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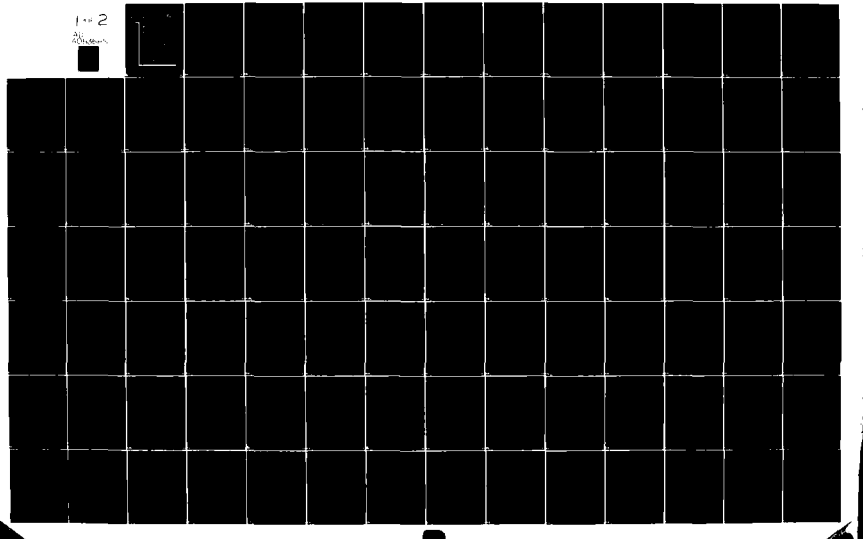

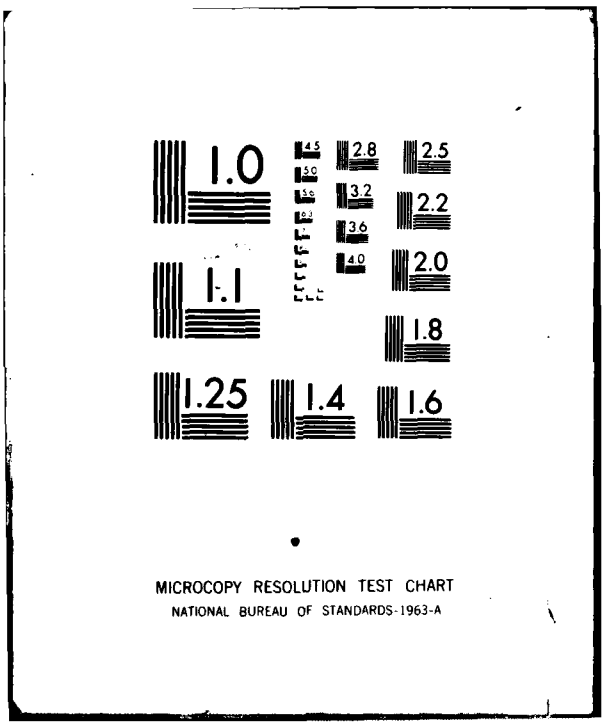
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AIR FORCE HUMAN RESOURCES LABORATORY

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MAINTENANCE TASK IDENTIFICATION AND ANALYSIS:

ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE

By

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January 1980

Final Report

Approved for public release; distribution unlimited.

AIR FORCE SYSTEMS COMMAND
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This final report was submitted by the Management and Technical Services Company, P.O. Box 7507, Philadelphia, Pennsylvania 19101, under contract F33615-78-C-0015, project 1710, with Advanced Systems Division, Air Force Human Resources Laboratory (AFSC), Wright-Patterson Air Force Base, Ohio 45433. SMSgt Robert C. Guy (ASR) was the Contract Monitor for the Laboratory.

This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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Advanced Systems Division

RONALD W. TERRY, Colonel, USAF
Commander

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logic tree troubleshooting aids	quality assurance	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides a draft military specification for use by Air Force and other DoD agencies in specifying the requirements for maintenance task identification and analysis (MTI&A). Several new types of technical data, such as job guide manuals (JGMs) and logic tree troubleshooting aids (LTTAs), have been adopted for use by the Air Force. The development of accurate and effective JGMs and LTTAs requires that a thorough MTI&A be accomplished to prepare the data base from which JGMs and LTTAs are developed. At present there is no suitable specification available to establish MTI&A requirements for use in procuring JGMs and LTTAs. The draft specification was developed to fill this need.

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A thorough review of the state-of-the-art in performing the MTI&A was accomplished to provide the basis for developing the draft specification. This was accomplished by first reviewing the literature in the area and then conducting extensive interviews with government and industry personnel who are knowledgeable of and experienced in current MTI&A procedures. Interviews were conducted with industry personnel who have had experience in conducting research to develop MTI&A procedures, and with personnel who have had experience in managing and conducting MTI&A programs. Interviews were also conducted with Air Force and Army personnel who have had experience in procuring MTI&A based technical data. The results of the literature review and interviews were analyzed and used to provide the basis for developing the MTI&A requirements included in the specification.

The draft specification requires that the contractor accomplish specific tasks to insure that all required maintenance tasks are identified and that all information required to prepare effective JGMs and LTTAs is developed. The tasks include the development of (a) a task identification matrix to identify all required tasks and specify the level of maintenance (intermediate, organizational, depot) at which they are to be performed, (b) a description of the intended user (abilities, training, experience), (c) listings of required support equipment and special tools, (d) guidelines for determining the level of detail to be included in JGMs and LTTAs, (e) an analysis of possible equipment faults and resulting symptoms, (f) effective step-by-step procedures for accomplishing each task, and (g) action trees outlining a troubleshooting strategy to isolate each possible fault. A special section is provided for accomplishing the MTI&A for systems for which Logistic Support Analysis data are available. The draft specification is suitable for the procurement of MTI&A for organizational and intermediate levels of maintenance. The specification establishes firm requirements for conducting the MTI&A but allows the contractor considerable freedom in how he accomplishes the analysis. The specification may be used to procure MTI&A for the development of a data base for use in developing other types of manuals.

PREFACE

This draft, dated November 1979, prepared by Management and Technical Services Company (MATSCO) as agent of Air Force Human Resources Laboratory, has not been approved and is subject to modification. Contract No. F33615-78-C-0015.

The authors express their appreciation to SMSgt E. G. McFall, AFHRL, for his guidance and support throughout the project and to his successor at AFHRL, SMSgt R. Guy. Appreciation is also extended to Mr. Robert Johnson and Dr. Donald T. Thomas, both of AFHRL, for their knowledgeable consultation and guidance during the project. Special recognition is also due to the research efforts of MATSCO's Mr. Fred Scheurer and Mr. Lew Frazier, and to the informative support of Mr. Leonard Mancini, Manager of MATSCO-TDS at Valley Forge, PA.

The draft specification was developed after research early in the project and the authors express their appreciation to those personnel at military bases and industrial firms who contributed important knowledge and ideas to the study. They are:

Dr. John Foley - AFHRL Brooks AFB, San Antonio, Texas

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DRAFT MILITARY SPECIFICATION FOR MAINTENANCE TASK IDENTIFICATION AND ANALYSIS: ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE

1. SCOPE

1.1 Scope. This specification defines the requirements for the content and format of Maintenance Task Identification and Analysis (MTI&A) to be used as a basis for subsequent preparation of Organizational and Intermediate level Job Performance Aids (JPA) called Job Guide Manuals (JGM) and Logic Tree Troubleshooting Aids (LTTA), as well as other types of technical manuals. As used in this specification "maintenance task identification," also referred to as "task identification," means the ascertainment and itemization of the troubleshooting tasks required to maintain a system, subsystem, or equipment at the *Organizational and Intermediate levels.* "*Maintenance task analysis,*" or "task analysis," means the analysis of the identified task to determine what the task consists of, what is needed to perform it, and how it should be performed. The end results of the identification and analysis efforts, as well as certain intermediate stages of development, are recorded in a manner (specified herein) that will permit the information to be: (1) easily understood and applied during the Job Performance Aid preparation phase; (2) to be checked for accuracy and adequacy; and (3) to be updated as needed.

1.2 Application. This specification applies to all classes of equipment: electrical, electronic, mechanical, hydraulic, pneumatic, optical, and combinations of these. This specification shall be used by both Contractor and Government activities performing MTI&A. As used in this specification, the term contractor includes, in addition to private organizations, any Government activity performing any of the analyses specified herein. Maintenance task analysis can be an important preparatory phase to developing types of manuals other than Job Performance Aids. Therefore, its use should be considered for manuals such as the Functionally Oriented Maintenance Manual (FOMM) and other conventional maintenance manuals. This specification applies to all types of activities, systems, and equipments, including those in which the maintenance concept terminology differs somewhat from terms used herein. For example, this specification is equally appropriate for systems in which maintenance activities are categorized as "on-equipment" and "off-equipment," as delineated in AFR 66-5, Production Oriented Maintenance Organization, and AFR 66-14, Equipment Maintenance Policies, Objectives, and Responsibilities.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. Unless specified otherwise in the contract the following documents, of the issue in effect on the date of the invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

MILITARY

MIL-M-38784	Manuals, Technical: General Style and Format Requirements
MIL-M-38800 (USAF)	Manuals, Technical: Organizational Maintenance Instructions
MIL-M-83495 (USAF)	Manuals, Technical, Organizational Maintenance Manual Set: General Requirements for Preparation of
AFHRL-TR-79-49	Manuals, Technical: Logic Tree Troubleshooting Aid (LTTA)
MIL-I-45208	Inspection System Requirements
MIL-Q-9858	Quality Program Requirements
MIL-STD-863	Preparation of Wiring Diagrams and System Schematic Diagrams

STANDARDS:

MIL-STD-1388-1 and -2	Logistic Support Analysis
MIL-STD-785	Reliability Program for Systems and Equipment Levelopment and Production
MIL-STD-882A	System Safety Program Requirements

INDUSTRY

ANSI Y32.16	Reference Designations for Electrical and Electronics Parts and Equipments

(Copies of the above documents may be obtained from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.)

3. REQUIREMENTS

3.1 General requirements. The intent of this specification is to define the analyses required to be performed as part of MTI&A and to provide guidelines for content, preparation and use of the products of those analyses. The specific details and methods by which the analyses are actually developed are less important than the effectiveness and thoroughness with which they are carried out and the usefulness of the final results. A number of "products" are prepared to document the analysis. These products then become the criteria for the content, structure, and completeness of the JPAs, to be used as planning documents and source data during JPA development and as checks on JPA completeness later on.

