, the one most likely to have failed shall be considered first.
- e. If a test result is not obtained, the malfunction symptom shall be keyed to the appropriate part of the troubleshooting diagram. However, if there is only one remedy for a specific malfunction, the remedy may appear following the appropriate checkout procedural step.
- f. Whenever a component is replaced, testing should be restarted to ensure that the replacement did not introduce a new fault into the system. This assumption shall not be interpreted as a requirement to repeat an entire system checkout in all cases.

3.3.2.3.3 Integrated system. Integrated system troubleshooting procedures shall be presented in two levels: first, the integrated system as a unit, and second, the systems that make up the integrated system. At the integrated system level, troubleshooting should consist of a set of procedures leading to visual or aural indication, readout, or display. The logic tree diagrams or fault-probable-cause troubleshooting tables are acceptable provided that a clearly defined path is evident from the fault description to its probable cause and description. The operational test of the integrated system is an operational check of the interdependent systems, less non-associated systems. This procedure assumes that the maintenance technician performing the check is qualified on the aircraft and is familiar with its systems and subsystems. The level of instruction shall reflect this assumption. When a test is called for and the result is obtained, the process shall continue through a new series of instructions leading to a new indication. If the sequence produces all the desired results, it shall be assumed that the system/subsystem is operating satisfactorily. If any result called for cannot be obtained, the fault isolation shall consist of further instructions that will isolate to a subsystem and, if possible, to a component or interface wire. Following the integrated system, the associated systems shall be presented in system and subsystem order.

3.3.2.3.4 General requirements.

- a. Introduction. An introduction, including an explanation of the testing and troubleshooting format and techniques, shall be provided.

MIL-DTL-81928C(AS)

- b. Depth and scope of coverage requirements. The testing and troubleshooting procedures are determined by the complexity of the test requirements, either complex or non-complex. The complexity of the test requirements is determined by the task analysis.

3.3.2.3.5 Operational checkout (testing) requirements:

- a. Operational circuit tests. Maximum use of operational circuits shall be made using the appropriate support equipment and:

- (1) Built-in tests,
- (2) Power supply and power distribution indications,
- (3) Functional modes of operation, and
- (4) All available controls and indicators.

- b. Test sequence. The operational checkout shall be sequenced to establish:

- (1) An increasing confidence in the circuit/unit under test.
- (2) That passing previous test ensures proper input requirements for the test being performed.
- (3) A logical entry point for fault isolation.
- (4) A fault isolation entry point for each test indication.
- (5) That successful completion of the operational checkout verifies proper operation.

- c. Fault isolation reference methods. A fault isolation entry point may reference:

- (1) Logic text format. Combined testing and troubleshooting (logic text) format:
 - (a) "Yes" or "No" column entries should only reference another procedural step.
 - (b) A procedural step may reference appropriate action, including separate fault isolation procedures.

MIL-DTL-81928C(AS)

- (2) Logic tree format. In separate testing and troubleshooting (logic tree) format, the operational checkout (testing) should reference:
 - (a) Entry point on a logic tree troubleshooting diagram,
 - (b) Separate fault isolation procedures, or
 - (c) Direct reference to appropriate action.
 - d. Separate fault isolation/maintenance procedures. Separate fault isolation or maintenance procedures may be provided as, but not be limited to:
 - (1) Step-by-step test access or item/circuit isolation procedure,
 - (2) Test result(s) to appropriate fault isolation procedure matrix table,
 - (3) Separate logic text format procedures,
 - (4) Additional entry point or separate logic tree troubleshooting diagram, or
 - (5) Any combination of the above procedures.
 - e. Separate procedure usage. Separate fault isolation procedures should be used when:
 - (1) Extensive pre-test setup and/or test access procedures are required.
 - (2) Lengthy step-by-step fault isolation procedures are required.
- 3.3.2.3.6 Common requirements:
- a. Support equipment and material required identification. "Support Equipment Required" and "Material Required" lists shall be prepared in accordance with MIL-DTL-81927. Only approved support equipment (SE) required for the maintenance level(s) covered, shall be listed or used in the procedures.
 - b. Step-by-step procedures. Step-by-step procedures, supported with appropriate illustrations, should be provided for all pre-test setup, testing, troubleshooting, and post-test teardown procedures.
 - c. References: See MIL-DTL-81927.
 - d. Adjustment or alignment procedures. Adjustment/alignment procedures should be integrated into the testing (checkout) or troubleshooting (fault isolation) procedures at the point of observation, if possible. When extensive access or different setup procedures are

MIL-DTL-81928C(AS)

required, the procedure(s) should be referenced.

3.3.2.3.7 Manual test procedures.

- a. Pre-test setup procedures. Pre-test setup procedures, including pre-test setup illustrations, as required, e.g. test equipment interconnection diagram.
- b. Testing and troubleshooting procedures. Testing and troubleshooting procedures may be integrated into one procedure using "Logic Text format" or :
 - (1) Separate testing (operational checkout), using logic tree format procedural text with fault isolation entry points established to reference;
 - (2) Separate troubleshooting (fault isolation) procedures based on the operational checkout established entry points. Troubleshooting (fault isolation) procedures may be provided a format that will give the most effective presentation.
- c. Post-test teardown procedures.

3.3.2.3.8 Troubleshooting procedures using semi-automatic or automatic test equipment.

Many high performance systems have been designed to accept the use of semi-automatic/automatic test equipment. These systems are designed and programmed for rapid electronic test in the interest of reducing maintenance downtime to fault isolate and repair. The following procedures apply:

- a. Automatic testing requires the same basic test information as described in 3.3.2.3.1 and 3.3.2.3.6 above with minor exceptions.
- b. Testing set-up procedures and troubleshooting criteria defined in separate manuals shall not be duplicated.
- c. Reference should be made to other documents containing the automated test information.
- d. A schematic of the system/component under test shall be prepared to support the non-automated test capability in the event of automatic test equipment nonavailability, or failure. The schematic shall contain an indication of all test points and the appropriate input and output signals.

3.3.2.3.9 Testing and troubleshooting using built-in-test equipment. Built-in-test capabilities are designed to operate in various formats. One of these is built-in-test using preprogrammed magnetic test tapes; another is the incorporation of electronically controlled sensors within the systems to be tested.

