NOT MEASUREMENT SENSITIVE

MIL-STD-3001-2A(AS)
10 October 2014
SUPERSEDING
MIL-STD-3001-2(AS)
15 May 2001

DEPARTMENT OF DEFENSE STANDARD PRACTICE

DIGITAL TECHNICAL INFORMATION FOR MULTI-OUTPUT PRESENTATION OF TECHNICAL MANUALS

DESCRIPTION, PRINCIPLES OF OPERATION, AND OPERATION DATA

(PART 2 OF 8 PARTS)

AMSC N/A AREA TMSS

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

FOREWORD

1. This standard is approved for use by the Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

2. This eight-part standard establishes the requirements needed to prepare digital technical information for multi-output presentation of NAVAIR work package (WP) Technical Manuals (TMs). The technical content and style and format requirements contained in this eight-part standard can be used to develop and assemble complete TMs for aircraft weapon systems, aeronautical equipment, airborne weapons/equipment, and support equipment WP TMs. The requirements are applicable for the output of printed paper and PDF screen displayed TMs. The requirements are also applicable for the display of Interactive Electronic Technical Manuals (IETMs) on any viewer that supports MIL-STD-3001-1.

3. MIL-STD-3001-2 is Part 2 of eight parts and is incomplete without Part 1 and Parts 3 through 8. Part 2 establishes the technical content requirements for the preparation of description, principles of operation, and operating data for aircraft weapon systems, aeronautical equipment, airborne weapons/equipment, and support equipment. This data can be used to develop TMs in a variety of output forms, including interactive screen presentations and page-based printed and PDF screen displayed TMs.

4. MIL-STD-3001-1 contains general preparation requirements for the multi-output presentation of NAVAIR WP TMs. MIL-STD-3001-2 through MIL-STD-3001-8 contain specific functional technical content requirements for the preparation of all NAVAIR WP TMs and revisions. Parts 1 through 8 are identified below:

MIL-STD-3001-1	Preparation of Digital Technical Information for Multi-output Presentation of Technical Manuals.
MIL-STD-3001-2	Description, Principles of Operation, and Operation Data.
MIL-STD-3001-3	Testing and Troubleshooting Procedures.
MIL-STD-3001-4	Maintenance Information with Illustrated Parts Breakdown (IPB).
MIL-STD-3001-5	Aircraft Wiring Information.
MIL-STD-3001-6	Structural Repair Information.
MIL-STD-3001-7	Periodic Maintenance Requirements.
MIL-STD-3001-8	Separate Illustrated Parts Breakdown (IPB).

5. Comments, suggestions, or questions on this document should be addressed to the Naval Air Systems Command (Commander, Naval Air Warfare Center Aircraft Division, Code 412000B120-3, Highway 547, Lakehurst, NJ 08733-5100) or emailed to michael.sikora@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST online database at https://assist.dla.mil.

CONTENTS

PARAGRAPH PAGE

CONTENTS

PARAGRAPH PAGE

FIGURES PAGE

1. SCOPE

1.1 Scope. This part of the standard establishes the technical content requirements for the preparation of description, principles of operation, and operating data for aircraft weapon systems, aeronautical equipment, airborne weapons/equipment, and support equipment. This data can be used to develop TMs in a variety of output forms, including interactive screen presentations and page-based printed and screen displayed PDF TMs.

2. APPLICABLE DOCUMENTS

The applicable documents in section 2 of MIL-STD-3001-1 apply to this Part.

3. DEFINITIONS

The definitions in section 3 of MIL-STD-3001-1 apply to this Part.

4. GENERAL REQUIREMENTS

4.1 General. Sufficient descriptive information and principles of operation necessary for a user to familiarize and comprehend the aircraft weapon system, aeronautical equipment, airborne weapons/equipment or support equipment shall be developed. In addition, operating data for selected end item equipment shall also be prepared.

4.2 Maintenance level applicability. Requirements contained in this Part are applicable to all types and maintenance levels of TMs, unless specifically noted in bold and in parentheses (e.g., **Support Equipment Manuals only**, **Depot Level only**, etc.).

4.3 Selective application and tailoring. This Part contains some requirements that may not be applicable to the preparation of all TMs. Selective application and tailoring of requirements contained in this Part shall be accomplished through the use of the Technical Manual Content Selection Matrixes contained in MIL-STD-3001-1, Appendix A. The applicability of some requirements is also designated by one of the following statements: unless specified otherwise by the requiring activity or as/when specified by the requiring activity.

4.4 Preparation of digital data for electronic delivery. TM data prepared and delivered digitally in accordance with this Part of the standard shall be XML-tagged and assembled using the modular Document Type Definition (DTD). Refer to MIL-STD-3001-1 for information on obtaining or accessing this modular DTD. XML tags used in the modular DTD are noted throughout the text of this Part in bracketed, bold characters (i.e., **<descopim>**) as a convenience for the TM author and to denote the appropriate tag to be used for the specific information when developing a document instance.

4.4.1 Use of the DTDs. The modular DTDs referenced in this Part interpret the technical content and structure for the functional requirements contained in this Part and are mandatory for use.

4.5 Technical content. Technical content requirements contained in this Part are considered mandatory and are intended for compliance. The content structure for the technical data being developed shall conform to the associated modular Document Type Definition (DTD) for Description, Principles of Operation, and Operation information.

4.5.1 Types of work packages. There are basically two types of WPs. The first type is an information-oriented WP. It provides information such as general information about the printed TM or the IETM and specific information about the weapon system/equipment, such as principles of operation and operating instructions. The second type of WP is task-oriented. Task-oriented WPs reflect all required maintenance tasks, including testing and troubleshooting, at the assigned level of maintenance. Task-oriented WPs also contain supporting information such as required materials and support equipment required for each defined task. WPs are written to reflect the engineering design, Logistics Support Analysis (LSA) or Logistics Management Information (LMI), Level of Repair Analysis (LORA), approved maintenance plan, and the established repair concept (i.e., Source, Maintenance, and Recoverability (SM&R) Codes).

4.5.2 Style and format requirements. For mandatory style and format requirements for WP TMs intended for a printed, page-oriented presentation, refer to MIL-STD-3001-1, Appendix B. For style and format requirements for the on-screen display of IETMs, refer to NAVAIRINST 4120.11, Policy for Preparation and Standardization of the Naval Air Systems Command Interactive Electronic Technical Manuals (IETMs).

4.6 Standard tables and lists. Standard tables and lists are noted throughout the text of this standard in bold and in parentheses (i.e., (**standard table**), (**standard list**)). The structure and titles of the column headings for these standard tables and lists shall have no deviations.

5. DETAILED REQUIREMENTS

5.1 Preparation of descriptive information, principles of operation, and operation data. Descriptive information shall be developed for the overall aircraft weapon system and contained in a General Aircraft Information Module **<genacim**>. Descriptive information, principles of operation, and operation data shall be developed for major aircraft systems, aeronautical equipment, airborne weapons/equipment, and support equipment and contained in a Description and Operation Information Module **<descopim>**. Both information modules shall be logically subdivided into information- or task-oriented WPs.

5.2 Work package content. Each WP developed for descriptive information, principles of operation, and operation data shall consist of the following:

a. Title block.

b. WP information.

c. Required descriptive, principles of operation, or operation data.

5.2.1 Title block **<titleblk>**. Refer to MIL-STD-3001-1, Appendix B, B.5.3.2.1.1 for WP title block content requirements.

5.2.2 Work package information **<wpinfo>**. Each WP developed for descriptive information, principles of operation, and operation data may begin with a reference material list, a record of applicable technical directives, and a support equipment required list, if applicable.

5.2.2.1 Reference material list **<reflist>**. Reference material required to complete a task or discussion within a WP shall be contained in a reference material list (**standard list**). If no reference material applies, the heading "Reference Material" shall be omitted from the WP. Guidelines for developing the reference material list are provided below:

a. Only those publications required for performance of the task covered by the WP should be included in the reference material list.

b. Publications such as guides or standards which are not directly needed to accomplish the task (backup informational material or bibliography) should not be included in the reference material list even if cited in the WP text.

c. Each entry in the list shall consist of:

(1) A title. Referenced publications within the WP by title. If the reference is to a specific WP, the WP title may be listed below the related publication title.

(2) A number. The appropriate publication or WP number.

d. The maintenance level of publications listed is not required.

e. Referenced publications shall be presented by title in alphabetical order. The publication title, WP title, and WP number shall also be identified. When two or more WPs are referenced in the same manual, they shall be listed in numerical sequence; repetition of the manual title and publication number is not required.

f. Additional WPs within the same manual that are required to complete the task or discussion shall be presented first in numerical sequence. The WP title and WP number shall also be identified. The publication number is not required.

g. Referenced publications not prepared in WP format shall be presented in numerical sequence. The title and publication number shall also be included.

5.2.2.2 Record of Applicable Technical Directives **<ratd>**. Technical directives applicable to a specific WP shall be listed in a record of applicable technical directives list (**standard list**). If no technical directives apply, the heading "Record of Applicable Technical Directives" shall be omitted from the WP. The record of applicable technical directives shall be prepared in accordance with the following guidelines:

a. All issued technical directives having any impact on the WP shall be listed upon incorporation into the WP.

b. Approved engineering change proposals (ECPs) that have no effect on retrofit of the end item shall not be listed in the record of applicable technical directives (e.g., "no technical directive will be issued").

c. All technical directives and related ECPs or Rapid Action Minor Engineering Changes (RAMECs) shall be listed upon incorporation into the WP:

(1) "TD Type/No." - Enter the type and number of the technical directive, e.g., "F/A-18 AFC 126" or "AVC 102." Note: The "TD Type/No." is identified on the Change Control Board (CCB) formal letter of ECP or RAMEC approval. Refer to NAVAIR 00-25-300.