3.1.1 Relationship to Job Performance Aids. Job Performance Aids (JPAs) are technical manuals that provide complete, step-by-step instructions. They permit relatively inexperienced maintenance technicians as well as those who are more experienced to perform the specific tasks required to maintain a system in the field. Job Guide Manuals and Logic Tree Troubleshooting Aids are types of JPA manuals that contain non-troubleshooting and troubleshooting procedures, respectively, for Organizational and Intermediate level maintenance. The development of JPAs requires a rational, systematic means of first identifying the job tasks and then determining the scope, content, method of performance and other details of the tasks. MTI&A provides this means by a systematic process of data collection, analysis, and decision making. Essentially, the analysis answers these questions: What tasks are required? Which tasks should be included in the JPA? At what maintenance level should they be performed? What are the preconditions? What support equipment is needed? What instructions must be provided for its use? What are the most efficient, understandable steps for the technician to follow when performing a troubleshooting or non-troubleshooting task? And, what follow-on maintenance is needed? The more complete, accurate, and understandable the analysis, the more useful is the JPA. The validity of the MTI&A, and therefore of the subsequent JPA, is assured by the following key requirements for MTI&A development:

a. Use of the actual equipment in representative configuration for 'hands on' analysis of maintenance tasks

b. Early identification and definition of the user population and its information needs

c. Use of the same logistics data base and analyses that are used for other logistics purposes, thereby assuring commonality and eliminating redundant effort

d. Early and continuing evaluation and guidance through contractor Quality Assurance (QA) and Government in-process reviews

e. Timely update to accommodate modifications/changes to equipment or software and to correct errors

f. Thoroughness of the effort and skills and experience of those performing the analysis

3.1.2 Relationship to other manuals. MTI&A may be applied to development of other types of technical manuals as well as to JPAs, and its use for this purpose is encouraged. When MTI&A is used as a basis for conventional technical manual development, the major difference is the degree of detail required, particularly in the task detail analysis. A further use of MTI&A is as a tool for evaluating existing technical manuals, ascertaining that all needed maintenance tasks have been covered, and determining that the amount and kinds of detail are appropriate to the actual user population.

3.1.3 Task Analysis plan. The MTI&A for each program shall be designed to accommodate the unique objectives and conditions of that program. For this purpose, MTI&A planning is implemented by the procuring activity as an integral part of the technical manual acquisition program. The Task Analysis Plan shall reflect the program requirements as contained in the contract. It shall detail the contractor's plans for performing the MTI&A and for ensuring its quality, and shall contain as a minimum, the following information:

a. MTI&A products to be produced and description of their content and format

b. Analysis methods and procedures

c. Equipment plan (availability and use for hands-on development and validation of MTI&A) (see 4.6)

d. Proposed data sources

e. MTI&A/LSA coordination plan (see 3.5.1.1)

f. Qualifications of assigned analysis personnel

g. Quality Assurance plan (see 4.4.)

h. Schedules for in-process reviews, validation, delivery of MTI&A products, and User Profile definitization meeting

3.1.3.1 Approval of plan. The Task Analysis Plan shall be submitted to the procuring activity for review and approval as specified in the contract. The approved plan shall be used during the contract period for monitoring performance and as the definitive guide for conduct of the MTI&A effort.

3.1.4 Data items. MTI&A shall be performed for the subsystems/equipments and levels of maintenance (Organizational, Intermediate, or Organizational and Intermediate) specified in the contract. All of the MTI&A products listed in 3.1.4.1 shall be prepared as a minimum for the specified subsystems, in accordance with the reference paragraphs. The products listed in 3.1.4.2. shall be prepared only if specified by the procuring activity. Figure 1 depicts the interrelationships of the various mandatory and optional MTI&A analyses and products.

3.1.4.1 Mandatory products.

a. Task Identification Matrix (3.2.1.)

b. Definitized User Profile (3.3.1.2.)

c. Support Equipment Guide (3.3.2.1.)

d. Level-of-Detail Guide (3.3.3.)

e. Task Analysis Worksheets (3.3.4.1.)

f. Annotated Source Documents (3.4.2.1.)

g. Checkout Summary (3.4.2.2.)

h. Fault Symptom List (3.4.3.2.)

i. Action Trees (3.4.3.3.)

3.1.4.2 Optional products

a. Expanded TIM (if specified, prepared in lieu of Task Identification Matrix) (3.2.2.)

b. Task Identification Summaries (3.2.3.)

3.1.5 Data sources. Data sources used for MTI&A shall consist of written documents, interviews and observations. These sources are of two basic categories: (a) Government provided information, directions, policies, and concepts furnished in accordance with the contract and 6.2; and (b) data gathered or generated by the contractor under this and other Contract Data Requirements List (CDRL) data item requirements of the contract. Previously prepared MTI&A products covering like systems/equipment may be used for reference purposes to the extent that they are based on similar program requirements; approval for their use shall be obtained from the procuring activity. The elements of data listed in 3.1.5.3 and 3.1.5.4 shall be used as the principal data sources for MTI&A, but other valid sources that contain information in addition or supplementary to the principal sources may also be used. Documents shall be of the latest issue as of the time of MTI&A preparation.

3.1.5.1 Duplication of effort. Performance of MTI&A shall include searching out and making maximum use of valid existing data and analysis results from other sources, including concurrent contract data requirements such as Logistic Support Analysis Record (LSAR). However, MTI&A shall not duplicate any of the data gathering, analysis or decision-making efforts involved in producing these items. When such data are used, they shall be checked for adequacy and accuracy and validated for use in the intended MTI&A application in accordance with section 4. They shall be adapted and reorganized only to the extent necessary to meet the requirements of this specification.

3.1.5.2 Use of source data. Source documents and other data sources used for performance of MTI&A shall be considered only as reference information until proven to be valid as part of the analysis. The process of MTI&A requires that the informed judgment of trained task analysis personnel be applied to existing data to determine their validity for purposes of the particular analysis. The final results of the analysis are based on the experience, training, judgment, and ability of the analyst and the analyst's application of the maintenance concept to the subject system/equipment.

3.1.5.3 Developmental systems. The following elements of source data, as available, shall constitute the principal references for systems that are in a pre-operational phase:

a. LSAR (3.5.3.)

b. Design and engineering data (drawings, lists, specifications)

c. Support equipment requirements/recommendation data such as Aerospace Ground Equipment Recommendation Data (AGERD), and Ground Support Equipment Recommendation Data (GSERD)

d. Provisioning Parts Lists (PPLs)

e. Test specifications, test reports

f. Preliminary User Profile (3.3.1.1.)

g. Maintenance concept

h. Subject system equipments (mockups, prototypes, development models)

i. Photographs

j. Manufacturers'/vendors' literature for off-shelf equipment and assemblies

k. Technical Manuals for Government-Furnished Equipment (GFE)

l. Interviews with designers, engineers, maintenance specialists.

3.1.5.4 Operational systems. The following data sources, as available, shall be used as principal references for operational systems, in addition to those listed in 3.1.5.3:

a. Organizational and Intermediate Maintenance Manuals, Manual Changes, and Illustrated Parts Breakdowns (IPBs)

b. Time Compliance Technical Orders (TCTOs)

c. AFTO Forms 22 – Technical Order System Improvement Report (as provided by the procuring agency)

d. Test equipment and ground support equipment manuals

e. Standard Operating Procedures (SOPs)

f. Parts utilization summaries

g. Engineering reports

h. Field engineering bulletins

i. Interviews with engineers, maintenance supervisors, and technicians

j. Observations of maintenance in progress.

3.1.5.5 Identification of sources. To provide an audit trail for quality assurance checks, permit maintenance of the MTI&A in a current status, and facilitate later updates, all MTI&A products shall contain positive identification of all data sources used in their development. For source documents the identification shall include the document title and number, original issue and revision date, page number, and any additional significant information needed to provide positive identification. Items derived from the LSAR shall use the LSAR control number, output summary title and page number, date and revision codes etc., as applicable. For equipment items used for development or validation of analysis products, the identification shall consist of the nomenclature, part/model number(s), serial number(s), modification status, and configuration. For information obtained verbally, the identification shall consist of the name(s) of the person(s) interviewed, their organization and title, and the date of interview. The identification information may be shown in any convenient manner so long as it can be positively associated with the item or items of information on the MTI&A product for which it served as the source.

3.1.6 Format and legibility. The format of MTI&A products is subordinate to their content. Nevertheless, for ease of recognition and use and to facilitate their review by contract monitors the products shall be prepared in accordance with the general format and legibility requirements herein. Furthermore, they shall also meet the special format requirements specified in 3.2 through 3.5.5. Contractor format or any alternative formats recommended by the contractor shall be subject to prior approval by the procuring agency. MTI&A products may be prepared on preprinted forms containing column headings, rules, titles, and other repetitive material.

3.1.6.1 Page size. MTI&A products shall be prepared using any convenient page size that accommodates the material contained thereon without crowding or otherwise degrading readability. However, all sheets of a particular product (TIM, Task Analysis Worksheets, etc.) shall be the same size.

3.1.6.2 Arrangement. The MTI&A document shall be arranged in sections, each section consisting of one product (TIM, Support Equipment Guide, Task Analysis Worksheets, etc.) covering all required subassemblies of the system. The sections may be bound in one or more volumes as needed for convenience of handling, storage and use. When a volume contains more than one section, tab dividers or page-edge tabs shall be used to identify each section. Only pages of the same size shall be bound in the same volume. Any binding method that permits easy insertion and removal of pages without damage is acceptable.

3.1.6.3 Legibility and reproducibility. Analysis products may be handwritten or typed (on preprinted forms if desired) if prepared manually, or shall utilize a printing device if produced by automated means. Regardless of method, the material shall be neat, clearly readable and understandable and shall be capable of producing clear, readable copies when reproduced by office copier. Some hand corrections, additions and deletions are permissible providing they are neat, legible and reproducible. See 3.5 for special requirements for the use of LSAR output summaries.

3.1.7 Delivery of products. The MTI&A products prepared under this specification shall be either delivered to the Government facility specified in the contract or delivered in place, as specified in the contract. When delivery to the Government is specified, the product shall be prepared for delivery in accordance with MIL-M-38784. When an item is designated for delivery in place, it shall be retained by the contractor for the retention period and in the manner specified in the contract. It shall be made available for review, inspection, or audit by the procuring agency representative, but subsequent delivery to the Government facility shall not be required. Whether deliverable to the Government or deliverable in place, all MTI&A products shall meet all other requirements of this specification.

3.1.8 Use of subject equipment. MTI&A shall be conducted using the subject equipment, or procuring activity approved alternates or mockups, for hands-on development and validation purposes. The equipment shall reflect the current stage of development (prototype, preproduction, production) and shall be the latest version available for use as of the time of MTI&A preparation. The specifics of the availability and use of the equipment shall be provided in an equipment plan, which shall be incorporated in the Task Analysis Plan (3.1.3.).