3.3.2.3.9.1 Built-in-test using preprogrammed magnetic tape or software. Testing

MIL-DTL-81928C(AS)

procedures shall identify the specific part number tape required for test performance. The illustrations shall define some of the basics related to how the program works, and the primary objectives of the system test. Procedures shall normally include but not be limited to the following:

- a. Identification of any pretest requirements.
- b. Step-by-step instructions covering the installation of the tape within the system and any precautions or observations to be noted during this process.
- c. Procedures covering test operations; for example, system turn-on, identification of time required to run and complete the system test, an indication of any possible mid-test interruptions or stoppages and how to respond to them.
- d. How to perform a test analysis to identify and fault isolate possible malfunctions.
- e. Testing set-up procedure and troubleshooting criteria defined in separate manuals shall not be duplicated.
- f. Reference shall be made to other documents containing automated test information.
- g. The same type back-up information is required as identified in 3.3.2.3.8d.
- h. The troubleshooting information shall be accompanied by logic charts, schematics, signal flow diagrams, tables and other illustrations as may be required for comprehensive understanding of the procedures.

3.3.2.3.9.2 Testing and troubleshooting using sensors. Sensors, installed at critical points in aircraft systems, are installed to detect discrepancies in system operation during flight. Readout capability varies from magnetic tape in-flight monitors to digital display maintenance monitoring panels. Special documentation has been designed to properly interpret these displays and isolate and correct malfunctions. The fault reporting manual and fault isolation manual have been developed to respond to this requirement. When required, recommendations for these manuals shall be listed on the proposed manual list for approval by the requiring activity.

3.3.2.3.9.3 Fault reporting manual. The fault reporting manual shall provide flight crews and ground maintenance personnel with a standard method of reporting and interpreting fault symptoms and malfunctions detected in flight. Requirements for this manual shall include but not be limited to the following:

- a. Format. When authorized, the manual may be prepared in the 5 1/2 x 7-inch page format. Foldouts shall not be incorporated unless specifically authorized by the requiring activity.
- b. Introduction. The introduction shall conform with the requirements of the

MIL-DTL-81928C(AS)

MIL-DTL-81927. The introduction shall explain the rationale for use of this manual. The relationship of this document to other manuals in the organizational set shall be included.

- c. Content. The manual shall display all data necessary to assist maintenance personnel in the recognition and interpretation of system and subsystem fault indications. The data shall identify specific faults, related conditions, and any pertinent information that would direct the user to a specific maintenance action for fault connection. The following guidelines shall apply to preparation of the fault reporting manual.
 - (1) Content shall be based on faults which can be observed by ground and flight personnel during normal ground operations or an in-flight condition.
 - (2) Faults shall be identified by codes which will assist maintenance personnel in recognition, interpretation and diagnosis of detected system discrepancies.
 - (3) To conform to the WP system and task orientation, fault codes shall be grouped numerically to respond to fault indications within a given system or related integrated systems.
 - (4) System and subsystems faults shall be tabulated numerically within a given WP. Fault and action information shall be tabularly presented adjacent to the fault code. A concise translation shall be prepared in standard language to indicate fault interpretation. Specific references shall be made to fault correction.
 - (5) Fault symptoms or trouble indications shall also be charted with a corresponding fault isolation indicator which refers to the appropriate maintenance manual and task.
 - (6) To aid comprehension, explanatory illustrations and locator drawings shall be included where required.

3.3.2.3.9.4 Fault isolation manual. The fault isolation manual is a companion manual to the fault reporting manual. The two manuals are designed for consolidated use in rapid isolation of system defects revealed in flight or during operational ground operations. Requirements for this manual shall include but not be limited to the following:

- a. Format. When authorized, the manual may be prepared in the 5 1/2 x 7-inch page format. Foldouts shall not be incorporated unless specifically authorized by the requiring activity.
- b. Introduction. The introduction shall conform to the requirements of the MIL-DTL-81927. The introduction shall explain the rationale for use of this manual. Relationship of this document to other manuals in the organizational set shall be included.
- c. Content. The manual shall display supporting fault analysis procedures that assist

MIL-DTL-81928C(AS)

maintenance personnel in the recognition and interpretation of system and subsystem faults. The manual shall present fault isolation procedures for identification of specific discrepancies and recommendations for maintenance actions. The following guidelines shall apply to preparation of the fault isolation manual technical content:

- (1) The manual shall include baseline step-by-step procedures dedicated to the identification and isolation of faults identified and reported by the fault reporting manual.
- (2) Procedural steps shall guide the maintenance technician through the various troubleshooting steps which eliminate possible, if unrelated, fault corrections and zero in on detection of the actual fault. The presentation shall be made in such a manner that positive reactions will permit circumventing or eliminating subordinate or unaffected steps, thus reducing the time to fault isolate.
- (3) Fault logic shall be carried to the level of identifying the replacement of a Weapon Replaceable Assembly (WRA), or discovery of a wiring, adjustment or rigging problem. All attempts shall be made to fault isolate to a single WRA replacement. However, if the fault logic fails to reduce to the possible faults as specified, references shall be made to the system trouble-shooting and its supporting schematics for further investigation.
- (4) Upon isolating to a given discrepancy, reference to the applicable technical manual and WP shall be made to obtain procedures for direct replacement, wiring correction, adjustment or rigging procedure as may be required.

MIL-DTL-81928C(AS)

- (5) The recommended maintenance action shall be specific to the reported malfunction(s) and normally shall not call for further fault diagnosis to be repeated if detection was made through in-flight monitoring. However, the fault isolation manual shall direct and define equivalent diagnostic procedures in the event fault diagnosis had not been completed in flight.
- (6) The step-by-step fault isolation procedures objective shall be to minimize the use of special tools and test equipment. Maximum use shall be made of on-board equipment and built-in-test features. However, if required, procedures shall be prepared to permit the use of authorized test equipment to improve or reduce fault detection time. Extensive use of additional testing equipment shall result in reference to the system test and troubleshooting manual.
- (7) The selection and sequencing of isolation procedural steps shall take the following into consideration:
 - (a) The probability of success for an action.
 - (b) The time required to complete an action.
 - (c) Component accessibility and ease of placement.
 - (d) Parts availability or interchangeability.
 - (e) Support equipment availability.
 - (f) Meantime between failure (reliability).
- (8) To aid comprehension, simple illustrations and locator drawings shall be included where required.