(2) "TD Date" - Enter the date of issue of the technical directive. If the number of the technical directive has been assigned but the directive has not been issued, a dash (-) shall be entered.

(3) "Title and ECP/RAMEC No." - The title of the technical directive and the ECP number or RAMEC, if applicable, shall be listed. If a technical directive listed is the direct result of an approved ECP or RAMEC, the acronym ECP or RAMEC and number shall be shown in parentheses following the technical directive title.

(4) "Date Inc." - The date the information affected by the technical directive or the ECP was incorporated into the WP.

(a) If the technical directive number has been assigned and the directive has not yet been issued (retrofit program), but the ECP that incorporates the change in the production program has been approved, the production ECP coverage shall be included, and the notation "Production coverage only" shall be entered under "Remarks."

(b) When the retrofit TD is approved and incorporated in a change or revision following the incorporation of the production ECP coverage, the TD date of issue shall be entered under "TD Date," the notation "Production coverage only" shall be removed from under "Remarks," and the date of retrofit coverage incorporation shall be listed under "Date Inc." (in lieu of the production ECP coverage incorporation date).

(5) "Remarks" - Enter any applicable remarks.

5.2.2.3 Support equipment required list **<selist> (operation data only)**. All support equipment (SE), including special tools required to perform operational type procedures, shall be listed (**standard list**) immediately following the record of applicable technical directive data. If no support equipment is required, the heading "Support Equipment Required" shall be omitted from the WP. Only those special tools (including torque wrenches) and equipment authorized for use at the level of maintenance covered shall be listed. Items shall be listed in alphabetical sequence by noun nomenclature. Standard hand tools shall not be listed. Illustrations shall not be prepared in support of such lists. When the WP is used by other services or commands that require usage restrictions, the item shall be identified by a symbol following the part number in parentheses. The usage of the symbol shall be explained in a notation (e.g., "(AF)=USAF only," "(NS)=NAVSEA only," "(MC)=MARINE CORPS only").

5.2.2.3.1 Each support equipment entry in the list shall be identified by "Nomenclature," "Part Number," and "CAGE Code." When more than one of the same item is required, the quantity shall follow the nomenclature in parentheses. If a “CAGE Code” is not available, a dash shall be substituted for the “CAGE Code”.

5.2.2.3.2 If the WP contains multilevel maintenance procedures and any of the SE items are authorized for use at only certain level(s), the restrictive use shall be indicated by the use of an O, I, and/or D in parentheses following the item nomenclature. For **Aircraft Engine Manuals**, the following special application codes to identify usage restrictions shall be used:

a. "J" shall be used to indicate the first degree engine maintenance level,

b. "8" shall be used to indicate the second degree engine maintenance level, and

c. "9" shall be used to indicate the third degree engine maintenance level.

5.2.2.4 Facilities required list <**faclist**> **(operation data only)**. All facilities needed to accomplish the maintenance procedures shall be listed **(standard list)** immediately following the support equipment required list. If no facilities are required, the heading "Facilities Required" shall be omitted from the WP. Each facility entry in the list shall be identified by "Nomenclature," "Part Number," and "CAGE Code."

5.2.2.5 Materials required list **<matlist> (operation data only)**. All materials (consumable materials and/or expendable items) required to perform maintenance type procedures shall be listed **(standard list)**. If no materials apply, the heading "Materials Required" shall be omitted from the WP. Items shall be listed in alphabetical sequence by noun nomenclature. The materials required list shall be prepared in accordance with the guidelines listed below. If the material is a hazard material the hazard material warning summary (HMWS) shall be included.

a. Each material entry in the list shall be identified by "Nomenclature," "Specification/Part Number," and "HMWS Index Number," as applicable.

(1) Unless alternate identification is approved by the requiring activity, materials shall be listed by Government specification.

(2) If the WP contains multilevel maintenance procedures and any of the materials are authorized for use at only certain level(s), the restriction shall be indicated by the use of an O, I, and/or D in parentheses following the item nomenclature.

(3) When more than one of the same item is required, the quantity shall follow the nomenclature in parentheses.

b. Parts that require mandatory replacement (e.g., preformed packing) in the procedure shall be listed.

c. An appropriate notation shall follow the item to explain each restriction and/or quantity requirement.

5.2.3 Required descriptive information, principles of operation, and operation data. Descriptive information, principles of operation, and operation data shall be developed and divided into WPs. Nomenclature used to identify aircraft weapon systems, aeronautical equipment, airborne weapons/equipment, and support equipment shall remain consistent throughout and between all WPs.

5.2.4 Description work packages.

5.2.4.1 Aircraft general description work packages (**General Aircraft Information and Plane Captain's Manuals only**). The descriptive WPs listed in 5.2.4.1.1 through 5.2.4.1.9 shall be developed for the aircraft weapon system, as applicable. All descriptive WPs may have an introduction <**intro**>.

5.2.4.1.1 Aircraft general description work package **<acdescwp>**. This WP shall contain the descriptive data requirements for the overall aircraft weapon system listed in 5.2.4.1.1.1 through 5.2.4.1.1.3, as applicable.

5.2.4.1.1.1 Aircraft description <**acdesc**>. A brief description of the aircraft and its mission capabilities shall be provided. A detailed definition of systems and subsystems shall not be included.

5.2.4.1.1.2 Aircraft dimensions <**acdim**>. Illustrations showing the external dimensions of the aircraft shall be provided.

5.2.4.1.1.3 Aircraft materials distribution <**acmats**>. The types of material that comprise the aircraft airframe skins and doors shall be identified. Supporting illustrations shall be used to locate and differentiate the types of airframe materials.

5.2.4.1.2 Aircraft arrangement work package **<acarrgwp>**. This WP (see figure 1) shall describe and identify the major sections of the aircraft, such as fuselage, wings, empennage, and booms.

5.2.4.1.3 Aircraft systems description work package **<acsysdescwp>**. This WP shall contain brief descriptive data **<sysdesc>** that includes the purpose, type, content, and main features of each of the aircraft's major systems. Illustrations shall not be used to support the descriptive data.

5.2.4.1.4 Aircraft instrument panel location work package **<acpnlwp>**. A description and location of cockpit, instrument panels, and consoles shall also be provided. Supporting illustrations shall be used to locate all instrument panels and consoles in the aircraft.

5.2.4.1.5 Danger areas and precautionary measures work package **<dangarwp>**. Safety information, such as hazardous areas on, in, and around the aircraft shall be clearly identified. Information on ground run-up areas, movable surfaces, personnel survival equipment (ejection seat), no-step areas, handholds, walkups, 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 (see figure 2). 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 IEEE C95.3. The safe exposure level of personnel to electromagnetic radiation is defined in IEEE C95.1. Safe exposure levels of HERO susceptible and HERO unsafe ordnance are functions of radar frequency as shown in NAVSEA OD 30393.

5.2.4.1.6 Aircraft stations work package **<acstawp>**. 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 waterline of the aircraft shall be indicated on the fuselage drawing. The numbering system used to identify aircraft coordinates and stations shall be used consistently throughout all WPs.

5.2.4.1.7 Aircraft dimensions work package **<acdimwp>**. The dimensions to stations from a reference or datum line shall be identified in this WP. Illustrations shall be included to effectively convey this information.

5.2.4.1.8 Aircraft access and inspection panels and provisions work package <**acacesswp**>. This WP shall identify all aircraft access and inspection panels and provisions. Illustrations shall be included to effectively convey this information.

5.2.4.1.9 Aircraft external power source connections work package <**acextpwrwp**>. Identification of external power source connections and the authorized power sources that may be connected to the aircraft shall be identified and described in this WP. Illustrations shall be included to effectively convey this information.

5.2.4.2 Aircraft systems, aeronautical, airborne weapons/equipment, support equipment, and engine description work packages. All descriptive WPs may have an introduction <**intro**>. The following descriptive WPs shall be developed for aircraft systems, aeronautical and airborne weapons/equipment, support equipment, and engines, as applicable:

a. Aircraft system, subsystem, and component description WPs.

b. Aeronautical equipment, airborne weapons/equipment, and support equipment description WPs.

c. Engine and engine system description WPs.

d. Programming software description WPs.

5.2.4.2.1 Aircraft system, subsystem, and component description work packages **<descwp>**. A separate description WP shall be developed for each aircraft system (see figure 3). The WP shall contain descriptive data <**sysdesc**> that includes the purpose, type, content, and main features of the system. Other supportive descriptive data <**addesc**> shall be included when it is necessary to describe additional technical data that may relate to, but not be physically integral to, the system/equipment, such as specific operating software. When required, a table of leading particulars or technical characteristics shall be included to present the physical and electrical characteristics of the system and the major functional components. Subsystem <**sysdesc**> and component descriptions <**sysdesc**> shall also be included, when applicable. When necessary for usability or clarity, subsystem and component descriptions may be provided in separate WPs. Subsystem component descriptions may be included in either the subsystem description WP <**descwp**> or in a separate component description WP <**descwp**>. If a system has a relationship to other systems installed in the aircraft, a brief description <**desc**> of these related systems shall also be provided. The purpose, use, and function of all operating controls and auxiliary equipment, or attachments furnished with the system or equipment shall also be included, as applicable (refer to 5.2.4.2.1.1). Illustrations shall support the descriptive data. The illustrations shall identify and locate the system, equipment, and components and their associated access panels, if any. When necessary for usability or clarity, separate description WPs may be used for each aircraft system, subsystem and individual system component, or the descriptive data may be included within the principles of operation WPs (refer to 5.2.5.1).