The equipment plan shall be based on the directions in the work statement concerning availability and use of equipment, such as: equipment to be furnished by the Government or the contractor; furnishing of a dedicated prototype; or scheduling of time on Government-owned equipment, etc. The equipment plan shall cover the following topics:

a. Identification of the end equipment to be used (stage, version, location, ownership), or alternative equipment or mockup

b. Plan for equipment access and schedule of availability for MTI&A purposes

c. Support equipment plan (identification, availability, and use of test equipment, tools, and ground support equipment; alternatives if equipment is not available)

d. Methods and procedures for using equipment to develop MTI&A and for validating MTI&A through equipment tryouts

e. Alternative plans for periods when equipment may become unavailable as scheduled.

3.1.9 Integrated logistic support relationships. As specified in 3.1.5, the MTI&A shall make maximum use of other CDRL data items and analyses prepared as part of the integrated logistic support program for the subject system. In particular, Logistic Support Analysis (LSA) requirements provide much of the data and analyses required for MTI&A. Therefore, when a LSAR in accordance with MIL-STD-1388 is a requirement of the contract, the requirements of 3.5.1 shall apply.

3.1.10 Use of computer. The use of a computer for data storage, processing, retrieval, and formatting is acceptable. Data formats specified in this specification may be modified for computer use so long as the information requirements of this specification are met. Prior approval by the procuring agency of proposed computer printout formats is required. The request for approval shall include a sample layout of each product to be outputted by computer with notations showing where the items of information required by this specification are located.

3.2 Task identification requirements. The initial step of the MTI&A shall be the identification of all troubleshooting and non-troubleshooting tasks required to be performed on the equipment at the Organizational and/or Intermediate levels, as specified in the contract. The bases for the identification shall be an equipment breakdown and a list of all periodic, preventive and corrective maintenance tasks applicable to the equipment. Once the equipment and its assemblies, subassemblies, sub-subassemblies, and significant parts have been identified and listed, the appropriate tasks shall be assigned to each item at the proper maintenance level. A determination shall then be made of the tasks to be included in a JGM or LTTA. The results shall be documented in the form of a matrix, called a Task Identification Matrix (TIM, or Basic TIM). When required by the contract the Basic TIM shall be augmented to show additional information and as further options, it shall be rearranged and adapted for various purposes. An augmented matrix is called an Expanded Task Identification Matrix (Expanded TIM). A rearranged and adapted matrix is called a Task Identification Summary, which may take any of several forms. The validated and approved task identification product(s) shall be used as the basis for the subsequent task analyses specified in 3.3 and 3.4.

3.2.1 Basic Task Identification Matrix. The Basic TIM (examples are shown in Figures 2 and 3) shall be prepared in accordance with the following requirements:

3.2.1.1 Equipment breakdown. For each designated major, minor, and ancillary equipment of the system a top-down breakdown shall be used or prepared, listing each assembly, subassembly, and sub-subassembly that is maintainable at the Organizational and Intermediate (O&I) levels. Maintenance significant pieceparts that are maintainable at O&I levels but which are not part of a subassembly or sub-subassembly shall also be listed. (Refer to 6.3.15. for the definition of "Maintainable.") When functional group codes (FGCs) have been assigned, the breakdown shall be arranged in FGC order. The relationships to the next higher assembly shall be indicated by a system coding method per MIL-STD-863, reference designator, or other numerical code, or by indenture if no code has been assigned. The hardware indenture level of the breakdown shall be that level identified in the Statement of Work or Task Analysis Plan; items belonging to a lower level shall be excluded from the TIM. GFE and standard off-shelf equipment shall be included or excluded as indicated in the SOW and Task Analysis Plan. The source of the data used for the equipment breakdown shall be the latest approved equipment listing as of the time of TIM preparation. Depending on the stage of system development/procurement one of the following shall be used, as available.

a. LSAR (see 3.5)

b. Group Assembly Parts List (GAPL) of the IPB

c. PPL

d. Engineering drawings/parts lists

3.2.1.1.1 Latest configuration. The equipment breakdown portion of the Basic TIM as finally submitted to the procuring agency for approval shall reflect the latest approved equipment configuration.

3.2.1.1.2 Nomenclature. The nomenclature of items in the equipment breakdown shall be that used in the source document. Further descriptive modifiers shall be added parenthetically as needed to clearly identify the item.

3.2.1.1.3 Item identification. Each item listed in the equipment breakdown shall be further identified by the system code, functional group code, LSA control number, reference designator, or other number system that positively identifies the item and its system relationship. The numbering system used shall be consistent with that used in other system documentation. Part numbers shall be given as needed for positive identification of equipment items.

3.2.1.2 Maintenance functions. All scheduled and unscheduled maintenance functions applicable at the Organizational and Intermediate levels to the particular system/equipment and its assemblies, subassemblies, sub-subassemblies and maintenance significant pieceparts shall be entered as the column headings of the matrix. The following function verbs shall be used as a minimum for all types of systems/equipment, along with additional verbs as necessary and applicable in accordance with 3.2.1.2.1.

a. Align/Adjust

b. Checkout/Troubleshoot

c. Disassemble/Assemble

d. Inspect

e. Install

f. Remove/Replace

g. Repair

h. Service

i. Test

3.2.1.2.1 Permissible verbs. Maintenance function verbs, including the above, which are permissible for use as task identifiers are listed with their definitions in 6.3.16 under "Maintenance Function." Other verbs approved for use in task analysis are listed in Appendix B, Verb List. Alternative verbs, or verbs describing maintenance functions not included either in Appendix B or 6.3.1.6 that if deemed necessary, shall be used only upon approval of the Procuring agency. If such verbs are used, their definitions shall be appended to the TIM. If a maintenance function verb requires additional defining or clarifying, the more specific function verb shall be entered in the Notes column. For example, "Service" shall be more positively identified in the Notes column as "Clean," "Lubricate," "Refill," "Recharge," etc., as applicable.

3.2.1.3 Identification of tasks and maintenance level assignments. Each intersection of an equipment item and maintenance function, called a "cell," shall represent a decision point. Each cell shall accommodate two single-character entries. Three decisions shall be reflected on the matrix for each cell; the first two decisions in the left-hand position and the third in the right-hand position:

a. Is such a task required to be performed on this item?

b. If so, at which maintenance level (O or I) is the task to be performed?

c. Is an identified O or I task to be included in a JPA (JGM or LTTA)?

3.2.1.3.1 Maintenance task decisions. All decisions shall be based upon the definitive maintenance concept for the subject system as initially provided by the procuring agency and expanded and refined as necessary by the contractor, and on the requirements of the equipment. The requirements for the first two decisions (3.2.1.3a and b) are given below, and for the third decision (c) in 3.2.1.4.

a. If a task is not required to be performed on the item, or if required at a level other than Organizational or Intermediate, the cell shall be left blank. A completely blank cell shall always indicate "no such task required at O or I level." (See Figure 4 for the Basic TIM codes.)

b. If a determination as to whether or not a task is required cannot be made at the time, enter a question mark (?) in the cell until such time as a decision is forthcoming. A '?' in a cell shall always indicate "a decision is

needed." It is an interim code only and shall be used only until the decision is made. The final approved TIM as submitted to the Government shall contain no question marks.

c. If a task is required to be performed on the item, enter an 'O' or an 'I' in the left half of the cell to indicate the lowest maintenance level at which it is capable of being performed, as follows:

O = This task is required and it can be performed at the Organizational level.

I = This task is required and it can be performed at a level no lower than Intermediate.

Refer to 6.3.17. for the definitions of Organizational and Intermediate "Maintenance level."

d. If a task is required to be performed at both O and I levels but the methods of accomplishment/procedure differ, enter a 'B' in the left half of the cell.

e. The entry for a required task shall be made at the equipment breakdown level at which it is to be performed (that is: system, equipment, assembly, subassembly, sub-subassembly, significant part).

3.2.1.4 Tasks selected for JPAs. For each 'O,' 'I,' and 'B' entry, indicate in the right half of the cell whether the task is to be included in a JGM or LTTA. If a task is too simple to require coverage or is to be excluded for other reasons, leave a blank. If it is to be included, enter a 'J' or 'L' as follows:

J = This task is to be included in a JGM.

L = This task is to be included in a LTTA.

If a determination cannot be made at the time, enter a '?.' The final decision as to which tasks will be covered in a JPA shall be that of the procuring agency. The '?' is an interim code and shall be used only until the decision is made. The final approved TIM as submitted to the Government shall contain no question marks. Systems that make use of built-in test equipment (BITE) for Organizational level Checkout tasks, and of automatic test equipment (ATE) featuring programmed self-test routines for Intermediate (shop) level Checkout tasks, shall be analyzed to determine the breakdown level to which checkout is performed

automatically by that equipment. Such tasks shall be identified by a code OA or IA, indicating that they are performed by automatic test equipment.

3.2.1.5 Other information. Significant facts and information generated or gathered during preparation of the TIM that will be of value during later stages of MTI&A preparation shall be entered in a 'Notes' column opposite the appropriate equipment item. The 'Notes' entries differ from the requirements of an expanded TIM described in 3.2.2 in that the Notes are brief, noncomprehensive items of information incidental to the data contained on the Basic TIM. Representative of the types of data that shall be entered in the 'Notes' column are:

a. Data source identification (3.1.5.5)

b. Special relationship to another task

c. Facts concerning entries requiring further resolution ('?' entries)

d. Other significant facts regarding the equipment item, maintenance task, or level of accomplishment.

3.2.2 Expanded Task Identification Matrix. In lieu of the Basic TIM described in 3.2.1, the procuring agency may require preparation of an Expanded TIM. An expanded TIM is a Basic TIM containing additional information about the identified tasks for use as a management tool, a comprehensive reference document, an audit document, or other purpose as designated by the procuring agency. The added data shall be entered on the TIM in additional columns or in the appropriate cells. Cell entries shall be appropriately coded and an explanation of the codes shall be provided by means of notes, either on the same sheet or on added sheets. The Expanded TIM shall meet all of the requirements of 3.2.1 and include specific types of additional information designated by the Procuring Agency. Representative types of added information that may be included in an Expanded TIM are:

a. Status information

b. Source document status/identification

c. Test equipment, tool, and ground support equipment information

d. System numbers per MIL-STD-863/MIL-M-83495

e. Tasks to be considered for training

f. Selected data from other MTI&A documents

g. Other significant information and decisions concerning the tasks

h. Additional breakdown of equipment and task identification to the Depot level, for example, for use in a program where complete LSA has not been required.