3.3.2.4 Maintenance with IPB. The functional element of maintenance with IPB includes all of the following maintenance tasks, as applicable:

3.3.2.4.1 General coverage requirements. These may be provided as separate WPs or as integrated maintenance procedures, depending on the depth and scope of the required coverage.

- a. General maintenance procedures. See MIL-DTL-81927.

MIL-DTL-81928C(AS)

- b. Support equipment maintenance instructions. When requested, support equipment maintenance instructions may be provided, when not covered by another manual.
- c. Local manufacturing and assembly instructions.
 - (1) Fabrication procedures for items source coded as "Make From" or "Assemble From" at the organizational or intermediate maintenance level shall be provided.
 - (2) Simple procedures, adequately depicted in the IPB, shall not be covered.
- d. Periodic (scheduled) maintenance. Periodic maintenance does not include operator's maintenance. Operator's maintenance is included in "Operating Instructions."
- e. Servicing instructions. Aircraft servicing shall be covered in the General Aircraft Information Manual or the Ground Handling and Servicing Manual (see 3.3.3a).
 - (1) When required, this functional task shall include all routine replenishment of expendable materials used during the maintenance of systems, or equipment.
 - (2) It shall not include periodic or scheduled servicing of systems or equipment covered by the Planned Maintenance Systems (PMS), such as hourly and calendar maintenance requirements.
 - (3) Servicing procedures shall be provided as required without time requirements.
 - (4) Lubrication and other maintenance procedures involving expendable materials during assembly or test of equipment shall not be considered servicing. These procedures shall be identified in the maintenance WPs as steps in the assembly or testing procedure.

3.3.2.4.2 Common coverage requirements;

- a. Calibration procedures. Calibration procedures shall not be included under "Maintenance" and shall be provided in separate calibration procedures or manuals.
- b. Support equipment and material required identification. "Support Equipment Required" and "Material Required" lists shall be prepared in accordance with MIL-DTL-81927. Only approved, for the maintenance level(s) covered, support equipment required shall be listed or used in the procedures.

MIL-DTL-81928C(AS)

- c. Step-by-step procedures. Step-by-step procedures, supported with appropriate illustrations, shall be referenced or provided for all maintenance procedures.
- d. References. Refer to MIL-DTL-81927.
- e. Maintenance analysis. Procedures shall include an assessment, the reported/actual problem and the action required to accomplish repair.
- f. Repairable assemblies. Normally a repairable assembly would require complete coverage in a separate WP. However, when testing and troubleshooting are not required, a simple assembly or subassembly can be properly covered under the coverage of the next higher assembly. When the task analysis has determined that the testing and troubleshooting is required to be accomplished using the next higher assembly, the complete coverage may be contained in a separate WP or in the WP for the next higher assembly. When complete separate coverage is co-located with the next higher assembly, procedures shall stand alone. The technical manual outline shall reflect the intended coverage.
- g. Special procedures. Specific instructions for any precautions, or special maintenance required for items susceptible to electrostatic discharge or hardness critical processes shall be included.
- h. Special processes. Information shall be included for any special process required under extreme environmental or operational conditions within the design limits of the equipment.
- i. IPB. IPBs and GAPs shall appear in the same WP as procedural maintenance steps. Procedural maintenance steps shall utilize the IPB illustration. Other maintenance illustrations may be required where a critical measurement, dimension, alignment, or inspection location must be identified to facilitate assembly.
 - (1) The IPB shall include parts provisioned for the applicable maintenance level(s) support of the item.
 - (2) An organizational level IPB shall contain and illustrate items replaceable at the organizational level that do not affect the integrity of equipment provisioned for complete repair at a higher level of maintenance; for example: knobs, lens covers, light bulbs, reflectors, and fuses. These items shall also be listed and illustrated in the appropriate level of maintenance data in accordance with the complete repair (SM&R) code assigned.
 - (3) Source documentation shall determine the scope and depth of coverage required. SM&R codes will be assigned by the government and shall be listed in the IPB to identify the source of spares, repair parts, and support equipment and the levels of maintenance authorized to maintain, repair, overhaul, or condemn them.

MIL-DTL-81928C(AS)

- j. Illustrations. Illustrations shall be prepared in accordance with MIL-PR-81927 and the specific technical content requirements specified herein.
 - (1) IPB illustrations. IPB illustrations shall be prepared in accordance with MIL-DTL-81927 and either MIL-DTL-15014 or MIL-DTL-81929, as applicable. When separate IPB manuals are authorized by the contract, the maintenance procedures shall not reference the separate IPBs. Separate maintenance illustrations shall be developed using, to the maximum amount possible, the separate IPB illustrations. Refer to MIL-DTL-81927 (Multiple use of illustrations) and either MIL-DTL-15014 or MIL-DTL-81929, as applicable.
 - (2) Separate maintenance illustrations. When separate maintenance illustrations are required, they shall be reproductions of illustrations prepared for the IPB except for marginal copy, figure numbers, and titles. The layout of illustrations shall take into consideration the possible dual usage. Clarity of maintenance instructions shall be the prime consideration. Reproduction of all "parts" of an IPB figure, when only one or more "parts" of the total illustration is required, is not acceptable. The reproduction shall also be modified as required for clarity; for example, removal of index numbers and leader lines not used in maintenance. Additional illustrations required for support of procedures shall be prepared when required for clarity.

3.3.2.4.3 System and subsystem maintenance procedures. The following paragraphs are intended to provide guidance for preparing applicable maintenance procedures (MPs). These instructions are not intended to restrict additional coverage that may be required. The procedures shall reflect the approved MP, and/or Logistics Support Analysis (LSA), and provisioning documentation for each level of maintenance authorized. End item MPs shall include, but not be limited to the following functional tasks arranged in logical task order:

- a. Removal procedures. Complete step-by-step removal procedures for assemblies and components identified by test or inspection as being faulty shall be in one WP or series of WPs. Removal/installation procedures shall be written for assemblies/components individually rather than a top-to-bottom breakdown.
- b. Cleaning and corrosion control procedures. Peculiar instructions for cleaning the equipment and components shall be included. Only approved cleaning materials shall be

MIL-DTL-81928C(AS)

used. Precautions to be observed and hazardous material icons shall be included as applicable.