5.2.4.2.1.1 Controls and indicator descriptions. A description and use of controls and indicators **<ctrlinddesc>** shall be prepared for each equipment, assembly, or control panel having controls and indicators. The coverage should also provide interpretation of typical instrument readings (with acceptable limits stated) and indicator presentations to inform the operator what recognizable results to expect to observe during each mode of operation. Illustrations shall be prepared to locate and identify all operator controls and indicators and related placard data. Each control and indicator shall be clearly labeled as it appears on the equipment. Controls and indicators that are not labeled shall be identified. The functional use of each control and indicator shall be explained. A table **<ctrlindtab>** shall be used to explain the use of the controls and indicators (see figure 3, Table 1). When the controls or indicators for a system are situated on

more than one panel or equipment, a table for each panel or equipment shall be developed. When it is necessary to provide operating instructions for the system or equipment, controls and indicator descriptions may be included in the operating instruction WPs to facilitate the operating procedures (refer to 5.2.6.1).

a. Illustration. The purpose of the illustration is to identify each control and indicator, placard data, and location. Each control or indicator shall be identified using either an index number (with leader line) identifying the location and related placard data or its official nomenclature. When used, index numbers shall be assigned in logical sequence related to location of the item.

b. Table. The purpose of the table is to provide the required data for each control and indicator. The table shall indicate the index number (when used) referenced from the illustration, the associated control or indicator and its decal/stencil nomenclature, including the reference designator, if applicable, and the function of the control or indicator. The following entries shall be provided for each control and indicator listed:

(1) "Index No." reference, if used.

(2) "Control/Indicator" nomenclature.

(3) "Function."

5.2.4.2.2 Aeronautical equipment, airborne weapons/equipment, and support equipment description work packages **<descwp>**. Descriptive WPs shall be developed for aeronautical equipment, airborne weapons/equipment, and support equipment, as applicable. When necessary for usability or clarity, the descriptive data may be included within the principles of operation WPs (refer to 5.2.5.2). The description <**sysdesc**> shall include the following information, as applicable:

a. The purpose, type, content, and main features of the equipment and components. Unusual shapes or special material make-up of equipment or components shall also be described.

b. A table of leading particulars or technical characteristics giving the physical (dimensions, weight, etc.) and electrical (power requirements, output, etc.) characteristics of all major functional components.

c. Illustrations shall support the descriptive data. The illustrations shall identify and locate the system, equipment, and components. For support equipment, the views depicted shall indicate the placement, verbiage, and appropriate indexing for color requirements of all stenciled or painted markings.

d. A description of the controls and indicators (refer to 5.2.4.2.1.1).

5.2.4.2.3 Engine and engine system description work packages **<descwp>**. A WP shall be developed to provide maintenance personnel with a basic description of the engine <**sysdesc**>, including its purpose, type, series, and main features. A table of leading particulars, including dimensions, weight, and other basic engine data shall also be included. If more than one model of the engine is used, the significant differences shall be explained. In addition, a separate description WP **<descwp>** for each major section or module of the engine shall also be prepared. For usability or clarity, the descriptive data may be included within the principles of operation WPs (refer to 5.2.5.3). Separate description WPs **<descwp>** for each related engine system <**sysdesc**>, subsystem <**sysdesc**>, and its major components <**sysdesc**> shall also be prepared. As applicable, the description shall include the system's purpose, type, series, main features, and a table of leading particulars, including dimensions, and weight.

5.2.4.2.4 Programming software description work packages <**softwp**>. WPs shall be developed to provide descriptive information for programming software used for aircraft systems, aeronautical equipment, and test equipment, when applicable. Description of stimulus and measurement programming <**stim-measdesc**>, programming statements <**statedesc**>, and any programming tests or self tests <**progtestdesc**> shall be prepared. A description of any microcircuit logic and associated diagrams shall also be included when necessary. Block diagrams, test setup diagrams, and pictorials of display readouts shall be included when necessary to support the descriptive narrative. All descriptive WPs may have an introduction <**intro**>.

5.2.5 Principles of operation. The principles of operation shall define the purpose and functions of the equipment, the technical characteristics, and other general information to be used by maintenance personnel to enable understanding of the equipment and its related systems, including integration. The operation of the system and related equipment/components shall be presented in a logical flow. Significant input, output, and control signals, supply voltages and power supply output voltages shall be identified. If the equipment operates in more than one mode, each mode shall be explained. Functional block diagrams shall be provided. When the LSA/LMI/MP directs fault isolation to the bit and piece component(s), the principles of operation shall describe detailed circuitry. Internal circuits, their relationship to each other, input and output signals, waveforms and time-phase relationship to significant waveforms shall be included when required to understand detailed equipment operation. Presentation of the principles of operation shall 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. These diagrams and other related illustrations shall be placed in the same WP as their related text. Principles of operation for functionally significant nonrepairable items shall be described as necessary to support understanding of the system or equipment. Basic theory, normally found in textbooks, shall not be included. Principles of operation data shall be contained in the following types of WPs, as applicable:

a. Aircraft weapon system principles of operation WPs.

b. Aeronautical equipment, airborne weapons/equipment, and support equipment principles of operation WPs.

c. Engine systems principles of operation WPs.

d. Schematic diagram WPs.

5.2.5.1 Aircraft weapon system principles of operation work packages <**popwp**>. A separate principles of operation WP shall be developed for each aircraft system (see figure 4). All principles of operation WPs may have an introduction <**intro**>. The WP shall contain the functional operation for the system <**systhry**>, its subsystems <**systhry**>, and components <**systhry**>. Detailed physical descriptions of the systems and components may be included here when usability is enhanced (refer to 5.2.4.2.1). When descriptive data is included, it is not necessary to prepare separate description WPs. The descriptive data shall precede the narrative for the principles of operation. When necessary for usability or clarity, subsystem <**popwp**> and component <**popwp**> principles of operation may be provided in separate WPs. Subsystem component principles of operation may be included in either the subsystem principles of operation WP or in a separate component principles of operation WP. Detailed component functional operation, common circuitry, and wiring diagrams shall not be included unless necessary to understand system/subsystem function.

5.2.5.2 Aeronautical equipment, airborne weapons/equipment, and support equipment principles of operation work packages <**popwp**>. Principles of operation WPs shall be developed for aeronautical equipment, airborne weapons/equipment, and support equipment, as applicable. All principles of operation WPs may have an introduction <**intro**>. Detailed physical descriptions **<sysdesc>** of the systems and components may be included here when usability is enhanced (refer to 5.2.4.2.2). The descriptive data shall precede the narrative for the principles of operation (see figure 5). When descriptive data is included, it is not necessary to prepare separate description WPs. The principles of operation **<systhry>** should consist of a functional narrative written to help understand the equipment operation (electrical/electronic, hydraulic, pneumatic, and mechanical). When necessary, principles of operation may be divided into simplified and detailed principles of operation and contained in separate WPs.

5.2.5.3 Engine systems principles of operation work packages <**popwp**>. A separate WP explaining the operation **<systhry>** of the engine and each of its systems shall be prepared. All principles of operation WPs may have an introduction <**intro**>. Detailed physical descriptions **<sysdesc>** of the systems and components may be included here when usability is enhanced (refer to 5.2.4.2.3). The descriptive data shall precede the narrative for the principles of operation. When descriptive data is included, it is not necessary to prepare separate description WPs. Information such as compressor stages, combustion chamber arrangement, and location of major sections, modules, components, and accessories shall be presented. The principles of operation shall consist of a functional narrative written to facilitate understanding of the engine systems to the extent necessary to support fault detection and isolation and maintenance of the systems. This text shall describe system operation and the relationship of other systems/components during system integration.

5.2.5.4 Schematic diagram work packages <**schemwp**>. Schematic diagrams required to support the principles of operation or the testing and troubleshooting of systems, equipment and

components may be included in separate WPs, especially when a large number of schematics are required. However, when only a small number of schematics are required, they should be included in the applicable principles of operation or testing and troubleshooting WP. Schematic diagram WPs shall include an introduction <**intro**>.

5.2.6 Operation data. Operating instructions shall be developed when the equipment is designed to be operated by a dedicated operator. The operation of support equipment shall be integrated into the testing (checkout) procedures using the support equipment. Operating instructions may also be developed to provide standard basic operating procedures when the equipment is used for testing or maintenance of multiple items (e.g., Automatic Test Equipment (ATE), hydraulic test stands, and portable or mobile power supplies).

5.2.6.1 Operating instruction work packages **<operwp>** (end item). These WPs shall contain step-by-step operating instructions for the equipment, including all safety precautions, covering the complete pre-operational to post-operational cycle. The procedures shall identify all normal and abnormal observations or indications and appropriate action to be taken. Supporting illustrations may be prepared, as necessary, to locate and identify all controls and indicators required to operate and monitor the equipment (see figure 6). All operating instruction WPs may have an introduction <**intro**>. The coverage shall include the technical procedures described below, as applicable. If necessary, for systems or equipment that have more than one method of operation or several modes of operation, the procedures described below can be repeated for each method or mode in the same WP.

a. Equipment preparation for use <**prepuse**>. As applicable, special procedures shall be prepared for unpacking, removing protective coatings, depreservation, and setting up equipment furnished in a partially assembled state. When the equipment is intended to be anchored or mounted in a fixed location and installed by a supporting facility, installation procedures are not required. If containers are to be used again, kept for future use, turned in to supply, or require special disposition method, the necessary procedures shall be prepared.

b. Pre-operational setup procedures <**preop**>. Pre-operational setup procedures, including pre-operation setup illustrations and initial switch settings to prepare the equipment for operation, if required.

c. Start-up procedures <**startup**>. Start-up procedures are normally part of the operating procedures or the pre-operational setup, but when lengthy, may be included as separate procedures.

d. Controls and indicator descriptions. To facilitate the operation procedures, a description and use of controls and indicators <**ctrlinddesc**> may be included for each equipment, assembly, or control panel having controls and indicators. Refer to 5.2.4.2.1.1 for controls and indicator description requirements. If controls and indicator descriptions are provided, they shall not be repeated within the aircraft systems, aeronautical equipment, and engine description WPs.

e. Built-in-test or self-test procedures <**bit-st-op**>. Procedures for testing the equipment when a built-in-test (BIT) feature or self-test capability is provided. These procedures are normally integrated into the operating procedures, but may be required as part of the pre-operational setup procedures. If this information is contained in another document, reference shall be made to the applicable document.

f. Operating procedures (normal sequence of operation) <**op-proc**>. Step-by-step procedures for operation of the equipment in normal sequence of operation. If this information is contained in a test program instruction or another TM, reference shall be made to the applicable document.

g. Emergency operation <**emerg-proc**>. Step-by-step procedures by "functional mode" or "emergency condition," detailing the operating procedures with proper warnings or cautions that can be performed without further damage to the equipment. The procedures shall identify any different indications or observations with appropriate actions to be taken. When the equipment should not be operated with a specific "functional mode(s)" or "emergency condition," this requirement shall be clearly identified with appropriate warning or caution.

h. Emergency shutdown procedures <**emshut-proc**>. Emergency shutdown procedures with cautions to be observed, including warnings as to safety of operations to prevent injury to operating personnel.

i. Post-operational shutdown procedures <**post-op-proc**>. Procedures to return the equipment to its normal configuration, prior to pre-operational setup, if required.