3.2.3 Task identification summaries. If required by the Procuring Agency as part of the MTI&A, a Task Identification Summary or Summaries shall be prepared. A Task Identification Summary is a document that lists information shown on the Basic or Expanded TIM in other formats for use as checklists, reference documents, audit documents, or management tools. The Procuring Agency shall designate the summary or summaries required, if any, and the type of information to be included therein. The Task Identification Summaries shall be prepared in contractor format unless otherwise specified by the procuring agency. Examples of Task Identification Summaries include:

a. Individual listings, by title, of all Organizational or all Intermediate level tasks to be included in JGMs and LTTAs

b. Individual listings by maintenance function ('Adjust/Align,' 'Disassemble/Assemble,' 'Remove/Replace," etc.) of all tasks to be included in JGMs

c. A summary listing of all 'Checkout/Troubleshoot' tasks to be included in LTTAs

d. A summary listing of required maintenance tasks not to be included in JPAs.

3.3 Task Analysis requirements for non-troubleshooting tasks. All tasks other than troubleshooting that are identified on the TIM as Organizational, or Intermediate level (as specified in the contract) maintenance tasks to be included in JGMs (codes OJ, IJ, and BJ) shall be analyzed and the results recorded in accordance with the requirements of this section. Three types of general-application analyses shall first be performed to establish ground rules to be applied to the development of task steps. They consist of a user analysis (3.3.1.), a support equipment analysis (3.3.2.), and a level-of-detail analysis (3.3.3.). Using the results of these analyses as guidelines, along with other source data, a task detail analysis (3.3.4.) of each identified task shall be

performed and recorded on Task Analysis Worksheets. One complete set of worksheets shall be prepared for each identified task. When Logistic Support Analysis in accordance with MIL-STD-1388 is a requirement of the program, the provisions of this section are further subject to the requirements of 3.5.

3.3.1 User analysis. A User analysis shall be performed to establish a detailed narrative description of the User population at whom the MTI&A is targeted and for whom the resultant JPAs will ultimately be written. It shall be developed in two steps: the first step shall be a Preliminary User Profile to be prepared by the appropriate commands and agencies and furnished to the contractor by the procuring agency. The second step will consist of the refinement, development and expansion of the target population description in the preliminary document by cooperative action of the contractor and the appropriate Government representatives. The product of this step is a Definitized User Profile. The content of the Preliminary and Definitized User Profile shall be in accordance with 3.3.1.1 and 3.3.1.2, respectively. The Definitized User Profile shall be documented in contractor format unless otherwise specified by the procuring agency. The Definitized User Profile shall be used as one of the bases for the Support Equipment Analysis (3.3.2) and the Level of Detail Analysis (3.3.3) which, in turn, shall be used as guidelines for preparation of the "Task Steps" (3.3.4.4) portion of the Task Detail Analysis. In addition to these immediate uses, the Definitized User Profile also serves later as a guidance document for the JPA preparer and for JPA planning and management.

3.3.1.1 Preliminary User profile. A Preliminary User Profile prepared by representatives of the training activity, the User commands, and other interested organizations will be provided to the contractor by the Procuring Agency. The profile will describe the following two users for each specialty code applicable to Organizational and/or Intermediate level maintenance of the subject system/equipment:

a. An apprentice technician – A graduate of a technical training school who has less than 6 months experience on the job.

b. An experienced technician – A qualified technician who has had moderate to extensive experience on the job and who possesses a capability on similar systems/equipments.

3.3.1.1.1 User population background. The definition of the User population so described will be based on a knowledge of the capabilities of current technical school graduates, the current or planned maintenance concept for the

subject system/equipment, current maintenance policies and directives, and an appreciation of the current and projected personnel situation. The Preliminary User Profile will contain the following elements of information for each identified user:

a. Reading Level. An estimate of the target User's ability to read and comprehend, in terms of grade level.

b. Courses Received in Technical Training Schools. A brief description or outline of the typical technical courses received by the User that are relevant to maintenance of the subject system/equipment.

c. Other Relevant Training. A brief description or outline of other relevant training, including school and on-the-job training received by the User.

d. Skills Inventory. An inventory of job-related skills, knowledges, and duties. The list should be comprehensive and complete but it need not mention each task by name. It is sufficient to say, for example, that the user "is able to use all tools in the standard tool kit with acceptable speed and accuracy, without the necessity for job-performance-aid support." Each such tool need not be discussed. It is sufficient to say, for example, that the JPA user "is able to recognize the time and/or circumstances for performing all necessary checkouts on the fuel indicating subsystem. Given a JPA, the user is able to take the necessary actions to ensure that the aircraft is in a safe condition when each such checkout is initiated. Using a JPA and appropriate tools, test equipment, and ground support equipment the user is able to perform each necessary checkout on the fuel indicating subsystem, with adequate speed, safety, and accuracy. The user does not need to consult the JPA for the purpose of knowing how to use tools, test equipment, and ground support equipment." Some assistance in assuring a comprehensive listing is available from Air Force Occupational Survey Records.

e. Work Conditions. A description of the work conditions for which the user has been trained and can be expected to carry out assigned duties without further instructions; and which should be expected to be encountered under the maintenance concept established for the subject system. If there are not significant differences between the two, so state; otherwise describe the differences. List those work conditions for the subject system which will require special

instructions in the JPAs. The term "work conditions" includes: (1) the physical location, such as in aircraft in flight, in or on an aircraft on the flight line, missiles in silos, subsystems and equipment in a shop, etc.; (2) environmental conditions requiring special considerations such as extreme cold or heat, high noise levels, darkness or low light levels, and unusually dusty conditions; (3) hazardous or otherwise stressful conditions; and (4) any other extraordinary conditions requiring special consideration.

f. Supervision. The kinds of work the user may be expected to do under supervision and without supervision.

3.3.1.2 Definitized User Profile. It shall be the responsibility of the contractor to recommend modifications, expansions, and/or refinements of the Preliminary User Profile based on the contractor's knowledge of the maintenance needs of the subject system/equipment. The contractor shall notify the procuring agency when such recommended modifications are ready for review and discussion. Upon receipt of notification the procuring agency will convene a conference at the location designated in the contract. Participants shall include the contractor and the representatives of the commands and agencies indicated in 3.3.1.1. The conferees shall consider the contractor's recommendations and accept, reject, or modify the individual recommendations accordingly. The agreed upon results of the conference shall be incorporated subsequently by the contractor into the User Profile and the resultant document shall be submitted for final approval by all participants. Upon their approval and incorporation of any further comments by the contractor, the document shall become the Definitized User Profile.

3.3.2 Support Equipment Analysis. An analysis shall be performed to identify all of the operational functions of the test equipment, special tools, and special ground support equipment required for Organizational and Intermediate maintenance of the subject system/equipment, the assumptions to be made about the target users' knowledge of each, and the standard statements to be made about them in the JPAs. In this way, whenever a task requires any of these functions, directions for each function will always appear in the same way. Both common and special-purpose test equipment, and ground support equipment, and special tools shall be included. Common tools need not be included.

3.3.2.1 Support Equipment Guide. The analysis product, called a Support Equipment Guide, shall be prepared in accordance with the content and format requirements of 3.3.2 through 3.3.2.5. The Support Equipment Guide shall be used for reference when preparing the "Task Steps" portion of the Task Analysis

Worksheets (3.3.4.1) involving such equipment. During JPA preparation, the guide serves as a reference document for the JPA preparer. It also is a valuable reference for planners of training programs, as the personnel assumptions serve as training objectives in training for the use of the support equipment required by the subject system. When the need for additional support equipment or functions is disclosed during the Task Detail Analysis, the required information shall be added to the Support Equipment Guide.

3.3.2.2 Support equipment functions. All common and special-purpose test equipment, and special tools and ground support equipment functions required to maintain the subject system/equipment at the Organizational or Intermediate levels shall be listed in a column headed "Functions" (Figure 5). The functions shall be grouped in terms of similar or closely related functions insofar as possible. An exception is dissimilar functions provided by the same item of equipment (for example, a multimeter). The support equipment functions identified in the Skills Inventory portion of the Definitized User Profile (3.3.1.2) as being in the User's repertoire shall be grouped together.

3.3.2.3 Equipment identification. The name and identifying number of the item of support equipment, when identified and approved, which provides the needed [illegible]ion(s) shall be entered in the "Equipment Identification" column oppos[illegible]propriate function(s) entry. If a system identifying number has b[illegible]l to an item of support equipment, it shall also be listed.

3.3.2[illegible] [illegible]a sumptions. For each test equipment, tool, and ground suppor[illegible]ict[illegible]n listed, the assumptions to be made regarding the use[illegible]g[illegible]of the item to perform the function shall be given al[illegible]the infor[illegible]and directions that a JPA preparer will have to pro[illegible]in the procedures employing the item. The assumptions for functions identified in the Definitized User Profile as being in the User's repertoire shall be based on the User skills and abilities identified in that document. For all other functions the assumptions shall be based upon an analysis of what the user can be expected to do successfully without detailed instructions, and those functions that require detailed instructions because of their peculiar or complex nature or lack of user experience or knowledge. Implicit in the complete set of Personnel Assumptions when compared with the Definitized User Profile is a set of training objectives for those functions for which the user is assumed to possess a capability not identified in the Definitized User Profile.

3.3.2.5 Standard statements. Standard statements are exact statements to be made in the Task Steps portion of the Task Analysis Worksheets and the JPAs each time a function is needed; they shall be entered in the "Standard Statements" column opposite each function. The statement shall consist of a

sentence stating instructions for use of the particular function of the test equipment. It shall leave blanks for the expected reading, point of test, and "where-to-go-next" reference: For example: "Connect multimeter + lead to_____ and - lead to_____. Check that meter reads_____. If not,_____." Each occurrence of a similar event in the Task Steps shall be written using the same sentence, except for the unique variable(s) in the sentence.

3.3.3 Level-of-Detail analysis. Using the characteristics of the target Users described in the Definitized User Profile (3.3.1.2) and the analyst's knowledge of the system as a basis, a set of ground rules (guidelines) shall be developed stating how much and what kind of detail must be provided when various types of task actions are described. These rules shall be recorded in contractor format in a Level of Detail Guide (Figure 6). These rules are used by the analyst when preparing the Task Steps portion of the Task Analysis Worksheets (3.3.4.1) and later during JPA development. As the initial step in the level of detail analysis the standard guidelines for writing task steps contained in AFHRL TR-79-XX, Handbook for Developers of Maintenance Task Identification and Analysis, shall be examined for their applicability to the particular system/equipment and program needs. The criteria in 3.3.3.1 shall be used to determine the types of task actions to be included. Those rules that apply in their entirety shall be listed as is. Rules that are largely or partially applicable shall be altered as necessary and listed in their modified form. If the particular system/equipment or program requires rules that are not contained in the guide, new rules shall be developed and listed in accordance with 3.3.3.1.