- c. Inspection procedures. Instructions for inspection of the equipment and components during maintenance shall be prepared. Inspection methods, equipment required, allowable service limits, and adequate standards for determining when parts shall be replaced or repaired shall be included.
- d. Repair procedures. Instructions for the repair of the equipment and its components are required to the extent authorized by the approved MP. Tables of acceptable tolerances and limits shall be included when applicable. The tables shall serve as a standard and shall list the plus or minus tolerances that are acceptable for continued operation without affecting the reliability of the equipment, including;
 - (1) Part replacement or reconditioning, including installation of repair kits.
 - (2) Wiring and connector repair.
- e. Local manufacturing and assembly instructions.
 - (1) Fabrication procedures for items source coded as "Make From" or "Assemble From" at the organizational or intermediate maintenance level shall be provided.
 - (2) Simple procedures, adequately depicted in the IPB shall not be covered.
- f. Preparation for storage or shipment. Only special instructions or precautions relative to storage procedures such as corrosion prevention, draining fluids, or purging which are peculiar to the component/equipment, shall be included.
 - (1) Standard packaging procedures contained in other manuals and related documentation shall not be included, but shall be referenced. Packaging and preservation requirements for ASO and NAVAIR repairable assemblies shall reference NAVSUP 701 (or NAVSUP 700).
 - (2) Preparation for shipment shall be included when a special shipping container is used.
 - (3) Refer to NAVAIR 01-1A-23 (WP 005 00) for handling when item is ESD sensitive.

MIL-DTL-81928C(AS)

g. Installation, assemblies and repair parts. This includes:

- (1) Pre-installation setup, if required.
- (2) Alignment, adjustment, rigging.
- (3) Servicing, including;
 - (a) Environmental conditioning.
 - (b) Lubrication.
- (4) Quality assurance reference. The last procedural step should refer to testing or a pre-test requirement, e.g., end item alignment, different WP.

h. IPB. Refer to MIL-DTL-15014 or MIL-DTL-81929, as applicable.

3.3.2.4.4 Repairable assembly or subassembly maintenance procedures. Repairable assembly or subassembly maintenance procedures shall include, but not be limited to the following functional tasks arranged in logical task order:

- a. Removal procedures. Complete step-by-step removal procedures for subassemblies and components identified by test or inspection as being faulty shall be in one WP or a series of WPs. Removal/installation procedures shall be written for assemblies/components individually rather than a top-to-bottom breakdown.
- b. Disassembly. Procedures required for disassembly of a repairable assembly or components shall be presented in a logical sequence. Disassembly procedures for complex assemblies or components shall be in individual WPs. Illustrations required for support of procedures shall be prepared when required for clarity.
- c. Cleaning and corrosion control procedures. Peculiar instructions for cleaning the equipment and components shall be included. Only approved cleaning materials shall be used. Precautions to be observed and hazardous material icons shall be included as applicable.
- d. Inspection procedures. Instructions for inspection of the equipment and components during maintenance shall be prepared. Inspection methods, equipment required, allowable service limits, and adequate standards for determining when parts shall be replaced or repaired shall be included.
- e. Repair procedures. Instructions for the repair of the equipment and its components are required to the extent authorized by the approved MP. Tables of acceptable tolerances and limits shall be included when applicable. The tables shall serve as a standard and shall

MIL-DTL-81928C(AS)

list the plus or minus tolerances that are acceptable for continued operation without affecting the reliability of the equipment, including:

- (1) Part replacement or reconditioning, including installation of repair kits.
- (2) Wiring and connector repair.

f. Local manufacturing and assembly instructions.

- (1) Fabrication procedures for items source coded as "Make From" or "Assemble From" at the organizational or intermediate maintenance level shall be provided.
- (2) Simple procedures, adequately depicted in the IPB, shall not be covered.

g. Preparation for storage or shipment. Only special instructions or precautions relative to storage procedures such as corrosion prevention, draining fluids, or purging which are peculiar to the component/equipment, shall be included.

- (1) Standard packaging procedures contained in other manuals and related documentation shall not be included, but shall be referenced. Packaging and preservation requirements for ASO and NAVAIR repairable assemblies shall reference NAVSUP 701 (or NAVSUP 700).
- (2) Preparation for shipment shall be included when a special shipping container is used.
- (3) Refer to NAVAIR 01-1A-23 (WP 005 00) for handling when item is ESD sensitive.

h. Assembly procedures. Procedures required for assembly of the repairable assemblies/subassemblies/components of the equipment shall be included. Assembly instructions shall contain all pertinent assembly criteria, including clearances, back-lash dimensions, torque values, and similar data. Procedures describing required alignment, adjustment, rigging, lubrication, painting, etc., shall be included. Instructions such as "assemble in reverse order of disassembly" shall not be used.

i. Installation, assemblies and repair parts. This includes:

MIL-DTL-81928C(AS)

- (1) Pre-installation setup, if required.
- (2) Alignment, adjustment, rigging.
- (3) Servicing, including;
 - (a) Environmental conditioning.
 - (b) Lubrication.
- (4) Quality assurance reference. The last procedural step should refer to testing or a pre-test requirement, e.g., end item alignment, different WP.

h. IPB. See MIL-DTL-15014 or MIL-DTL-81929, as applicable.

3.3.2.5 Support equipment maintenance (separate WP). Maintenance procedures for SE required to be covered shall be provided in separate WPs if not covered in separate maintenance manuals. The procedures shall reflect the approved MP and provisioning documentation at each level of maintenance authorized. If a piece of SE of this category is applicable to two or more systems covered in different volumes of the end item SE manuals, the WP shall not be duplicated.

3.3.2.6 Local manufacturing and assembly instructions. When a repairable assembly is source coded as "Make From" or "Assemble From" at the organizational or intermediate maintenance level, separate WP coverage shall be provided. When multiple items have common coverage requirements, the items may be covered in the same WP or series of WPs, e.g., cable assemblies.