5.2.6.2 Software loading work packages <**softldwp**>. WPs shall be developed containing procedures for identifying, loading, initializing, and downloading of applicable operational and diagnostic software (see figure 7). Identification of the software shall include the purpose, configuration applicability, and version information. Procedures that verify that the proper software has been loaded and is operating properly shall also be included. All software loading WPs may have an introduction <**intro**>.

6. NOTES

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

The notes in section 6 of MIL-STD-3001-1 apply to this Part.

A1-F18AC-GAI-000 **004 00**
1 August 1995

ORGANIZATIONAL MAINTENANCE

AIRCRAFT ARRANGEMENT

F18AC

Record of Applicable Technical Directives

TD Type/Number	TD Date	Title and EPC/RAMEC Number	Date Incorporated	Remarks
F/A-18 AFC-49	20 Feb 90	Sealed Lead Acid Battery, Addition of (ECP MDA-F/A-18-00074)	1 Feb 87	
F/A-18 AFC 54	1 Aug 92	Video Recording System Incorporation (ECP MDA-F/A-18-00027)	1 Feb 87	

1-1. GENERAL ARRANGEMENT.

1. Radome
2. Forward fuselage
3. Center fuselage
4. Aft fuselage
5. Wings

1-2. Radome. The radome (figure 1) spans from Y coordinate 60.50 to Y coordinate 128.50. It is a filament wound fiberglass/epoxy shell mounted on an articulated hinge to allow easy access to the radar set. It provides an electrically transparent window for transmission and receiving of radar signals.

1-3. Forward Fuselage. The forward fuselage (figure 1) spans from Y coordinate 128.50 to Y coordinate 383.00. The forward fuselage includes the following:

1. Windshield
2. Canopy
3. Cockpit
4. Leading edge extension
5. Nose landing gear

1-4. Windshield.

1-5. The windshield is the aerodynamic fairing for the cockpit and allows forward visibility for the pilot. The one-piece windshield is stretched acrylic attached to an aluminum frame. The frame is hinged to allow the windshield to rotate forward for instrument panel servicing.

1-6. Canopy.

1-7. The one-piece clamshell canopy is stretched acrylic attached to an aluminum frame. The F/A-18B and F/A- 18D canopy is 54 inches longer and 125 pounds heavier than the F/A-18A and F/A-18C canopy. The canopy may be opened and closed

1

FIGURE 1. Example of an aircraft arrangement work package.

either manually or electrically operating the canopy actuator. When closed, the F/A-18A and F/A-18C canopy is secured by three latches and a forward latch pin on each side. The F/A-18B and F/A-18D canopy is secured by four latches and a forward latch pin on each side.

1-8. Cockpit.

1-9. The F/A-18A and F/A-18C (figures 2, 3 and 4) have a single place cockpit. The F/A-18B and F/A-19D (figure 5) have a front and rear cockpit. These views are for familiarization purposes only.

1-10. Leading Edge Extension.

1-11. The leading edge extension (LEX) is a highly swept and cambered extension of the wing leading edge and provides added lift at high angles of attack. The boarding ladder is mounted in the left LEX (figure 1).

1-13. Center Fuselage. The center fuselage (figure 1) spans from y coordinate 383.00 to Y coordinate 557.50. The center fuselage includes the following:

1. Main landing gear
2. Air intake ducts
3. External stores stations
4. Fuselage fuel tanks
5. Airframe mounted accessory drive

1-14. Main Landing Gear.

1-15. The main landing gear is a lever design with an oleo shock absorber. The lever design provides a stable platform for aircraft carrier and shore based operations. The shock absorbs the energy from ground loads during landing and taxi operations.

2-1. WALK AREAS.

2-2. Maintenance personnel should walk only on designated areas shown. Protective shoe coverings should always be worn when walking on aircraft is necessary. Protective covers should be placed on walk areas during periods of high volume traffic. Portions of the flap and horizontal stabilator area may be used for walks, provided the applicable locks are installed. For ground protective devices (A1-F18AC-PCM-000).

3-1. MINIMUM STRUCTURAL ACCESS DOORS.

3-2. Some access doors are in an integral part of the aircraft structure. Any time the aircraft is subject to stress, these doors must be installed and/or closed. Procedures in A1-F18AC-LMM-000 that apply these requirements, reference the A1-F18AC-LMM-010.

FIGURE 1. Example of an aircraft arrangement work package - Continued.

A1-F18AC-GAI-000 004 00

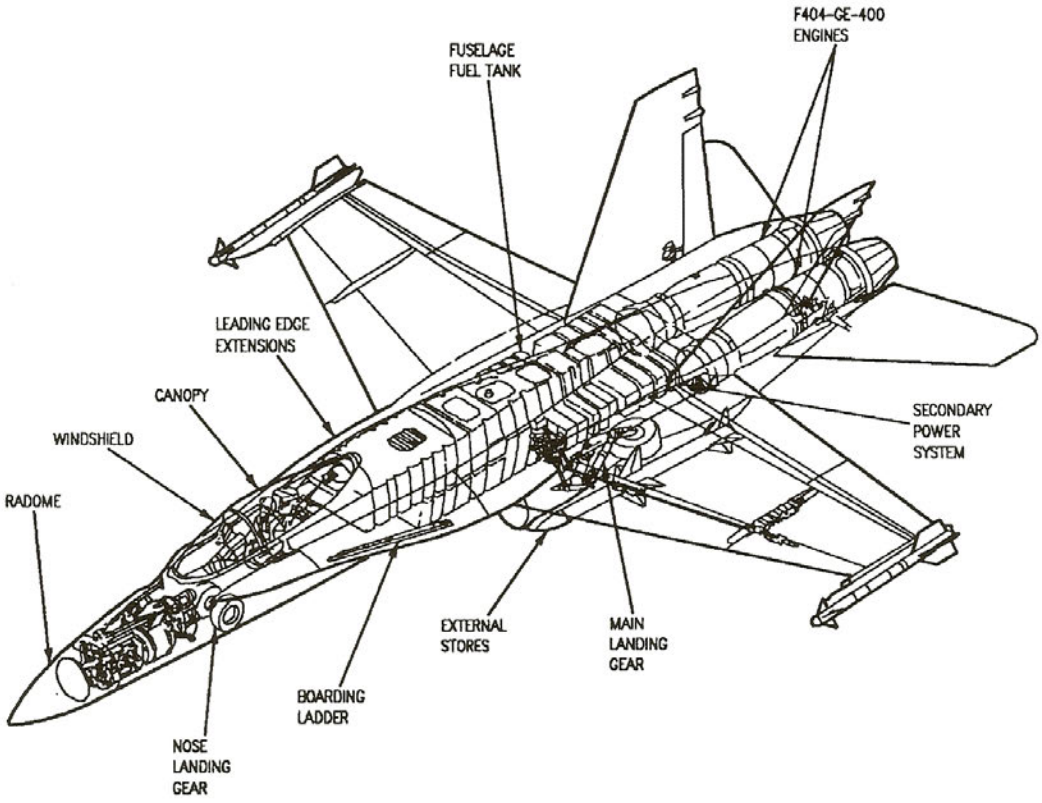

Figure 1. Aircraft General Arrangement

3/(4 blank)

FIGURE 1. Example of an aircraft arrangement work package - Continued.

A1-F18AC-GAI-000 **006 00**
1 August 1995

ORGANIZATIONAL MAINTENANCE
DANGER AREAS AND PRECAUTIONARY MEASURES
F18AC

Record of Applicable Technical Directives

TD Type/Number	TD Date	Title and EPC/RAMEC Number	Date Incorporated	Remarks
F/A-18 AFC-126	1 Oct 94	Addition of (DFIRS) Deployable Flight Incident Record Set (ECP 321R1C1)	1 Dec 92	
ACC 446 REV A	9 Jan 85	Parachute Harness Sensing Release Unit; Installation of (ECP CHINA LAKE-93)	1 Dec 86	

1-1. FLAMMABLE LIQUIDS, COMPRESSED GASES AND EXPLOSIVE DEVICES.

1-2. Areas including reservoirs of flammable liquids, gases under pressure, and explosive devices are shown in figure 1. Rescue and maintenance personnel should be aware of the hazards related to these areas.

2-1. CANOPY, SEAT AND DFIRS EXPLOSIVE DEVICES.

2-2. Many explosive devices (figure 2) are located in and around the crew station. The ejection seat(s) have rocket motors, initiators, and controls that require special handling during ground operations. The canopy has rocket motors, initiators, thrusters, and controls that also require special handling. Safety procedures are covered in A1-F18AC-PCM-000.