3.3.3.1 Task actions. A rule shall be provided for each of the following types of task actions that applies to the subject system/equipment. Additional rules shall be provided as necessary to cover task actions required by the system/equipment but not listed below. Figure 6 is exemplary of the nature of the information to be provided in the rules.

a. Discriminations and Perceptions. These shall include:

(1) Observing Gross Indications – such as lights being on or off or meters being in or out of the acceptable band.

(2) Reading Quantitative Values – such as voltages or pressures read on equipment meters and gauges.

(3) Noting Relative Motion Between Components – such as between mechanical linkages.

(4) Reading or Interpreting Oscilloscope Patterns or Waveforms – What sort of standard of comparison will be supplied by the JPA? What discriminations will be required of the JPA reader?

(5) Noting Visually Detectable Physical Defects – such as scored cylinder walls, deteriorated "O" rings, charred insulation, or change in color of an object.

(6) Detecting Presence or Absence of Sounds and Vibrations – such as bearing whine, backfire, or hum. Some vibrations will be best detected by feel.

(7) Discrimination of Pitch or Other Characteristics of a Sound – such as loudness, "roughness," or duration.

(8) Discrimination of Odors – such as those typical of burnt insulation, leaking fluids, or exhaust gases.

b. Problem-Solving and Decision-Making Critical to Successful Task Performance. These shall include:

(1) Selection of Appropriate Next Step or Task

(2) Performing Calculations – In some tasks, the necessity for performing calculations can be reduced through the use of tables, graphs, nomographs, or slide rules.

(3) Exercising Judgment – Judgments can be aided with rules of thumb, decision rules, estimates of the relative frequency of certain events, statements of the relative values of certain outcomes, presentation of comparison standards, etc.

(4) Conversion of Data From One Form to Another – such as from binary to decimal, from decimal to octal, from Fahrenheit to Celsius, from English to metric measure, etc.

c. Motor Actions Critical to Task Performance. These shall include:

(1) Activating Switches

(2) Adjusting Continuous and Multiposition Controls

(3) Performing Coordinated Gross Body Movements – such as required in positioning an item of hardware for installation.

(4) Performing Actions Requiring Fine Coordination – such as those involved in driving a vehicle, or such as the hand-eye coordination involved in a tracking task.

3.3.4 Task Detail Analysis. A Task Detail Analysis shall be performed to develop the basic elements of the procedures that will ultimately appear in the JPA or manual. Each non-troubleshooting task identified in the TIM for inclusion in a JGM (codes OJ, IJ, and BJ) shall be subjected to a searching analysis to develop the details needed to completely define the task elements. As a minimum, the analysis shall provide the following information about each task:

a. The preconditions for task performance (equipment conditions, personnel requirements, support equipment and supplies, and safety conditions)

b. The significant steps required for successful completion of the task, including performance standards and keyed locator illustrations

c. Identification of the necessary follow-on tasks

d. Other significant information, not included in the above, concerning the task that is important for the JGM developer to know.

3.3.4.1 Task Analysis Worksheets. The results of each analysis shall be recorded on a set of Task Analysis Worksheets, one set for each identified task, prepared in accordance with 3.3.4.1 through 3.3.4.6. The format of the worksheets shall be similar to Figure 7. Spacing may be varied to accommodate the required entries, but the sequence of information shall not be varied except as defined in 3.5.4 for LSAR output summaries. The capabilities and limitations of the target Users as defined in 3.3.1 shall be taken into account as well as the results of the Support Equipment Analysis (3.3.2) and the Level-of-Detail Analysis (3.3.3). When LSA is part of the contract, much of the data and analyses required by this section are available in the LSAR (see 3.5). Such data shall be adapted as necessary and incorporated in the task detail analysis to the extent that such data meet the requirements of this section.

3.3.4.2 Identifying information. The following information shall be provided at the top of the first sheet of the Task Analysis Worksheet (item numbers refer to encircled numbers on Figure 7):

a. Sheet No. (Item 1) – Indicate the sheet number on each sheet beginning with sheet 1 for the first sheet, and the total sheets, in the form: "Sheet _____ of ___".

b. Function Title (Item 2) – Function titles shall specify the type of maintenance to be performed and the end item (component, subsystem, sub-subsystem, etc.) that is to receive the maintenance. Titles shall be derived from the TIM columns.

c. Equipment Nomenclature and Applicability (Item 3) – Equipment nomenclature shall consist of the official nomenclature and AN type number if assigned, or the item name and part number as shown on approved assembly drawings. The configurations to which the function is applicable shall also be indicated. If the worksheet applies to all configurations, the word "all" shall be entered. Statements which explain applicability for individual items of equipment shall use either serial number range block designation, revision status, or similar identification. Such terms as "On later equipment" and "On early serial numbers" are not acceptable.

d. Task Interval (Item 4) – If the task is a scheduled task, indicate the hourly, daily, weekly, or monthly interval. If hourly, state whether calendar or operating hours.

e. Date Completed (Item 5) – Date on which the worksheet is completed. When any sheet is revised, add revision date.

f. Analyst (Item 6) – Name of the individual or individuals who prepared and revised the worksheet.

g. Document Number – A unique document identifying number may be assigned for reference purposes.

3.3.4.3 Input conditions. Under the heading "Input Conditions" indicate all the necessary information needed prior to performing the function. Input conditions shall consist of the following information in the order shown:

3.3.4.3.1 Required conditions (Item 7) – Certain maintenance tasks are dependent on the equipment being in a given condition. When the required conditions are covered on other Task Analysis Worksheets, these worksheets

shall be referenced by title, or document number if assigned, as prerequisite to the task. For example, if the aircraft must be on jacks prior to removing the shock strut, the "Required Condition" would be "Aircraft Positioned on Jacks - see Worksheet 0012." If there are no preconditions, enter "None."

3.3.4.3.2 Personnel Required (Item 8) – The minimum number of personnel required to effectively perform the maintenance shall be indicated. Action requirements shall be identified (Person A, Person B, etc.) for each technician of multi-person tasks, including location and duties at the beginning of the function, as follows:

a. Multi-Person Requirements. The tasks shall be analyzed to determine the minimum personnel requirements. Assistants may be employed when the procedures can be accomplished more effectively by their presence. The task steps (3.3.4.4) with multi-person requirements shall be written to integrate the actions and observations of each technician into a single sequence of instructional steps. Each action and observation comprising the task shall carry a code (Person A, Person B, etc.) identifying the person responsible for accomplishing such action or observation.

b. Requirements for Assistance. The requirement for assistance occurs when:

(1) The function requires cooperation, coordination, or other teamwork under the direction of a primary technician.

(2) The function involves large or heavy items that would be dangerous or difficult for one person to handle.

(3) Simple observations or actions must be performed by a second person at some location out of sight or reach of the primary technician.

3.3.4.3.3 Support equipment (Item 9) – The support equipment (test equipment, special tools, and ground handling equipment) needed to perform the task shall be listed. Common types of tools normally found in the technician's tool kit, such as screwdrivers, pliers, side cutters, and soldering irons, shall not be listed. However, common types of test equipment, such as voltmeters, signal generators, and transistor testers, shall be listed, along with any special test equipment and special ground support equipment required. Support equipment will be listed by official nomenclature and AN/AEID type designation,

if assigned, or the commercial or manufacturer's designation if an AN/AEID type is not assigned. If the item has not been identified, the required functions shall be given. The support equipment or functions listed shall be selected from the Support Equipment Guide (3.3.2.1). If the need for a new support equipment or function is disclosed during task development, the necessary information shall be added to the Support Equipment Guide as required by 3.3.2.1.

3.3.4.3.4 Supplies (Item 10) – Expendable items and support materials (consumables) required to accomplish the function shall be listed. Sealants, lubricants, replacement lamps, gaskets, seals, labels, "maintenance in progress" tags, etc. are considered expendable items. Attaching hardware that requires 100 percent replacement shall also be listed as supplies. The list will consist of the items and quantities listed in tabular form as follows:

Nomenclature	Specification	P/N (Mfg. Code)	Quantity

3.3.4.3.5 Safety conditions (Item 11) – Any information concerning safety of equipment or personnel shall be included under this heading as a note, caution, or warning. Notes, cautions, and warnings that apply generally to the complete task shall be provided here, but notes, cautions, or warnings that apply to an individual task step shall immediately precede the task step to which they apply.

3.3.4.4 Task steps. A basic set of essential procedural steps that describe the optimum method for successful accomplishment of the task (which is the primary goal of the task analysis) shall be developed during this stage of the task detail analysis. The results shall be recorded in three parts under the "Task Steps" heading: "Preliminary Tasks," "Subtasks," and "Step Descriptions."

3.3.4.4.1 Method of development. First, a determination shall be made of what preparatory tasks covered in other Worksheets are required, if any (3.3.4.4.5). Then, the subject task shall be analyzed to establish the basic subtasks of which it is composed and in what order they are best accomplished (3.3.4.4.6). Finally, each subtask shall be analyzed in turn to determine the essential steps for most efficient task performance (3.3.4.4.7).

3.3.4.4.2 Differences from JGM procedures. The essential differences between the task steps developed by the task analyst and those developed later by the JGM preparer using the Worksheets as a guide are as follows: (1) the Worksheets provide a synopsis of the technically accurate, logical, essential sequential steps proven to be the best method for task performance, while the final procedure as it appears in the JGM is amplified and refined by the JGM

preparer to take into account the human factors, or behavioral aspects (what the user sees or detects with the senses and what the user responses should be to achieve the task objectives); (2) the task analysis does not concentrate on the communication of the material to the target Users, while the JGM preparer applies behavioral considerations (such as task cues and responses for the User), as well as style, syntax, and readability standards, verb lists, and other appropriate communicative techniques that best convey the information to the users in terms they will readily understand; (3) the Worksheets are essentially unformatted, while the JGM procedures are prepared to detailed, precisely structured requirements for layout, spacing, keying, and illustrating.

3.3.4.4.3 Information sources. The subject system/equipment shall be used as the final source of information for validating the accuracy and completeness of the task steps. Other sources of information – such as engineering drawings and procedures, process sheets, photographs, interviews, and approved Worksheets or JGMs prepared previously for similar tasks on like equipment – may be used for initial development of the task steps. However, the procedure as finally approved must be validated by actual performance on the subject system/equipment as installed and configured in accordance with 4.6.1.