3.3.3 Aircraft general maintenance information manuals. The organizational level aircraft maintenance information manual set shall constitute a complete encyclopedia of operating, servicing, handling and other maintenance functions authorized for performance by squadron organizational maintenance personnel. Servicing instructions shall include all routine replenishment of expendable materials used during the operation of the aircraft, its weapon systems, or equipment. It shall not include periodic or scheduled servicing of systems or equipment covered by the Planned Maintenance Systems (PMS), such as hourly and calendar maintenance requirements. Servicing procedures shall be provided as required without time requirements. Lubrication and other maintenance procedures involving expendable materials during assembly or test of equipment shall not be considered servicing.

3.3.3.1 Operating and servicing instructions. This data is generally described as general

MIL-DTL-81928C(AS)

operating, handling and servicing procedures for the aircraft. Also included in this category are the general operating criteria for the aircraft. The operating and servicing instructions shall be contained in one manual titled the General Aircraft Information manual or broken out in manuals titled as follows:

- a. Plane Captain's manual.
- b. Ground Handling and Servicing manual.
- c. Line Maintenance manual.

3.3.3.1.1 General aircraft information manual. The following shall be included in this data element:

- a. A brief description of the aircraft, its mission capabilities, its installed systems, and their relationship. A detailed definition of systems and subsystems shall not be included.
- b. Line drawings which effectively describe and identify the major sections of the aircraft, such as fuselage, wings, empennage, and booms. The dimensions to stations from a reference or datum line shall be identified. Station numbers shall be identified with their exact location by connecting lines. The location of station zero shall be clearly identified in the diagram. The zero water line of the aircraft shall be indicated on the fuselage drawing.
- c. Identification of external power source connections and the authorized power sources that may be attached.
- d. Identification and illustration of access and inspection panels and provisions.
- e. Safety information, such as hazardous areas on, in, or around the aircraft. Information on ground run-up areas, movable surfaces, personnel survival equipment (ejection seat), no-step areas, physiological hazards, safety pins, and safety precautions peculiar to the aircraft shall be shown on one or more line drawings. Illustrations showing the hazard areas which exist during ground and air operations with radar systems turned on, both singly and in combination, shall be prepared. The illustrations shall provide safe separation distances and distribution patterns for personnel and Hazards of Electromagnetic Radiation to Ordnance (HERO) unsafe ordnance. Distances shall be presented in meters as well as feet. The safe separation distances shall be calculated and measured by the methods shown in ANSI C95.3. The safe exposure level of personnel to

MIL-DTL-81928C(AS)

electromagnetic radiation is defined in ANSI C95.1. Safe exposure levels of HERO susceptible and HERO unsafe ordnance are functions of radar frequency as shown in NAVSEA OD 30393.

- f. Instructions for engine start and run-up required to perform engine cockpit check. Reference shall be made to the appropriate NATOPS Preflight Checklist engine and Cockpit Check, if applicable.
- g. Concise and complete instructions and precautions for ground handling of the aircraft under conditions such as extreme cold, heat, humidity, dust, high winds, etc. Instructions for aircraft handling and mooring, including tie-down in high winds and the specific velocities that could damage the aircraft, shall be included. Instructions shall include the following as applicable: folding and unfolding wings, cockpit entry and safety check, towing/parking, jacking, hoisting, leveling, protective covers, ground safety locks and pins, preparation for catapulting, arrested landing operation, and carrier-deck handling.
- h. Instructions for replenishing fuel, oil, hydraulic fluid, oxygen, tire and landing-gear-strut pressures, and for other required aircraft servicing. Information shall be presented in chart or tabular form, whenever practicable. These data shall include tank and reservoir capacities in U.S., Imperial, and metric units and shall specify "AN" or other government specification numbers and grades, as applicable. Fuel and oil capacities shall also be given by weight. Expansion volume, total capacity, and net capacity for each tank shall be included. Precautions to be observed while servicing shall be included.
- i. Instructions, including safety precautions to be observed, for the following conditions: after an in-flight engagement of arresting cables, emergency canopy opening, de-arming of ejection seat, emergency wing-folding, and other maintenance actions applicable to the aircraft.

3.3.3.1.2 Plane Captain's manual. The Plane Captain's manual shall contain all information specifically required by the plane captain for performance of his duties.

3.3.3.1.2.1 Subjects: The following subjects shall be included:

- a. A brief description of the aircraft, its installed systems, and its mission requirements. A detailed definition of systems and subsystems shall not be included.
- b. The duties and responsibilities of the plane captain. The definition of his day-to-day responsibilities shall be supported with reference information identifying the availability of both technical and training material.

MIL-DTL-81928C(AS)

- c. Line drawings which effectively describe and identify the major sections of the aircraft such as fuselage, wings, empennage, and booms. The dimensions to stations from a reference or datum line shall be identified. The exact location of station numbers shall be identified by connecting lines. The location of station zero shall be clearly identified in the diagram. The zero water line of the aircraft shall be indicated on the fuselage drawing.
- d. Identification of external power source connections and the authorized power sources that may be attached.
- e. Identification and illustration of access and inspection panels and provisions.
- f. A description of the cockpit, instrument panels, and right and left consoles. Information shall include performance of all power-on functions authorized for completion by the plane captain.
- g. Method and procedures for aircraft cleaning and general upkeep.

3.3.3.1.2.2 Format. When authorized, the manual may be prepared in the 5 1/2 x 7-inch page format. Foldouts shall not be incorporated unless specifically authorized by the requiring activity.

3.3.3.1.3 Ground handling and servicing manual. This manual shall be prepared as a general purpose manual explaining the complete ground handling and servicing procedures. It shall be prepared in such a manner to permit handling and servicing of the aircraft in a transit condition by personnel unfamiliar with the aircraft.