2-3. On 164725 and up; also 164627 thru 164724 after F/A-18 AFC 126, the DFIRS impact initiator, underwater initiator and the severable door (63L) are explosive devices. They do not require special handling during ground operations.

3-1. AIRFRAME AND EXTERNAL STORES.

3-2. External fuel tanks, vertical ejection racks, missile launchers and conventional/nuclear weapons (figure 3), loaded on wing or fuselage centerline pylons, may be ejected by explosive cartridges. The area near these devices must be considered hazardous for maintenance personnel when aircraft electrical power is on.

3-3. Missile exhaust area and path of trajectory are hazardous for personnel. An inadvertently fired missile can cause death or injury from either end.

3-4. The M61A1 or M61A2 gun projectile trajectory path is hazardous to personnel. Gun fire can cause death or injury.

3-5. Aircraft carrying munitions must be loaded, unloaded, and parked in designated explosives parking areas.

4-1. ENGINE.

4-2. Danger areas resulting from engine operation are related to exhaust velocity and temperature, air intake, and noise.

4-3. AIR INTAKE AND EXHAUST. During ground operation of the engines, the forward and aft ends of the aircraft are danger areas (figure 4). Inrushing air can pull a person into or against the intake ducts. Engine exhaust air can cause death or serious burns. The area immediately aft of the tail pipes is hazardous for 15 minutes after engine shutdown.

4-4. ENGINE NOISE HAZARD. The noise level of operating jet engines can cause hearing loss. Figure 5 shows relative noise levels at various distances from aircraft. Ear protectors must be worn when working near operating engines.

1

FIGURE 2. Example of a danger areas and precautionary measures work package.

5-1. RADAR ANTENNA.

5-2. When the radome is open and the radar system is operating (figure 6), personnel should be aware that the radar antenna can make sudden position changes and should stay 3 feet away from the antenna.

6-1. RADIATION.

6-2. Radar operations are the main source of radiation injury to personnel. All radio, countermeasures set, and radar transmitters (figure 6) are sources of rf energy. Radiation hazards are listed below.

1. Long exposure to rf energy at close range will cause personnel injury. High rf energy areas should be posted with warning signs.
2. Accidental firing of electroexplosive devices (EED) can result from rf energy radiated through an opening in the EED, or conducted through the firing leads.
3. Radiation may cause photoflash bulbs to go off, resulting in injury to personnel.
4. Radiation may cause sparking between metal surfaces such as a fuel hose nozzle and aircraft structure. The sparks may ignite fuel vapor.

7-1. PRECAUTIONARY MEASURES.

7-2. Personnel should not work in radiation fields of operating radar antennas.

7-3. All transmitting equipment should be turned off before bringing EED into the area.

7-4. Transmitters should not be operated within 500 feet of uninstalled EED.

8-1. AUXILIARY POWER UNIT (APU).

8-2. The following precautionary measures shall be observed when working with the APU.

8-3. Air Intake and Exhaust. Danger areas resulting from APU operations are shown in figure 7. The APU intake duct is in door 52. The APU exhaust duct is in door 66.

8-4. Noise Hazard. Noise levels near APU intake and exhaust ports during operation may cause hearing loss. Ear protection must be worn when working near an operating APU.

FIGURE 2. Example of a danger areas and precautionary measures work package - Continued.

A1-F18AC-GAI-000 006 00

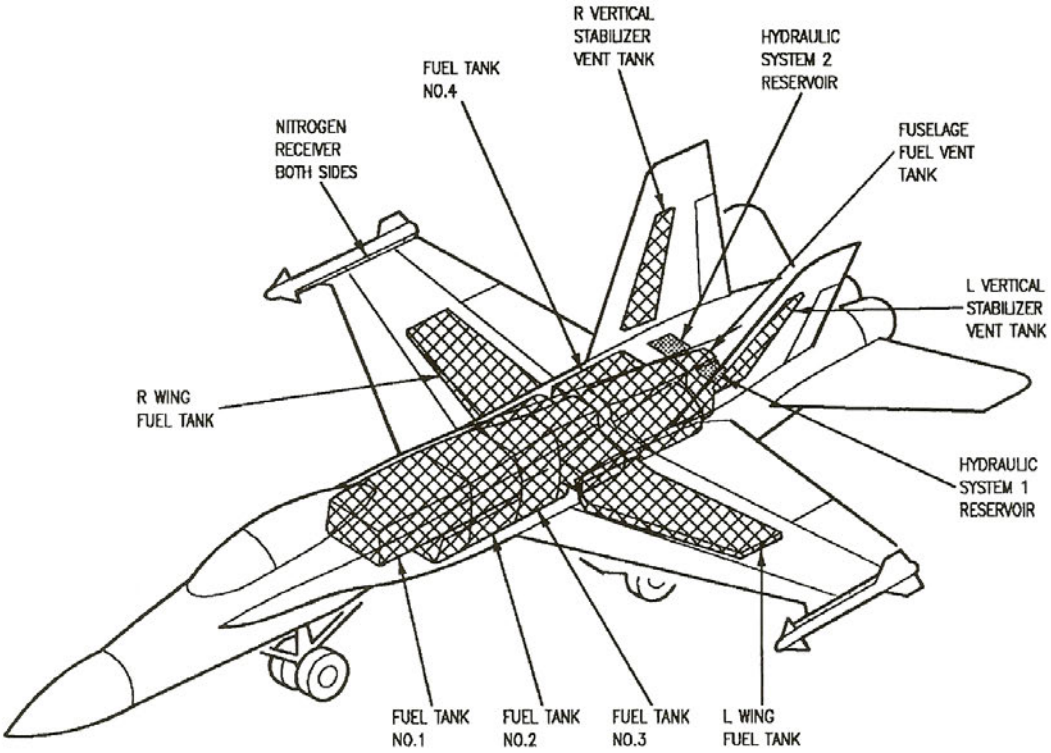

Figure 1. Flammable Liquids, Compressed Gases and Explosive Devices

3/(4 blank)

FIGURE 2. Example of a danger areas and precautionary measures work package - Continued.

A1–F18AC–600–100 **011 01**
1 May 1997

ORGANIZATIONAL MAINTENANCE

DESCRIPTION

ADF SYSTEM
161353 THROUGH 163782, 163985 THROUGH 164912, BEFORE F/A-18 AFC 185
This WP supersedes WP 008 00, dated 1 September 1993

Reference Material

ADF System Locator ..... WP 012 00
ADF System Operation — Simplified Schematic ..... WP 013 00

1-1. DESCRIPTION.

1-2. The description of the adf system is divided as listed below:

1. System Description
2. System Component
3. Related Systems
4. System Controls and Indicators

2-1. ADF SYSTEM.

2-2. The Direction Finder Set OA-8690()/ARD controls and indicators make up the automatic direction finder (adf) system. The adf system provides bearing to a station. The station is selected on vhf/uhf receiver-transmitter. The adf system sends bearing information to the mission computer system. The mission computer system uses adf information to position an adf bearing symbol on the HIS display. The bearing symbol position on the HIS display shows the bearing of the selected station in relation to aircraft position. The location of all system components is shown in figure 1.

2-3. DIRECTION FINDER SET OA-8697()/ARD. The direction finder operates in the 100 to 400 MHz frequency range. It has two sections. The antenna section receives and modulates rf signals. The audio processing section resolves the bearing of the adf audio received from vhf/uhf receiver-transmitter.

2-4. RELATED SYSTEMS. Related systems which interface with the adf system are:

1. VHF/UHF communication system
2. Mission computer systems

2-5. VHF/UHF Communication System.

2-6. VHF/UHF receiver-transmitter receives the rf from the adf system. The detected adf audio is returned to the adf system to determine adf bearing. The antenna selector is an rf switching unit that connects the adf system to either one of the vhf/uhf receiver-transmitters. The antenna selector automatically switches the vhf/uhf receiver-transmitter to the comm system antennas when keyed for transmission.

2-7. Mission Computer System.

2-8. The mission computer system uses adf information to position the adf bearing symbol on the HIS display. The HIS display shows bearing of the selected station in relation to aircraft position.

1

FIGURE 3. Example of an aircraft system, subsystem, and component description work package.

A1–F18AC–600–100 **011 01**

3-1. SYSTEM CONTROLS AND INDICATORS.

3-2. Operating controls and indicators are described in table 1. Cockpit displays are shown in table 2.

Table 1. System Controls and Indicators

CONTROL/INDICATOR	FUNCTION
Electronic Equipment Control	
a. ADF switch	
1	1. Connects direction finder to vhf/uhf receiver-transmitter no. 1.
	2. When squelch is selected on electronic equipment control (equipment control) for vhf/uhf receiver-transmitter no. 1, automatically disables squelch.
	3. Enables bandwidth control circuit in vhf/uhf receiver-transmitter no. 1.
	4. Turns on power to direction finder when GND PWR control panel assembly 2 switch is set to B ON.
2	1. Connects direction finder to vhf/uhf receiver-transmitter no. 2.
	2. When squelch is selected on equipment control for vhf/uhf receiver-transmitter no. 2, automatically disables squelch.
	3. Enables bandwidth control circuit in vhf/uhf receiver-transmitter no. 2
	4. Turns on power to direction finder when GND PWR control panel assembly 2 switch is set to B ON.
OFF	Turns off power to direction finder.
NOTE	
On F/A-18B 161354 thru 161360, COMM 1 or COMM 2 VOL controls on the equipment control and rear equipment control must be turned on in order for vhf/uhf receiver-transmitter equipment control comm option displays to appear.	
b. COMM 1 VOL control	Controls adf audio volume when direction finder interfaces vhf/uhf receiver-transmitter no. 1.
c. COMM 2 VOL control	Controls adf audio volume when direction finder interfaces vhf/uhf receiver-transmitter no. 2.
d. COMM 1 channel selector	Selects channel of station to which adf bearing is required when direc- tion finder interfaces vhf/uhf receiver-transmitter no. 1.
e. COMM 2 channel selector	Selects channel of station to which adf bearing is required when direc- tion finder interfaces vhf/uhf receiver-transmitter no. 2.