3.3.4.4.4 Typical procedures. When the method of performing a task is the same for more than one subsystem, component, assembly, subassembly, or sub-subassembly, a typical set of instructions may be prepared in lieu of individual sets. Such instructions must be identified in the identifying information portion of the first Worksheet as being typical. Furthermore, all of the equipment items to which the instructions apply shall be identified under "Equipt Nomenclature & Applicability." The instructions shall be subjected to tryouts on each equipment item so identified, as being valid for that equipment. Any variations or special instructions required for any of these equipments shall be included at the appropriate points in the Worksheets. Examples of the use of typical procedures would be "Removal of Left and Right Main Landing Gear Actuator Valves," "Installation of Cowling on Engines 1 through 4," or "Replacement of Printed Circuit Boards."

3.3.4.4.5 Preliminary tasks (Item 12). The tasks referenced under this heading shall be those whose performance is mandatory before the task under development can be initiated. For example, if the task is "Alignment of Radio Compass Subsystem" preliminary tasks might be "Adjustment of Power Supply Unit" and "Alignment of Radio Receiver." The appropriate Task Analysis Worksheets containing those tasks shall be referenced by title, or document number if assigned. If no preliminary tasks are required, enter "None."

3.3.4.4.6 Subtasks (Item 13). Every task is composed of one or more separately identifiable major activities (groups of individual actions or steps) that make up the task. These subtasks shall be identified and listed in sequential order by title or short description, under the "Subtasks" heading. An example of the subtasks of the task "Charge the Hydraulic Accumulator" might be: "Access the Accumulator," "Connect the Charger," "Charge the Accumulator", and "Return the Equipment to Operational Condition." Some tasks are so simple that they require no subdivision; for such tasks enter "None."

3.3.4.4.7 Step descriptions (Item 14). Each subtask shall be analyzed to determine the individual actions, or steps required to successfully accomplish that subtask. The set of steps selected shall be chosen from among the alternative ways of performing the task as being the simplest, briefest, and most straightforward and efficient. The step descriptions shall be recorded in sequential order under the subtask heading to which they apply, in the 'Step Descriptions' portion of the 'Task Steps.' Steps that are not an actual part of a subtask but are transitional in nature shall be included at the end or beginning of the subtask deemed most appropriate. All technical details shall be included, such as performance standards, notes, cautions, warnings, use of support equipment requiring such instructions, operation of end equipment and any special instructions. Step descriptions shall be developed by observing the following rules:

a. Level of detail. The level of detail of the step descriptions shall be appropriate to the intended Users as defined in the Definitized User Profile. It shall be consistent within a task and from task to task. This consistency shall be achieved by applying the appropriate guidelines of the Level-of-Detail Guide and the Support Equipment Guide to each step description. For example, whenever a task requires the use of a particular test equipment function, the directions for that function shall always be as stated in the Support Equipment Guide.

b. Repeated sequences. Identical sequences of steps, whether they are entire subtasks or parts of subtasks or tasks that must be repeated within the same task or in different tasks, shall be included in full at each appearance and not referenced.

c. Performance standards. In each step where a measurement, reading, or other equipment indication or response is required, the response shall be given in measurable or observable numerical or qualitative terms. Ranges of required values (tolerances) shall be provided for electrical measurements, distances, clearances, flowrates, pressures, torque values, and other such measurements.

d. Special Instructions. When special instructions are required, they shall follow the appropriate step of a task. An example of such an instruction is safety wire installation. Special instructions shall not be numbered, but instead shall be identified by the notation "Special Instruction" preceding the instruction.

e. Forms. Any maintenance forms that the technician needs to fill out during task performance shall be identified. The instructions for filling them out shall be provided unless such instructions appear on the form itself.

f. Maintenance support information. Any instructions or reference information needed to support task performance but not appropriate for inclusion as instructions in the job guides shall be identified by special note for the JGM preparer. The step or steps to which this additional information applies shall be indicated, unless it is for general application.

g. Illustration references. Wherever equipment identification and location information is required by the target users, as defined in the Definitized User Description, reference shall be made in the appropriate steps to keyed illustrations. The desired method of keying will be designated by the procuring activity. The requirements for illustrations are given in paragraph 3.3.4.4.8.

3.3.4.4.8 Illustrations. Illustrations required to support task steps shall be appended to the Worksheet sets from which they are referenced. They are not required to be in final form, but rather are intended as reference illustrations from which final illustrations can be made. Any required instructions to the illustrator, such as directions to alter the aspect or to add or delete detail, shall be noted on the illustration. Illustrations shall consist of annotated copies of engineering drawings, diagrams, sketches, photographs, or combinations of these, keyed to the task steps in accordance with 3.3.4.4.7.g. Callouts, leader lines, and any notes may be applied by hand without the use of guides or other mechanical aids. The illustrations and added material must be neat, clearly legible, understandable, and capable of producing clear, readable copies when reproduced by office copier. Extraneous material on the illustration may be hand-marked for deletion provided the above legibility and reproducibility requirements are met. A unique identifying number shall appear on each illustration, and the number shall be noted on the Worksheets at the first reference to the illustration and subsequently as needed to differentiate from other figures.

3.3.4.5 Follow-on maintenance. Any further maintenance actions required to return the system/equipment to operational readiness after completion of the task shall be referenced under the heading "Follow-On Maintenance" (Figure 7,

sheet 3). The reference shall be to the appropriate Worksheet set(s) by title or document number.

3.3.4.6 Notes. Significant facts and supplementary information generated or gathered during preparation of the Task Analysis Worksheets that will be of value for purposes of updating, reviewing, and for preparation of JGM procedures, shall be entered at the end of the Worksheets under the heading "Notes". Representative of the types of data that shall be entered as notes are:

a. Identification of data sources and equipment used to prepare the Worksheets (3.1.5.5.).

b. References to useful sources of general supplemental information such as descriptions, photographs, drawings, and manuals.

c. Additional important facts, general notes, and decisions concerning the task.

3.4 Task Analysis requirements for troubleshooting tasks. All tasks that are identified on the TIM as Organizational or Intermediate level Checkout/Troubleshoot tasks shall be analyzed and the results recorded in accordance with the requirements of this section. Checkout/Troubleshoot tasks are identified in the TIM as OL, IL or BL. Two types of task analysis efforts, a Performance Analysis and a Failure Mode and Fault Symptom analysis, shall be performed to establish the Checkout tasks, the troubleshooting tasks, and the Action Trees to be prepared. The Performance Analysis shall identify all design functions of the pertinent subsystems and equipment, and establish the checks that are required to determine if these functions are performing normally. The performance analysis shall also establish the measurable parameters associated with each function and each component that contributes to that function. A performance analysis shall be completed on each system, subsystem, and equipment identified in the TIM for LTTA coverage (codes OL, IL, BL). The results of this analysis shall be recorded on a Checkout Summary. This summary provides an organized data base for later development of checkout procedures by LTTA preparers. LTTA checkout procedures are used to test whether the system is functioning properly and are the systematic means for deriving fault symptoms as the starting point for trouble isolation using logic tree troubleshooting procedures. A failure mode and fault symptom analysis shall be performed on each performance parameter established by the performance analysis. The fault symptom analysis shall identify the ways in which each performance parameter can fail (its failure modes), causing a fault and a fault symptom. The product of this analysis shall be a list of fault symptoms for

each failure mode which will be the basis of preparation of action trees and for later development of logic trees in the LTTA. When Logistic Support Analysis is part of the contract, the requirements of 3.5 shall apply, in addition to the requirements of this section.

3.4.1 Source Data.

3.4.1.1 Developmental Systems. The performance analysis for systems/equipment under development shall be based in general on the same source data used throughout the MTI&A effort, as described in 3.1.5. Specifically, this analysis will focus on two basic sources of information: (1) engineering data; and (2) tryouts on the equipment. The following classes of engineering data shall be used as one basis for performance analysis, as available.

a. Design data such as: electronic and mechanical functional block diagrams, schematic diagrams, mechanical diagrams, wiring diagrams, functional descriptions, circuit descriptions, and similar data describing signal flow, dependencies, operation, and performance parameters.

b. Engineering test procedures.

c. Inspection test reports.

3.4.1.2 Operational Systems. For systems/equipment in operational use, a primary source of data shall be the existing technical manuals and actual experience with the equipment in the field as reflected in such documents as equipment logs and field engineering maintenance logs and reports. These sources shall be augmented as necessary by the sources identified in a. through c. above.

3.4.2 Performance Analysis. A Performance Analysis shall be performed to identify all tests required to completely check out the performance of each function of the system or equipment. The performance parameters of each check shall be identified in sufficient detail so that the fault symptoms for each performance parameter can be developed. Troubleshooting action trees will later be developed for each fault symptom and failure mode identified and referenced as a result of the performance analysis (and the checkout procedure). The starting point for the performance analysis shall be energy flow diagrams (functional blocks, schematics, wiring, mechanical, timing, etc.) which depict the interrelationships among all components. For each check that can be made on the performance of the unit (output voltages or waveshapes, mechanical action, etc.), a precise description of the

expected normal operating outputs shall be listed (e.g., "24 (± 1.2) Vdc", "horizontal scan = 5 (± .15) inches," or "mechanical lock should remain in locked detent"). The performance parameters listed in this analysis shall be measured and confirmed by measurement on the subject system/equipment. The product of the performance analysis shall be a summary list of all Checks that can be made at each and every output of the subsystems, units, assemblies, parts, etc., that are shown by the task analysis to require checkout and troubleshooting. This summary shall form the basis for the number of checkouts and Checks, as well as the fault symptoms from which action trees will be developed. Another product of the performance analysis effort shall be a set of Annotated Source Documents upon which the analysis details are recorded and a Checkout Summary which lists each Check and its measurable outputs.

3.4.2.1 Annotated source documents. A complete set of the diagrams used in the performance analysis (to the level covered by the task analysis) showing all system functions shall be neatly and clearly marked to show the measurable or observable parameters associated with each block, unit, or component. These parameters shall consist of input measurements, output measurements, observable indications, panel readings, and measurements at intermediate points not covered in lower level diagrams. These documents shall be retained by the contractor throughout the MTI&A effort, until their further use is directed by the procuring agency. They shall be made available for all contractor and Government in-process reviews.

3.4.2.2 Checkout summary. Using the annotated functional source documents, interviews with subject matter experts, and equipment experience, a list of Checks required to completely check out each function of the system/equipment shall be developed for each mode or condition of operation. These Checks shall be entered on the Checkout Summary (Figure 8) in the 'Checks' column. A Checkout Summary shall be prepared for each TIM item coded OL, IL, or BL. They shall be grouped by subsystem and equipment and shall identify each Check in sufficient detail (although not to the step level) to permit ready identification of the scope and intent of the Check. Opposite each check description the Performance Parameters associated with that Check shall be entered. There shall be an entry for each parameter identified on the annotated source documents. Parameters shall include the permissible range of tolerances for all parameters that are measurable and a precise description of the expected normal operation for parameters that are observed (sight, smell, touch, hearing).