3.3.3.1.3.1 Subjects. The following subjects shall be included:

- a. A brief description of the aircraft and its important dimensions and danger areas.
- b. Required servicing inspection and access panels which shall be illustrated and identified.
- c. Authorized external power sources and their connection points which shall be located and illustrated. Simple procedural steps for hook-up which shall be covered.
- d. Concise instructions and precautions required for ground handling under adverse conditions such as extreme cold, heat, humidity, dust, and high winds. Instructions for handling, moving, mooring, including tie-down in high winds, shall be provided. Specific wind velocities that could damage the aircraft shall be identified.
- e. Instructions for the following, as applicable:
 - (1) Folding and unfolding wings

MIL-DTL-81928C(AS)

- (2) Cockpit entry and safety check
 - (3) Towing/parking
 - (4) Jacking/hoisting, leveling
 - (5) Protective covers
 - (6) Ground safety locks and pins
 - (7) Carrier deck handling.
- f. Servicing instructions for replenishing fuel, oil, hydraulic fluid, oxygen, tire and landing strut pressures, and all other required aircraft servicing.
 - g. Servicing information which shall include tank and reservoir capacities in U.S., Imperial, and metric units and shall identify "AN" or other government specifications and grades as applicable. Fuel and oil capacity shall also be given by weight. Expansion volume, total capacity, and net capacity for each tank shall be included. Information shall be presented in chart or tabular form.
 - h. Instructions, including safety precautions to be observed, for the following conditions: after an in-flight engagement of arresting cables, emergency canopy opening, de-arming of ejection seat, emergency wing folding, and other maintenance actions applicable to the aircraft.

3.3.3.1.3.2 Format. When authorized, the manual may be prepared in the 5 1/2 x 7-inch page format. Foldouts shall not be incorporated unless specifically authorized by the requiring activity.

3.3.3.1.4 Line Maintenance manual. This manual shall cover all general aircraft information not already covered in the Plane Captain's manual or the General Aircraft Information manual. It shall contain a consolidation of all general line maintenance functions and procedures performed by all ratings and skill levels. It shall cover all visual and minor maintenance actions normally contained in the various system manuals within the aircraft maintenance instruction manual set.

MIL-DTL-81928C(AS)

- a. When authorized, the manual may be prepared to the 5 1/2 x 7-inch page format. Foldouts shall not be incorporated unless specifically authorized by the requiring activity.
- b. The manual shall include illustrations that divide and identify major sections of the aircraft. The manual shall be divided into WPs covering these sections of the aircraft. Wherever possible, the information shall be identified and tailored to the appropriate type skill(s) required for task performance.
- c. Technical information and procedures shall be supported by locator and maintenance illustrations, as required. The procedures shall be simple and direct. In the event that actions lead into greater in-depth maintenance or a periodic or scheduled maintenance requirement, reference shall be made to the appropriate systems manuals and WPs, or to the maintenance requirement card.

3.3.4 Other related aircraft MIMs.

3.3.4.1 Aircraft power plant build-up manual(s). This manual covers the build-up of a basic aircraft engine to meet the configuration required for aircraft installation. Two separate manuals may be developed when the composite requirements are performed at different maintenance levels. The manual(s) shall include the following:

- a. Quick Engine Change Kit (QECK). A listing of the components and equipment which constitute the QECK and a very brief description of each.
- b. Development of a Quick Engine Change Assembly (QECA);
 - (1) Removal of the basic engine and installation in the Quick Engine Change Stand (QECS), provided the information is not covered elsewhere.
 - (2) The manual shall present, in the appropriate order of sequence, the installation of all QECK components on the basic engine. These instructions shall include all securing and QA check procedures.
- c. Engine test. When required, the engine test procedures shall be referenced.
- d. Development of aircraft power plant installation assembly. The manual shall present, in the appropriate order of sequence:

MIL-DTL-81928C(AS)

- (1) Teardown. The removal of all non-QECA components required to make the QECA a complete specific aircraft power plant,
- (2) Build-up. The installation of all non-QECA components on the QECA. These instructions shall include all securing and QA check procedures.
- e. Power plant build-up instructions. These cover applicability and interchangeability of QEC units, preparation for power plant build-up, and ground handling of engines.
- f. Instructions for all power plant configurations and positions.
- g. Appropriate IPB figures. The IPB figures shall support the procedures (see 3.1.5). The IPB shall identify the QECK items as required by the IPB technical content specification identified in the contract.

3.3.4.2 Aircraft wiring diagram/list manual. Wiring documentation ensures understanding of the functions and makeup of each power, control, and signal interface with mechanical systems. They shall present a means for accomplishing the tracing of each circuit and its relationship to mechanical systems. See NAVAIR 00-25-700.

- a. The wiring diagram manual shall contain an introductory WP consisting of:
 - (1) A definition of the purpose and objective of the manual coverage and an explanation of how it is to be applied and used.
 - (2) An explanation of the relationship between the information contained in this manual and associated information contained in other manuals of the organizational level maintenance set.
 - (3) An explanation of the wire identification method and equipment and terminal board identification used.
- b. The wiring diagram manual shall incorporate all aircraft wiring information for all installed systems, subsystems and equipment. The diagrams shall be incorporated in the general order of work flow as dictated by the other manuals in the organizational level maintenance set.
- c. Junction box and panel wiring diagrams not included on system wiring diagrams, shall be presented in their complete form in this manual.

MIL-DTL-81928C(AS)

- d. Wire, connector and pin numbers shall be included in all wiring diagrams/schematics for aircraft wiring manuals, avionics equipment manuals and all intermediate and depot level component and equipment manuals to accomplish troubleshooting and traceability of each circuit.

3.3.4.2.1 Wiring diagrams and wire lists. Wiring diagrams are preferred over wire lists as maintenance data. Wire lists may be prepared in lieu of wiring diagrams when such lists adequately contain the maintenance data required by the technician to complete the task. A combination of wire lists and wiring diagrams may be prepared. However, a wire list and a wiring diagram listing and illustrating the same end item should not be prepared. When a combination of wire lists and wiring diagrams is prepared, certain wire numbers will appear on both data elements. This is acceptable. Wire lists and wiring diagrams shall be prepared in accordance with MIL-DTL-81927.

3.3.4.3 Aircraft wiring systems repair manual. This manual contains specific wire and connector repair information peculiar to the aircraft being covered. This manual shall be prepared in accordance with the requirements of NAVAIR 00-25-701.

3.3.4.4 Functional flow diagrams manual. This manual is a maintenance support document, primarily for use with troubleshooting procedures. However, it may also be used in conjunction with maintenance actions. The functional flow diagrams contained in this manual shall be those which were considered too complex or unusable if incorporated within the system troubleshooting manual, such as functional flow diagrams that would exceed three page units in length.