2

FIGURE 3. Example of an aircraft system, subsystem, and component description work package - Continued.

A1–F18AC–600–100 **011 01**

Table 2. Cockpit Displays

INDEX NO.	NOMENCLATURE	REF DES
1	GND PWR CONTROL PANEL ASSEMBLY	1A-H004
2	ELECTRIC EQUIPMENT CONTROL	79A-J006
3	LEFT DIGITAL DISPLAY INDICATOR	80A-H001
4	RIGHT DIGITAL DISPLAY INDICATOR	80A-J002
6	INTERCOMMUNICATION AMPLIFIER-CONTROL	76A-H009
7	COMM RECEPTACLE	76J-H016
8	RIGHT THROTTLE GRIP	52A-H048

3

FIGURE 3. Example of an aircraft system, subsystem, and component description work package - Continued.

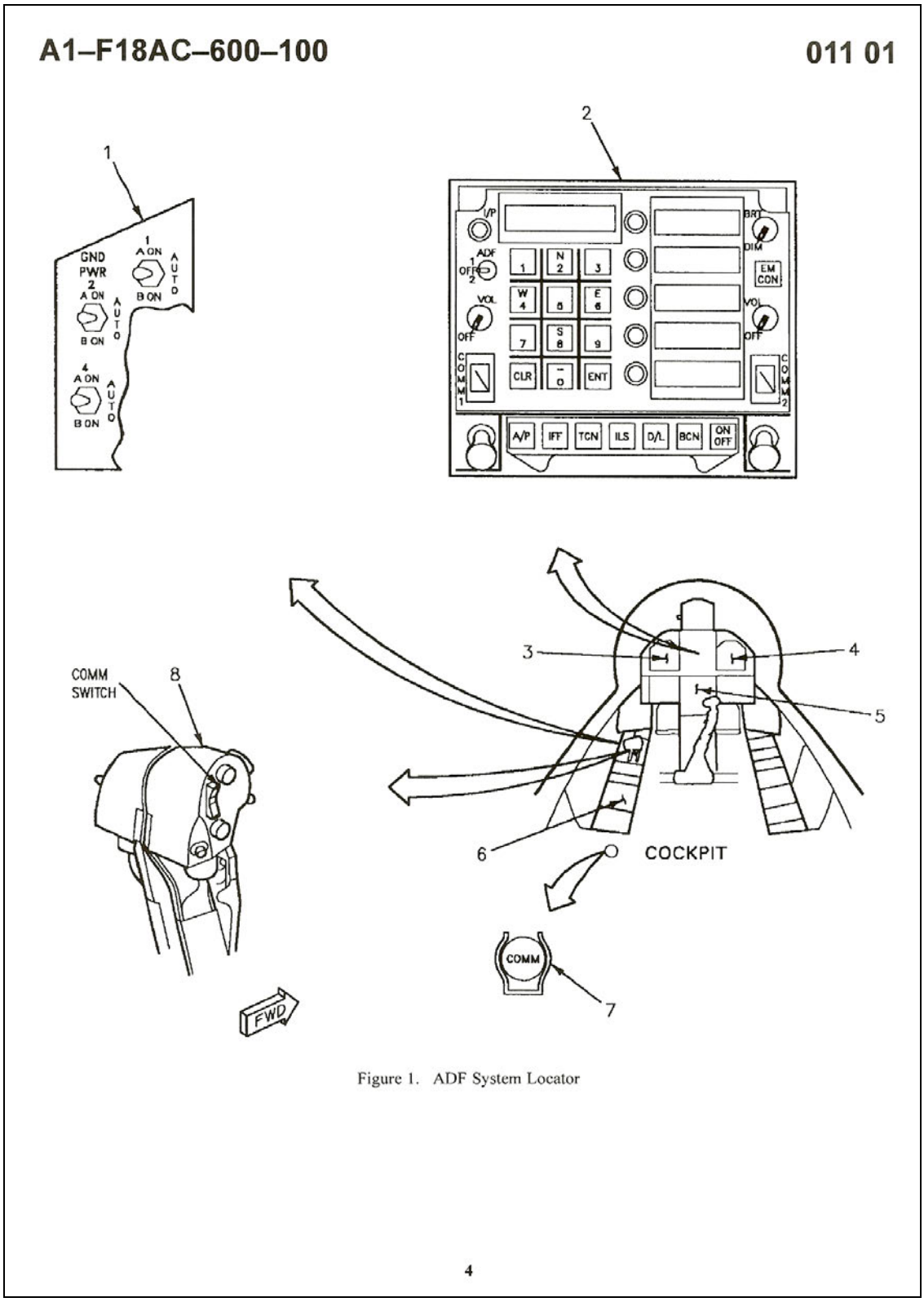

Figure 1. ADF System Locator

4

FIGURE 3. Example of an aircraft system, subsystem, and component description work package - Continued.

A1–F18AC–600–100 **012 00**
15 May 1997

ORGANIZATIONAL MAINTENANCE

PRINCIPLES OF OPERATION

ADF SYSTEM
161353 THROUGH 163782, 163985 THROUGH 164912, BEFORE F/A-18 AFC 185
This WP supersedes WP 011 00, dated 1 September 1993.

Reference Material

1-1. OPERATION.

1-2. The operation of the adf system is divided as listed below:

1. Sequence of Operation
2. Functional Operation

2-1. SEQUENCE OF OPERATION.

2-2. To start adf operation, apply aircraft electrical power. See table 1, GND PWR control panel assembly. On electronic equipment control (equipment control), set ADF switch 1 or 2 depending on which vhf/uhf receiver-transmitter is desired for adf operation. When adf 1 or 2 is selected, squelch is automatically deselected. Set the COMM 1 or COMM 2 VOL control to midposition and set the COMM 1 or COMM 2 channel selector to a channel for adf bearing. New adf frequencies can be entered using the equipment control. Refer to vhf/uhf communication system, sequence of operation, WP 003 00. On F/A-18B 161354 thru 161360, the COMM 1 or COMM 2 VOL controls on the equipment control and rear equipment control must be turned on for vhf/uhf receiver-transmitter equipment control comm option displays. To display the adf bearing marker (figure 1), turn on the Multipurpose Color Display IP-1535/A or Horizontal Indicator IP-1350/A. The adf bearing marker appears on the HSI display when the direction finder receives a signal.

2-3. FUNCTIONAL OPERATION. For simplified schematic, refer to figure 1. The adf system functional operation is divided into six functions:

1. Power
2. System Activation
3. ADF RF Signal Reception
4. Audio Signal Processing
5. Bearing Processing
6. Bearing Hold Processing

2-4. POWER. A synchro reference voltage (26vac, C) from no. 2 circuit breaker panel assembly is sent to the direction finder and to the control-converter. On 161353 thru 161359, the direction finder also receives 28vdc from no. 2 circuit breaker panel assembly. On 161360 and up, the direction finder also receives 28vdc from no. 4 circuit breaker panel assembly. This voltage is routed through the contacts of ground power relay no. 5, 1K-F057, to the direction finder. When 26vac, phase C and 28vdc voltage exist, the direction finder is ready for activation.

1

FIGURE 4. Example of an aircraft weapon system principles of operation work package.

A1–F18AC–600–100 **012 00**

2-5. SYSTEM ACTIVATION. The adf system is activated by the adf on signal (ground). The ground is provided by setting the ADF switch to 1 or 2 on equipment control. Setting the ADF switch to 1 or 2 enables the 28vdc to the direction finder power supply and enables bandwidth control circuits in the vhf/uhf receiver-transmitter. It also provides adf select signals to the mission computer system and antenna selector and disables the squelch on the selected vhf/uhf receiver-transmitter.

2-6. The adf select signal to the antenna selector connects the direction finder to vhf/uhf receiver-transmitter no. 1 when adf switch is set to 1. Setting the adf switch to 2 connects the direction finder to vhf/uhf receiver-transmitter no. 2. The mission computer system uses the adf select signal to compute the adf bearing marker on the HSI display.

2-7. ADF RF SIGNAL RECEPTION. ADF system activation enables reception of rf signals by the adf antenna section of the direction finder. The rf is modulated at the rotation frequency of the antenna and sent to the antenna selector. From the antenna selector the rf is routed to the vhf/uhf receiver-transmitter. The vhf/uhf receiver- transmitter, tuned to a station, detects the modulated rf and sends unattenuated audio and adf audio to the intercommunication amplifier-control.

2-8. AUDIO SIGNAL PROCESSING. The intercommunication amplifier-control processes the audio received from the vhf/uhf receiver-transmitter. The unattenuated audio is routed to the headsets (pilot, instructor, or ground crew) for an audio indication of adf signal reception. The adf audio is amplified and routed to the direction finder for resolving bearing information contained in the signal.

2-9. BEARING PROCESSING. Bearing information in the adf audio is resolved by the direction finder. The resolved adf bearing signal (bearing X, Y and Z) is sent to the control-converter for processing. The control-converter tests adf bearing validity and provides adf valid and adf bearing signals to the digital data computer no. 1.

2-10. The digital computer receives the adf information from the control-converter and does the computation required to put the adf bearing marker on the HSI display. The adf bearing marker (figure 1) position on the display shows the bearing of the adf signal source in relation to the aircraft position.