3.4.3 Failure Mode and Fault Symptom Analysis. For each possible performance parameter in the Checkout Summary, a Failure Mode and Fault Symptom analysis shall be performed to determine the ways in which each can fail, causing a fault and fault symptom. For each fault symptom caused by each of those failures, an action tree will later be developed to isolate the fault(s) and component(s) that cause each symptom. This analysis shall also make use of field experience data from all applicable sources, including the following:

a. Depot and intermediate failure reports

b. Operating failure logs and reports

c. Field maintenance logs and reports

d. Engineering test data

e. Field test data

f. Published manuals

g. Inspection reports

h. Experience with similar systems

i. Applicable documents for similar systems

j. Maintainability and reliability analysis. MTI&A shall make use of reliability analysis in conformance with MIL-STD-785A, which is required in many contracts and is an important input to failure mode and fault symptom analysis. In reliability analysis, potential failures are evaluated to determine the effect on mission accomplishment and ranked critical analysis.

k. Hazard analysis. MTI&A shall make use of hazard identification and analysis inputs, when required under MIL-STD-882, System Safety Program Requirements. Fault hazard data, which result from evaluation of component hazard modes, causes of those hazards, and resultant effects to the system and its operation, shall be considered in this phase of MTI&A.

3.4.3.1 Fault symptoms. For each fault symptom, the Task Identification Matrix shall be examined for all items that are repairable or replaceable and could have caused the fault symptom. The following questions must be answered.

a. Can this item be the cause of the fault and a fault symptom?

b. If so, which faults will cause the same fault symptom?

c. Should a Checkout or a Logic Tree, or both, be developed in the LTTA to isolate the fault or faults for each symptom?

If the answer to (a) or (c) is Yes, the TIM shall be annotated to show that decision.

3.4.3.2 Fault Symptom List. A fault symptom list shall be prepared for each system, subsystem or equipment which shows for each fault symptom all components which, if failed, could cause the symptom. If the system can operate in one or more secondary or subsystem modes, additional listings shall be prepared to show the fault symptoms for each such mode. The fault symptom list shall be developed with inputs from the Failure Mode and Fault Symptom Analysis and the TIM annotation process explained above. This list will form the basis for the development of action trees and ensure the completeness of the Logic Trees in the LTTA manual development.

3.4.3.3 Action Trees. For each fault symptom that is identified, an efficient Action Tree (AT) shall be developed. An action tree is a branching tree outline of the components, assemblies, or equipments that can cause the fault symptom, together with procedural information necessary for later use by the LTTA developer in explaining diagnostic procedures. It consists of a series of actions the troubleshooter should follow if a) the desired normal performance parameters are not achieved during checkout or b) the performance analysis indicates a fault symptom. The arrangement, to include all components, shall be in the order of their importance as most probable causes of the fault. Figure 9 shows the overview construction of a complete AT without the component names or procedural data. Figure 10 shall be used as a guide to developing the data for an AT from all other previous MTI&A inputs.

3.4.3.3.1 Action Tree Details. The Action Tree shall include sufficient technical details so that it provides the essential information needed by the LTTA developer to prepare comprehensive Logic Tree troubleshooting procedures. AT detail is similar to that of the Task Analysis Worksheets (3.3.4.1) in that it provides a synopsis of a technically accurate, complete troubleshooting procedure with the most logical arrangement that provides the fastest route to fault diagnosis. AT's shall contain the following data:

a. Preconditions for fault diagnosis (e.g. support equipment setup, waveforms, mechanical measurements, etc.).

b. Significant steps needed by a technician to proceed through each branch of the tree to diagnose each AT component, assembly or equipment.

c. Testing data for each failure mode of components to the extent that different modes can contribute to the fault symptom. Many components that have more than one failure mode will appear in different ATs because the failure modes produce different fault symptoms.

d. Identification of follow-on or related tasks that are important for the LTTA developer to know.

3.4.3.3.2 Differences from LTTA Logic Trees. The essential differences between the detail provided by the task analyst in each AT and that developed later by the preparer of Logic Trees are as follows: (1) ATs provide an outline of the breakdown of components, assemblies and equipments that can be the cause of faults together with a synopsis of the task step details for performing fault diagnosis. The final Logic Tree procedures as they appear in the final LTTA are amplified and refined by the LTTA preparer to take into account the human factors, or behavioral aspects (what the troubleshooter sees or detects and what the User responses should be to achieve the task objectives); 2) in developing the AT, the task analyst does not concentrate on communicating the material to the target users, while the LTTA preparer applies behavioral considerations (such as task cues and responses for the User) as well as style, syntax, and readability standards and other communicative techniques that best convey the information to the Users in terms they will readily understand, and 3) the ATs are essentially unformatted, while LTTA logic trees are prepared to detailed, precisely structured requirements for layout, organization, and illustrating.

3.5 Special requirements for programs using logistic support analysis.

3.5.1 MTI&A/LSA coordination. When LSA in accordance with MIL-STD-1388 is part of the contract, the MTI&A effort shall be coordinated with the LSA effort. The purposes of such coordination shall be to:

a. Assure that maximum use is made of LSA data and results from other functions (maintenance engineering, logistics engineering, reliability engineering, spares provisioning, etc.) in the MTI&A, and that applicable MTI&A data and results are provided to the LSA.

b. Avoid duplication of the data gathering, decision making, and analysis efforts required by MTI&A and those required by the LSAR and other related CDRL items.

c. Resolve differences which may occur between the LSA data and MTI&A data.

d. Assure that data and results common to MTI&A and other functions become part of the common data base, the LSAR.

e. Make maximum use of the LSAR data processing capability to input, process, store, and output data applicable to MTI&A in a form that is readily usable for MTI&A purposes.

3.5.1.1 Coordination plan. An MTI&A/LSA coordination plan shall be prepared as part of the MTI&A planning effort to define the relationships between the two. It shall be included as part of the Task Analysis Plan (3.1.3). Applicable portions of the coordination plan that are already included in the LSA Plan may be referenced to that plan. The MTI&A/LSA coordination plan shall be subject to the same approval requirements as the Task Analysis Plan, and it shall contain the following elements of information:

a. Identification of LSAR input data sheets and data elements thereon that apply to MTI&A, and the products in which they are used

b. Functional groups responsible for LSAR input data sheets/data elements applicable to MTI&A

c. List of LSAR output summaries, both informal for internal use and formal deliverable CDRL items, that will be used as inputs or reference documents for MTI&A preparation, including the planned use of each

d. List of output summaries to be specially prepared as MTI&A products, and those prepared for other purposes that will be adapted as MTI&A products, including format samples marked to show modifications if any, and their relationship to MTI&A product elements

e. Identification of data elements required by this specification but not available from the LSAR

f. Schedule for availability of LSAR input data sheets (including interim completion stages and updates), availability of output summaries, and and relationship to MTI&A schedules (3.1.3, item h). Include highlighting of items not available for MTI&A use or in time for MTI&A delivery.

3.5.2 Duplication of effort. Data gathered for other LSA purposes shall be assessed for application to MTI&A. It shall be incorporated as part of the MTI&A to the extent that it meets the detailed requirements of this specification. LSAR data may be adapted or reorganized for such use, but only as needed to meet specification requirements. If conflicts exist between this specification and MIL-STD-1388, this specification shall govern.

3.5.3 Use of LSAR data. Much of the information needed for MTI&A is available in the LSAR, which has a data base consisting of both standard data elements defined in MIL-STD-1388-2 and additional data elements required by the particular program and approved by the procuring activity. These elements are initially entered on LSAR input data sheets by the cognizant functional activity, and are then keypunched and inputted to the computer master file. The data can be accessed for MTI&A purposes in three ways: (1) from the input data sheets, (2) from the output summaries (reports) produced by the computer under program control, and (3) a combination of the two. The data elements contained on LSAR data sheets and output summaries shall be researched and analyzed for their potential application to MTI&A. Those data found to apply either wholly or in part to MTI&A shall be used in the appropriate MTI&A products after first having been checked to assure their validity as well as that of the analyses that led to their creation. This check may take the form of verification that the input data sheets have been approved by a reviewing and approving body created especially for the purpose.

3.5.3.1 Relationship of LSAR to MTI&A products. Although the input data sheets and output summaries vary with each program, there is a general relationship between the types of sheets and output summaries and the MTI&A products. This relationship is shown in the following chart (the titles of output summaries are only typical):

MTI&A Product	Typical LSAR Sources
Task Identification Matrix	• Maintenance Allocation Summary
Definitized User Profile	• Personnel and Skill Summary • Input Data Sheet G (Skill Evaluation and Justification)
Support Equipment Guide	• Support and Test Equipment Utilization Summary • Special and Common Tool Requirements • Input Data Sheet E (Support and Test Equipment or Training Material Description and Justification)

MTI&A Product	Typical LSAR Sources
Task Analysis Worksheets	• Input Data Sheet D (Maintenance and Operator Task Analysis) • Input Data Sheet C (Task Analysis Summary)
Fault Symptom List	• Failure Mode Effects Analysis • Reliability and Maintainability Summary • Input Data Sheet 'B' (Item Reliability and Maintainability Characteristics)

Appendix A of this specification lists and defines the standard data elements of MIL-STD-1388-2 that apply to MTI&A and references them to the applicable input data sheets and MTI&A products. Figure 11 shows a typical "D" sheet completed as part of the LSA effort. The D sheet is a primary LSAR source for the Task Analysis Worksheets.

3.5.4 Use of LSAR output summaries as MTI&A products. LSAR output summaries may be used as MTI&A products if they meet the content requirements of 3.2 through 3.4, as applicable, and the further requirements of this subsection.

3.5.4.1 Format and arrangement. LSAR output summaries that have been prepared primarily for purposes other than MTI&A may be used in their existing format and arrangement provided the data are arranged substantially in the order required by 3.2 through 3.4. Minor variations are permissible if they do not degrade the understandability and usability of the product.

3.5.4.2 Adaptation for use as MTI&A products. Any data elements that are not pertinent to the MTI&A product must be minimal and shall be neatly hand-marked as being not applicable by means of crossouts or other suitable means. Any data required by 3.2 through 3.4 that do not appear on the printout shall be added neatly by hand. The summary shall be retitled to identify it as the appropriate MTI&A product.

3.5.4.3 Legibility and reproducibility. LSAR output summaries prepared or adapted for use as MTI&A products shall meet the legibility and reproducibility requirements of 3.1.6.3.

3.5.4.4 Approval for use. Samples of the proposed printouts, with appropriate explanations and markings, shall be submitted for approval by the procuring activity in accordance with 3.5.1.1 prior to use.