3.3.4.4.1 Functional flow diagram manual - size and binding. The manual shall be prepared in the 11 x 17 format. The manual shall be bound in such a manner that in applied use, it will lay flat, thus providing a continuous diagram projection of 31". It is desired that completed diagram art meet this limitation. However, if such is physically impossible, this limit shall act as the point of diagram division. Diagrams which would exceed a four-page presentation are considered impractical because they impair usability.

3.3.4.4.2 Functional flow diagrams - technical content requirements. The functional flow diagram shall present a closed-loop representation of the operation of the aircraft weapon system, as an operational unit, and its systems and subsystems. Point-to-point interrelationship from one system to another at the integrated system level and point-to-point wiring from one WRA to another system and subsystem level shall be shown. Wire numbers may appear on the diagram when required to ensure clarity of presentation. Input-output signals between subsystems, controls, and indicators shall be included. The following shall be illustrated as required: test points, supporting organizational level testing capability, noting the accuracy and

MIL-DTL-81928C(AS)

resolution of all signals; waveshapes, including scope settings if applicable; controls and indicators referred to in troubleshooting procedures; and mechanical linkage.

3.3.4.4.3 Functional flow diagram layout. The diagram layout shall follow the arrangement of the organizational maintenance manual(s). The concept of separation of "airframe" and "electronic" systems is not acceptable in this presentation. When the airframe portion of a system and the electronic portion of a system are functionally dependent on each other for operation, the overall system shall be presented as a unit. The basic layout of the diagram shall present signal flow from left to right, starting at a power source or mechanical input and terminating at an end point, such as a display or surface control. All systems installed in the aircraft shall appear in one manual or series of manuals, in logical order, beginning with the aircraft as the identified end item (or integrated weapon systems), and progressing through each ancillary subsystem of the integrated weapon system. This is followed by the remaining systems of the aircraft weapon system that are not dependent on the operation of the integrated system.. As a reference document supporting two maintenance functions, these diagrams shall contain required documentation without inordinate referencing to any manual of the organizational level manual set.

3.3.4.5 Support equipment manuals. Support equipment manuals should be prepared in support of organizational level maintenance only when operation and replacement of hardware is provisioned for organizational level. Operation instructions should normally be for ground servicing and mobile equipment. Procedures for utilization of special tools and test equipment at the organizational level will be presented in the aircraft/system maintenance manuals.

3.3.5 Crew station manuals. The organizational level maintenance manuals shall provide the general and specific instructions required to perform maintenance on the avionics equipment in the weapon system. The organizational maintenance manuals shall be a series of manuals relating to crew stations aboard the aircraft. Coverage may be provided for a single crew station or grouped by operational and functional relationship. Each manual set shall include but not be limited to the following:

3.3.5.1 Crew Station Maintenance manual (CSMM). This manual shall provide all information necessary to perform in-flight and ground maintenance. It shall include the following:

- a. General information.
- b. Readiness test procedures.
- c. Station signal flow diagram.

MIL-DTL-81928C(AS)

- d. Station functional signal flow diagrams.
- e. Subsystem functional signal flow diagrams.
- f. Testing and troubleshooting.

3.3.5.2 CSMM development requirements. This manual shall support the use of built-in test and readiness test procedures based on manual/cross-operational checks of the various equipment covered by the manual. Testing and troubleshooting procedures shall be prepared to meet the requirements of this specification, but shall be developed using on-board spares and test equipment. Maintenance procedures shall be developed in support of the testing and troubleshooting procedures. The CSMM shall be a primary source of organizational level maintenance data and shall reference the supporting MIMs for backup information.

3.3.5.3 Crew Station MIMs. These manuals shall be prepared to provide direct and backup support for the CSMMs. Functional alignment shall be as follows:

- a. Principles of operation.
- b. Testing and troubleshooting.
- c. Maintenance with IPB.

4. VERIFICATION

4.1 Verification. Verification shall be conducted as prescribed in the contract.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

MIL-DTL-81928C(AS)

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful but is not mandatory.)

6.1 Intended use. Technical manuals prepared in accordance with this specification are intended for use in the maintenance of aircraft and related systems at organizational, intermediate, and depot maintenance levels.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type(s) of manuals to be prepared (see 1.2).
- c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).
- d. Packaging requirements (see 5.1).

6.2.1 Guidance documents. The following document is cited in section 3 of this specification and is provided for guidance and information only. Unless otherwise specified, the issue is that cited in the solicitation.

DEPARTMENT OF THE NAVY

NAVAIRINST 4423.11 - Assignment and Application of Uniform Source,
Maintenance, and Recoverability (SM&R) Codes.

(Copies of instructions are available by request to Commander, Naval Inventory Control Point Philadelphia, Publications/Forms Branch, Code 03334, 700 Robbins Ave., Philadelphia, PA 19111-5098).

6.3 Technical manuals. The requirements for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, specifications and standards that have been cleared and listed in DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

MIL-DTL-81928C(AS)

6.4 Specification figures. The figures previously included in this specification were intended to illustrate methods of presentation of technical data. They are being revised for incorporation into NAVAIR 00-25-700. Sample illustrations can be provided by the requiring activity, if requested. The sample figures shall not be interpreted as limiting the technical content requirements that are established by the text. The text must take precedence over all examples shown in the sample figures.