2-11. BEARING HOLD PROCESSING. If during adf operation the pilot or instructor keys either vhf/uhf receiver-transmitter, a bearing hold signal is produced by the amplifier-control. The bearing hold signal is sent to the digital computer through the control-converter. The bearing hold signal is used by the digital computer and the control-converter to hold the previous (before keying) adf bearing symbol position on the HSI display. Unkeying of the vhf/uhf receiver-transmitter causes adf operation to revert to normal bearing processing.

2

FIGURE 4. Example of an aircraft weapon system principles of operation work package - Continued.

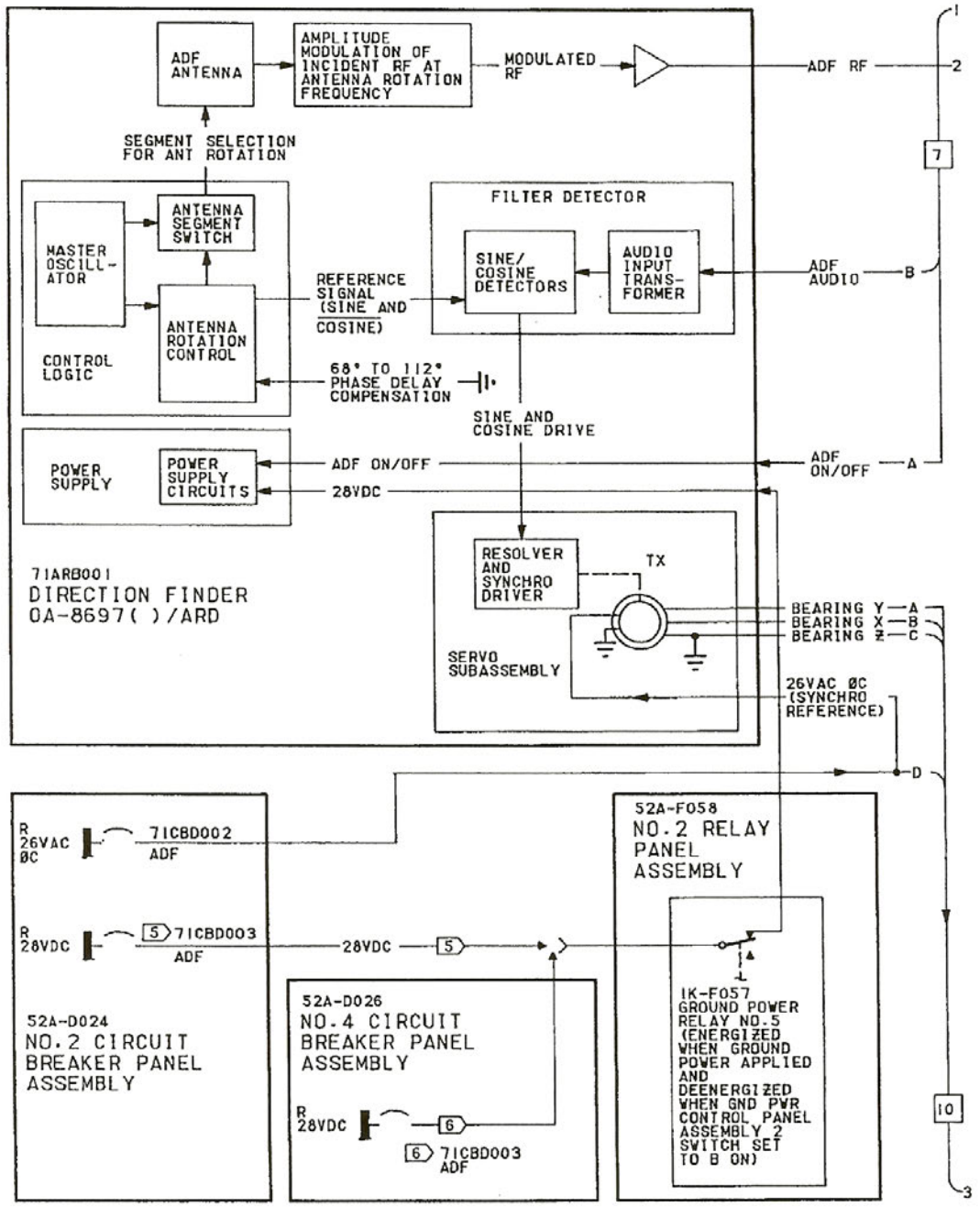

Figure 1. ADF System Simplified Schematic

3/(4 blank)

FIGURE 4. Example of an aircraft weapon system principles of operation work package - Continued.

NAVAIR 16-30USM449-5-50 **003 00**
1 July 1996

INTERMEDIATE MAINTENANCE

DESCRIPTION AND PRINCIPLES OF OPERATION

REFERENCE POWER SUPPLIES A2B4, A2B5
PART NUMBER 59822-40850-20

Reference Material

BIT 488-B Digital Programming Card Instruction Manual	NAVAIR 16-45-6126-16
IEEE-488 Standard Digital Interface for Programmable Instruction	IEEE-STD-488-1978
Model BOP 20-10M Bipolar Power Supply Instruction Manual	NAVAIR 16-45-6162-15

1-1. INTRODUCTION.

1-2. This work package provides information necessary for proper maintenance of Reference Power Supplies A2B4 and A2B5. This information includes a description and principles of operation.

2-1. DESCRIPTION.

2-2. Reference Power Supplies A2B4 and A2B5 are both located in Equipment Cabinet A2B. Reference Power Supply A2B4 provides the reference A high and low voltages, and Reference Power Supply A2B5 provides the reference B high and low voltages.

2-3. Each reference power supply consists of two identical bipolar operational (BOP) power supplies equipped with auxiliary digital programming cards and two identical switching power supplies mounted on a panel assembly.

2-4. Two BOP power supplies (PS1 and PS2) within each assembly provide the voltages that are used by the stimulus circuits within the Digital Test Station (DTS) to drive the unit under test (UUT). The BOP power supplies are programmable to provide a reference voltage between –20 and +20 vdc with a maximum voltage difference of 20 vdc.

2-5. Two switching power supplies (PS3 and PS4) within each reference power supply are used to provide a 5-volt signal in addition to the reference voltages produced by BOP power supplies PS1 and PS2.

2-6. Resistors R1 through R6 provide local sensing in the event that remote sensing is lost.

3-1. PRINCIPLES OF OPERATION.

3-2. BIPOLAR OPERATIONAL POWER SUPPLIES.

3-3. Figure 1 is a schematic diagram of Reference Power Supplies A2B4 and A2B5, and figure 2 is a block diagram of BOP power supplies PS1 and PS2 that are located within each assembly. Each BOP power supply consists of six internal power supplies: the –20 to +20 vdc programmable main dc power supply, +15-volt power supply, +15-volt power supply, +10-volt reference power supply, +12-volt power supply, and a driver collector power supply.

3-4. The dual dc source voltages for the main dc power supply are obtained from the center-tapped secondary windings of the main transformer. They are then bridge-rectified and smoothed by capacitor filters before being applied to two groups of series/parallel connected NPN/PNP power transistors at the output power stage and made available at terminal block TB201 on the rear of the supply chassis. The output power is driven by PNP/NPN power transistors with their base series resistors mounted onto a common heat sink. The secondary windings on the auxiliary transformer produce the dual dc voltages for the driver collector power supply. The driver collector power supply bridge-rectifies and filters the dc source voltages for the power transistor collectors.

1

FIGURE 5. Example of an aeronautical equipment, airborne weapons/equipment, and support equipment principles of operation work package.

3-5. BOP power supply PS1 and PS2 output power is interfaced to the DTS through connector J2; the sense lines for these power supplies interface through connector J5.

3-6. The BOP power supply front panel light emitting diode (LED) indicators and the digital integrated circuits for the voltage/current limiting circuitry are powered by the +15-volt supply. This is a single positive dc source originating from the secondary windings of the auxiliary transformer. The dc source is bridge-rectified and filtered through a capacitor to remove noise. The filtered voltage is then stabilized by a voltage regulator and filter capacitor before being applied to the digital components.

3-7. The linear integrated circuits within the BOP power supplies are powered by the +15-volt power supply, which is a dual dc source originating from the secondary windings of the auxiliary transformer. The dc source is bridge-rectified and filtered through capacitors to remove noise. The filtered voltages are then stabilized by a voltage regulator and filter capacitor before being applied to the linear components.

3-8. SWITCHING POWER SUPPLY.

3-9. AC power is applied to the switching power supply (figure 3) via wires connected to ac input power connector J1. AC power is applied to a bridge rectifier via two suppression chokes. After the power is rectified and filtered, it is applied to a regulator, which is part of a pulse width modulation circuit that transmits on and off pulses to a transformer. These pulses energize the transformer, which, in turn, supplies power through several filters to a filter choke and two diodes (a series diode and a flyback diode) at the output. During the on time, power is supplied to the outputs through the series diode while the filter choke stores up energy. During the off time, the series diode turns off and the flyback diode conducts to supply power to the output from the filter choke.

3-10. Output power from power supplies PS3 and PS4 is interfaced to the DTS through connectors J3 and J4. The sense lines for these power supplies interface through connector J5

FIGURE 5. Example of an aeronautical equipment, airborne weapons/equipment, and support equipment principles of operation work package - Continued.

AT-820FT-S78–010 **005 00**
15 January 1995

INTERMEDIATE MAINTENANCE

OPERATION INSTRUCTIONS

INTERMEDIATE AVIONICS TEST SET
PART NUMBERS 74D050000-1001, -1003, -1005, -1009, -1027

Reference Material

Intermediate Avionics Test Set AN/ASM-686 Aircraft Simulator..... AT-820FT-S78-030
Intermediate Avionics Test Set AN/ASM-686 Avionics Fault Tree Analyzer..... AT-820FT-S78-020

1-1. INITIAL CONTROL SETTING.