6.5 Subject term (key word) listing.

Aircraft maintenance
Aircraft technical manuals
technical manuals
work package

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

MIL-DTL-81928C (AS)

INDEX

	<u>PARAGRAPH</u>	<u>PAGE</u>
Acquisition requirements	6.2	37
Aircraft general maintenance information manuals	3.3.3	27
Aircraft Maintenance Instruction Manuals (MIMs)	3.3	9
Aircraft power plant build-up manual(s)	3.3.4.1	32
Aircraft systems and equipment MIMs.....	3.3.2	9
Aircraft wiring diagram/list manual	3.3.4.2	33
Aircraft wiring systems repair manual	3.3.4.3	34
APPLICABLE DOCUMENTS	2.	2
Breakout and arrangement of maintenance information.....	3.3.1	9
Built-in-test using preprogrammed magnetic tape or software.....	3.3.2.3.9.1	17
CSSM development requirements.....	3.3.5.2	36
Classification.....	1.2	1
Changes from previous issue	6.6	38
Common coverage requirements (Maintenance with IPB).....	3.3.2.4.2	21
Common requirements	3.1.6	6
Common requirements (Testing and troubleshooting).....	3.3.2.3.6	15
Conflict between specifications.....	3.1.3	4
Controls and indicators (Aircraft MIMs).....	3.3.2.2.1.1	10
Copyrights and advertising	3.1.1	4
Crew Station Maintenance manual (CSMM).....	3.3.5.1	35
Crew station manuals	3.3.5	35
Crew station MIMs	3.3.5.3	36
Depth of coverage (Principles of operation).....	3.3.2.2.2.1	11
Depth of coverage (Testing and troubleshooting)	3.3.2.3.1	12
Description (Aircraft MIMs)	3.3.2.2.1	10
Description and principles of operation (Aircraft MIMs).....	3.3.2.2	10
Development and presentation.....	3.1.6.1	6
Division of existing manuals	3.3.1.1	9
Fault isolation manual.....	3.3.2.3.9.4	18
Fault reporting manual	3.3.2.3.9.3	17
Foldout illustrations (multiple WP application)	3.1.6.2.2	7
Format (General).....	3.1.4	5

MIL-DTL-81928C (AS)

INDEX

	<u>PARAGRAPH</u>	<u>PAGE</u>
Functional flow diagrams manual.....	3.3.4.4	34
Functional flow diagrams manual - layout.....	3.3.4.4.3	35
Functional flow diagrams manual - size and binding.....	3.3.4.4.1	34
Functional flow diagrams manual - technical content requirements	3.3.4.4.2	34
General	2.1	2
General	3.1	4
General aircraft information manual.....	3.3.3.1.1	28
General coverage requirements (Maintenance with IPB).....	3.3.2.4.1	20
General requirements (Testing and troubleshooting)	3.3.2.3.4	13
General style, format, and technical content.....	3.1.4	5
General technical content	3.1.9	7
Government documents.....	2.2	2
Ground handling and servicing manual.....	3.3.3.1.3	30
Guidance documents	6.2.1	37
IPB	3.1.5	6
IPB figures.....	3.1.5.2	6
Integrated system (Testing and troubleshooting).....	3.3.2.3.3	13
Integrated systems (Principles of operation).....	3.3.2.2.2.3	12
Intended use.....	6.1	37
Layout and arrangement of maintenance information	3.1.6.2	6
Line maintenance manual.....	3.3.3.1.4	31
Local manufacturing and assembly instructions (separate WP)....	3.3.2.6	27
Maintenance level coverage.....	3.1.9.2	8
Maintenance with IPB, aircraft MIMs.....	3.3.2.4	20
Manual test procedure (Testing and troubleshooting)	3.3.2.3.7	16
Method of presentation (Principles of operation)	3.3.2.2.2.2	11
Method of presentation (Testing and troubleshooting)	3.3.2.3.2	12
Multilevel maintenance coverage	3.1.8	7
Multimanual coverage	3.1.7	7

MIL-DTL-81928C (AS)

INDEX

	<u>PARAGRAPH</u>	<u>PAGE</u>
Non-Government publications	2.3	3
NOTES	6.	37
Operating and servicing instructions	3.3.3.1	27
Operation instructions for aircraft systems and equipment.....	3.3.2.1	9
Operational checkout (testing) requirements	3.3.2.3.5	14
Order of precedence	2.4	4
Other Government documents, drawings and publications	2.2.2	2
Other related aircraft MIMs.....	3.3.4	32
PACKAGING.....	5.	36
Packaging	5.1	36
Plane Captain's manual.....	3.3.3.1.2	29
Principles of operation (Aircraft MIMs).....	3.3.2.2.2	11
Proprietary data.....	3.1.2	4
Relationship between the IPB and the WP concept	3.1.5.1	6
Repairable assembly maintenance WPs	3.1.6.2.1	7
Repairable assembly or subassembly maintenance procedures	3.3.2.4.4	25
REQUIREMENTS	3.	4
Review of existing related technical manuals.....	3.2	9
SCOPE	1.	1
Scope	1.1	1
Specification figures	6.4	38
Specifications, standards, and handbooks.....	2.2.1	2
Standard shop practices and techniques	3.1.9.1	7
Style (General)	3.1.4	5
Subject term (key word) listing.....	6.5	38
Support equipment maintenance (separate WP)	3.3.2.5	27
Support equipment manuals.....	3.3.4.5	35
System and subsystem maintenance procedures	3.3.2.4.3	23
Task development	3.1.10	8
Technical content (General).....	3.1.4	5

MIL-DTL-81928C (AS)

INDEX

	<u>PARAGRAPH</u>	<u>PAGE</u>
Technical manuals	6.3	37
Testing and troubleshooting	3.3.2.3	12
Testing and troubleshooting using built-in-test equipment.....	3.3.2.3.9	16
Testing and troubleshooting using sensors	3.3.2.3.9.2	17
Troubleshooting procedures using semi-automatic or automatic test equipment.....	3.3.2.3.8	16
VERIFICATION	4.	36
Verification	4.1	36
Wiring diagrams and wire lists	3.3.4.2.1	34

CONCLUDING MATERIAL

Preparing activity:

Navy - AS

(Project TMSS-N260)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.
NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

MIL-DTL-81928C

2. DOCUMENT DATE (YYMMDD)

971126

3. DOCUMENT TITLE

MANUAL TECHNICAL, AIRCRAFT MAINTENANCE INSTRUCTIONS, TECH CONTENT REQMNT S

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE
(Include Area Code)

(1) Commercial:

(2) DSN:
(If Applicable)7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. NAME
COMMANDER
NAVAL AIR WARFARE CENTER
AIRCRAFT DIVISION

b. TELEPHONE NUMBER (Include Area Code)

(1) Commercial
(908) 323-2628(2) DSN
624-2628c. ADDRESS (Include Zip Code)
CODE 414100B120-3
HIGHWAY 547
LAKEHURST, NJ 08733-5100IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
Defense Quality and Standardization Office, 5203 Leesburg Pike,
Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 DSN 289-2340