1-2. Set controls in accordance with table 1.

Table 1. Initial Control Position

CONTROL	POSITION
INPUT POWER DRAWER	
115VAC 600 Hz MAIN POWER circuit breaker	OFF
115VAC 400 Hz AFTA POWER circuit breaker	OFF (74D053000-1001, -1003, -1005, AND -1009)
115VAC 400 Hz WRA POWER circuit breaker	OFF
28VDC WRA POWER circuit breaker	OFF
COCKPIT SIMLUATION DRAWER	
SYSTEM POWER switch	STANDBY
WRA POWER switch	OFF
WRA COOLING switch	OFF

2-1. START-UP PROCEDURE.

2-2. To begin operation of IATS AIRISM, do the substeps below:

1. Lift switch cover and turn on the 115VAC 60 Hz MAIN POWER circuit breaker, located on the Input Power Drawer Assembly, to apply power to the system. The cooling fans should turn on.

NOTE

If testing does not require the use of AFTA, proceed to step 3.

2. On 74D053000-1001, -1003, -1005, and -1009, lift switch cover and turn on the 115VAC 400 Hz 3 Phase AFTA POWER circuit breaker, located on the Input Power Drawer Assembly, to apply power to the AFTA.

3. Lift switch cover on the 115VAC 400 Hz 3 Phase WRA POWER circuit breaker, located on the Input Power Drawer Assembly, to apply power to the UUT Interface Drawer for distribution to the WRA under test.

4. Lift switch cover and turn on the 28VDC WRA POWER circuit breaker, located on the Input Power Drawer Assembly, to apply power to the UUT Interface Drawer for distribution to the WRA under test.

1

FIGURE 6. Example of an operating instruction work package.

AT-820FT-S78–010 **005 00**

5. On 74D053000-1001, wait for the 115VAC 400 Hz, and 28VDC WRA POWER MONITOR lamps to illuminate indicating power tolerance.

6. On 74D053000-1003, -1005, -1009 and -1027 wait for the 115VAC 400 Hz, and 28VDC WRA POWER MONITOR lamps, located on both the AIRSIM and HALF RACK, to illuminate, indicating proper tolerance.

7. Apply system power by pressing the SYSTEM POWER switch, located on the Cockpit Simulation Drawer, until the switch illuminates OPERATE.

8. Apply WRA power by pressing the WRA POWER switch, located on the Cockpit Simulation Drawer, until the switch illuminates ON

9. If required, apply WRA cooling power by pressing the WRA COOLING switch, located on the Cockpit Simulation Drawer, until the switch illuminates ON.

10. On 74D053000-1001, after system power is applied, the operating system retrieves the proper program and the main menu appears indicating that the AIRSIM is ready for use. Refer to tables 2 thru 4 for startup, tables 7 and 8 for EBIT and operating menu readouts.

Table 2. Spin Up Menu

	AIRSIM BOOT PROM Vx.xx 2	
	COPYRIGHT <C> 3	
	MCDONNEL DOUGLAS CORP.	
	ALL RIGHTS RESERVED	
(TIME)	<WAITING FOR DISK TO SPIN	ABORT
(DATE)	UP>	

11. On 74D053000-1003, -1005, -1009 and -1027 after system power is applied, the operating system retrieves the proper program and asks the user if the Half Rack is required.

    a. If the Half Rack is required, or the operator does not answer the question within a specified period of time, the operating system will initialize the Half Rack and load the appropriate programs into the Half Rack computer.

    b. If the user answers no, then the main menu appears indicating that the AIRSIM is ready for use. Refer to tables 2 thru 8 for startup and operating menu readouts.

3-1. BUILT-IN TEST.

NOTE

Any text which is underlined on the plasma display may be selected and indicates that further instructions will follow.

1. Select the first page (PG 1) from the main menu.

2. Select EBIT from the page 1 menu.

2

FIGURE 6. Example of an operating instruction work package - Continued.

AT-820FT-S78–010 **005 00**

NOTE

The UTILITIES menu can also be selected to run certain disk and setup programs prior to WRA testing.

3. Select the desired EBIT test on the page 2 menu. Messages and results will be displayed while the test is in progress. Refer to tables 6, 7 and 8 for screen layout.

4-1. SHUTDOWN PROCEDURE.

4-2. After testing is complete or prior to disconnecting IATS AIRSIM from facility power, do the following:

1. Turn off WRA power by pressing WRA POWER switch, located on the Cockpit Simulation Drawer, until the switch illuminates OFF.
2. If operating, turn off WRA cooling by pressing WRA COOLING switch, located on the Cockpit Simulation Drawer, until the switch illuminates OFF.
3. Turn off system power by pressing SYSTEM POWER switch, located on the Cockpit Simulation Drawer, until the switch illuminates STANDBY.
4. Turn off the 28VDC WRA POWER circuit breaker, located on the Input Power Drawer, by lowering the switch guard.
5. Turn off the 115VAC 400 Hz 3 Phase WRA POWER circuit breaker, located on the Input Power Drawer, by lowering the switch guard.
6. On 74D053000-1001, -1003, -1005, and -1009 if AFTA power is on, turn off the 115VAC 400 Hz 3 Phase AFTA POWER circuit breaker, located on the Input Power Drawer, by lowering the switch guard.
7. Turn off the 115VAC 60 Hz MAIN POWER circuit breaker, located on the Input Power Drawer, to remove all power from the IATS AIRSIM.

5-1. EMERGENCY SHUTDOWN PROCEDURE.

1. On 74D053000-1001, -1003, -1005, and -1009, if the IATS must be shut down during normal operation to prevent damage to equipment or personnel, the 115VAC MAIN POWER circuit breaker and the 115VAC AFTA POWER circuit breaker, located on the Input Power Drawer, may be shut off by lowering the switch guard. Turn off all other circuit breakers before reapplying 115VA MAIN POWER.
2. On 74D053000-1027, if the IATS must be shut down during normal operation to prevent damage to equipment or personnel, the EMERGENCY STOP button on the Cockpit Simulation I drawer may be pressed. The circuit breakers will automatically trip to the off position.

3/(4 blank)

FIGURE 6. Example of an operating instruction work package - Continued.

NAVAIR 01–S3AAA–2–6–3 **007 00**
30 June 1988

ORGANIZATIONAL MAINTENANCE

SOFTWARE LOADING

S-3A AIRCRAFT

Reference Material

General Aircraft Information ..... NAVAIR 01-S3AAA-2-1
Electrical Power Application ..... WP 007 00

1-1. INTRODUCTION.

1-2. This WP provides the maintenance technician with the necessary information to initialize, load, and execute the System Test Program. Included in this work package is the PRE-POWER check list, avionics circuit breakers by system, TP load fault procedures, and pertinent safety precautions. Also tables and figures are provided where applicable.

2-1. POWER INITIALIZATION.

2-2. Perform PRE-POWER check outlined in table 1-1 upon entering aircraft.

WARNING

Do not connect external power before ensuring that sonobuoy safety switch is in open position, or during fueling, defueling, on-loading, or off-loading weapons. Before turning on electrical power, ensure that all electrical access panels are closed and personnel have been alerted that electrical power will be turned on.

CAUTION

Ground air conditioning must be applied (NAVAIR 01-S3AAA-2-1) if internal avionics is operated for longer than:

5 Min:	75 degrees without direct sun
	71 degrees with
1 Min:	78 degrees without direct sun
	74 degrees with
Continuous:	68 degrees without direct sun
	64 degrees with

If temperature can be measured in area between ADP and GPDC, the permissible temperature is 80 degrees (68 degrees ambient + 12 degrees rise in internal bay = 80 degrees).

1. Turn on electrical power (NAVAIR 01-S3AAA-2-1).
2. Ensure that appropriate circuit breakers on left and right circuit breaker panels are closed for tests to be run. Table 2 lists circuit breakers by system. Figures 1 through 4 show location of the circuit breakers.
3. On POWER CONTROL PANEL verify COMPUTER GROUP switch is OFF.

1

FIGURE 7. Example of a software loading work package.

4. Insert a TTC into DMTU and perform Avionics Initialization (table 3) for tests to be run.

3-1. STP PROGRAM LOAD PROCEDURES.

3-2. At TACCO station POWER CONTROL PANEL, momentarily operate COMPUTER RESTART switch to ON. When "SELECTION LOAD" is displayed, the following options are available:

SEL PROGRAM

1. OPERATIONAL
2. OPERATIONAL CONT
3. IFSTP
4. SYSTEM TEST
5. GPDC DIAG RECYCLE
6. TAPE COPY

NOTE

To ensure GPDC has attempted all possible load paths, wait 5 minutes after initiating RESTART for SELECTION LOAD cue before reinitiating RESTART switch. If SELECTION LOAD is not displayed within 5 minutes, refer to Paragraph 6-8 (NO SELECTION LOAD).

1. Select SYSTEM TEST by depressing numeric key 4 and ENTER on TACCO, SENSO, or Copilot INCOS. The following cue will be displayed:

SELECTION LOAD
GPDC DIAG LOAD
DISPLAYS GOING BLANK
FOR UP TO 250 SEC

NOTE

If an STP Load failure occurs or the GPDC Diagnostic fails, record the fault isolation data and refer to paragraph 6-10 or 6-12 for verification and possible work around.

6-1. TRANSMISSION ERRORS.

6-2. A transmission error occurs when the GPDC receives an illegal response from a peripheral. The total count of transmission errors is displayed at completion of a SAT. An excessive number is indicative of an impending inability to communicate properly with the General Purpose Digital Computer (GPDC).

FIGURE 7. Example of a software loading work package - Continued.

CONCLUDING MATERIAL

Custodian:
Navy - AS

Preparing activity:
Navy - AS
(Project TMSS-2014-015)

NOTE: The activity listed above was interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.