3.5.5 Currency of data. As submitted to the Government, MTI&A products using LSAR data shall agree with the latest approved issues of the LSAR input data sheets and shall be complete in every respect. Differences in the LSA and MTI&A data should be examined and resolved prior to submittal to provide the Government with coordinated, accurate information for evaluation.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use Contractor or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Contractor inspection. The adequacy and accuracy of the MTI&A products required by this specification and their suitability for the intended purpose shall be assured by a combination of planned, timely actions by the contractor and representatives of the procuring activity. The contractor shall have the primary responsibility for in-process quality assurance during the development phase of the MTI&A products, and shall be responsible for the integrity of the products as presented for Government acceptance. The contractor shall be further responsible for correcting any errors or omissions detected by the Government both prior to acceptance, and after acceptance for the period of time stated in the contract. In-process quality assurance shall be conducted in accordance with the quality assurance plan (4.4), and product integrity shall be assured by a validation program as required by 4.6. If subcontractors perform any of the analyses, the contractor shall be responsible for assuring that the analysis products conform with the contract and specification requirements. The extent of control invoked and exercised by the contractor shall be identified in the quality assurance plan, and the contractor shall inspect MTI&A products upon receipt from the subcontractor.

4.3 Government inspection. All material furnished in accordance with this specification shall be subject to inspection, verification, and approval or disapproval by the Government as specified by the terms of the contract. Inspection/Verification will be performed by the Government prior to acceptance. Government inspection will include periodic in-process reviews and in inspections during MTI&A development, and verification of the products submitted by the contractor. In-process reviews will be performed by the Government at key points in the development process. Additional unscheduled reviews will be performed as desired by the Government. The reviews will be conducted in the contractor's facility or an equipment site, or both, as appropriate.

4.4 Quality Assurance plan. The contractor's quality assurance program shall be conducted in accordance with a Quality Assurance plan. The plan shall document the contractor's plans and methods for assuring the quality of MTI&A products, and it shall be incorporated in the Task Analysis Plan (3.1.3). The quality assurance plan shall be subject to the same approval requirements as the Task Analysis Plan, and it shall contain the following elements:

a. Details of the proposed in-process quality assurance program. If an inspection system in accordance with 4.5 is a requirement of the contract, details of the system including inspection methods, records keeping, corrective action, and responsibilities of assigned departments and personnel.

b. Validation plan, including methods and procedures, records keeping, personnel assignments, correction and revalidation, and scheduling.

c. Provisions for participation in and support of Government in-process reviews, including facilities, equipment and data availability and access, personnel participation, and documentation of and compliance with guidance provided.

d. Methods and procedures for controlling quality of products prepared by subcontractors.

4.5 Contractor inspection system. When required by the contract, the contractor shall establish and maintain a continuous in-process inspection system for the purpose of assuring the quality of the MTI&A beginning with the earliest development stages. It shall be a written system conducted, documented, and maintained in accordance with the requirements of this section and the applicable portions of MIL-I-45208 cited herein. The system shall provide comprehensive control of the development and validation of the MTI&A products to assure that they meet the requirements of the contract and this

specification and are adequate for the intended use. If a quality program in accordance with MIL-Q-9858 is a requirement, it may be used instead, in whole or in part at the contractor's option to permit a single, uniform quality system. When the contract includes preparation of JPAs, the MTI&A inspection system shall be integrated with the overall technical manual quality assurance program. If the contract requirements for contractor inspection conflict with this specification, the contract shall govern. The contractor's responsibilities for the inspection system shall be as specified in 3.1 of MIL-I-45208. The contractor shall use in-house or other manpower facilities and services as approved by the procuring agency. Quality assurance personnel shall not be the same persons as those preparing the item being examined, but shall be qualified by training and experience to assess MTI&A requirements, products, and validation methods.

4.5.1 Detailed Requirements

4.5.1.1 Inspection Instructions. Directions for inspection shall be documented by clear, complete and current instructions as prescribed in 3.2.1 of MIL-I-45208. The instructions shall include sampling procedures, methods of checking the adequacy of analysis procedures, and checklists for assessing the content and completeness of analysis products. Criteria for approval and rejection shall be given. Inspections shall be conducted in accordance with the approved quality assurance plan. Sampling methods shall be applied when deemed suitable during the development period; however, all MTI&A products must be subjected to 100 percent validation prior to submission to the Government.

4.5.1.2 Records. The results of all inspections shall be recorded as required by 3.2.2 of MIL-I-45208. The records shall indicate the products sampled, the nature and number of observations made, the number and type of deficiencies found, and the nature of corrective action taken as appropriate.

4.5.1.3 Corrective Action. When defects are found during inspection, the contractor shall take prompt action as specified in 3.2.3 of MIL-I-45208 to correct the defects or the conditions that could result in the submission to the Government of defective MTI&A products.

4.5.1.4 Source data. The inspection system shall provide for procedures which assure that the latest source data are being used for conduct of the MTI&A.

4.5.1.5 Validation. The inspection system shall provide procedures for monitoring the validation of MTI&A products by quality assurance personnel to ascertain that it is being conducted in accordance with the requirements of 4.6 and the validation plan, that the validation results are properly recorded, and that any necessary corrections to the MTI&A products are made.

4.6 Validation. Prior to submission to the Government, all MTI&A products shall be validated by the contractor for adequacy, accuracy, and completeness in accordance with this specification. The validation shall constitute a complete and thorough check of the data and procedures to provide a measure of the overall quality of the products and to assure their technical integrity. Validation may be performed at the contractor's facility, at an equipment site, at subcontractors' facilities, or a combination of these as determined to be most suitable for the purpose. Validation shall be conducted in accordance with the approved validation plan (4.5.1.1) by qualified contractor technical personnel and quality assurance representatives. The Government reserves the right of witnessing the validation by representatives of the procuring activity, at its discretion. The contractor shall notify the procuring activity in advance of scheduled validation activities. All MTI&A products must be validated completely at one time or in any particular sequence.

4.6.1 Validation of task analysis worksheets. The adequacy of the task steps and illustration references of the Task Analysis Worksheets shall be checked by actual performance on the subject system/equipment. All procedures and steps shall be validated 100 percent on the equipment. Complete validation of the Worksheets ensures the accuracy of the subsequently prepared JGM; all that is required for JGM validation is a comparison with the corresponding Worksheet for fidelity of conversion. Those tasks or steps that would damage or degrade the equipment or are otherwise technically impractical shall be performed by simulation in whole or in part, subject to approval of such simulation by the procuring activity. "Simulation" means comparison of the instructions in the Worksheet against the physical equipment and any necessary supporting photos or drawings. The validation shall assess whether adequate warnings, cautions, and notes have been provided at the appropriate places to ensure the safety of personnel and avoid damage to the equipment. Validation may be conducted concurrently with removal, disassembly, test, assembly, etc. performed by other contract activities, when practical. However, the procedures and steps used shall be only those contained in the Worksheets. Non-procedural information on the Worksheets shall be validated in accordance with 4.6.2.3. The end equipment and support equipment used for validation shall be in accordance with the approved equipment plan and meet the requirements of 3.1.8.

4.6.2 Validation of non-procedural products.

4.6.2.1 Task identification matrix. The contractor shall validate the entire Task Identification Matrix prior to beginning the Task Detail Analysis. Initially, a complete check shall be made of the developed matrix by examining each hardware item listed against the latest data-base document (GAPL, PPB, IPB, Repair Parts and Special Tools List (RPSTL), or other complete parts breakdown). When the TIM is determined to accurately reflect the hardware complement, it shall be further validated as follows:

a. Personnel shall be selected who are technically qualified (design engineer, field maintenance instructor, etc. – sometimes called subject matter expert), have in-depth knowledge of maintenance performed on this equipment or subsystem, and are technically capable to make decisions based on factors such as maintainability, spares levels, maintenance philosophy, and availability of test equipment.

b. All TIM entries for each hardware item shall be analyzed for appropriateness of task types and indicated levels of maintenance (e.g., Can it be aligned? Can it be repaired? At what level?). If in error, the TIM shall be corrected by the validating team.

c. Any parts of the TIM that are found during validation to be missing or significantly in error shall be corrected and then revalidated, preferably by the same validation personnel.

4.6.2.2 Support equipment guide. The Support Equipment Guide shall be validated by qualified support equipment personnel (i.e., engineer or specialist) who are familiar with the target users as defined in the Definitized User Profile. Validation shall show that the Guide satisfies the following requirements:

a. It reflects the approved list of tools, test equipment, and ground support equipment or equipment functions that have been recommended or procured for O&I maintenance.

b. The tasks listed for JPA inclusion in the TIM can be performed with the specific items or functions listed in the Guide.

c. The standard statements to be included in the JPA are appropriate for the support equipment and for the specified user population.

4.6.2.3 Other non-procedural products. All other non-procedural MTI&A products shall be validated by a thorough review for adequacy, accuracy, and completeness and for compliance with this specification. Entries on each product shall be compared with the source data identified thereon as having been used for its development. The products shall be checked against inspection records, in-process review comments, and other contractor and Government interim review comments and documents to assure that all necessary corrections and modifications have been accomplished. Each product shall be further cross-checked against the other MTI&A products used in their development, or in whose development they were used, for agreement and for consistency of common data.

4.6.3 Validation of Troubleshooting products.

4.6.3.1 Non-Procedural products. The contractor shall validate the Annotated Source Documents, Checkout Summary, and Fault Symptom List prior to beginning the Action Trees. The validation shall constitute a complete and thorough check of data, performance parameters and failure mode and fault symptoms to ensure overall quality and technical integrity of the products that will form the basis for ATs and later Logic Trees. Initially a complete check shall be made that the checkout summary entries and failure modes and fault symptoms match the TIM cell decisions for checkout and troubleshoot functions, as well as other MTI&A products.

4.6.3.2 Validation of Action Trees. The hardware breakdown, and the troubleshooting strategy, implicit in each AT shall be validated for accuracy and completeness against source data. All procedural data shall be validated 100 percent on the equipment by qualified subject matter experts, as follows:

a. The adequacy of the AT task steps shall be checked by actual performance. Only the tools and test equipment authorized in the Support Equipment Guide shall be used. The objective shall be 100 percent validation of technical accuracy, adequacy and performability of each AT branch.

b. Simulation in lieu of full troubleshooting performance may be used if necessary to prevent degradation of parts, pieces or components associated with the faulty elements. Prior approval of the Government shall be obtained for all troubleshooting simulations.

c. Contractor personnel shall perform AT troubleshooting procedural steps on operational and authorized equipment using only the information provided in the AT.

d. There must be an AT for each fault symptom identified during troubleshooting task analysis.

e. The AT must include diagnostic branching steps that will expose every component that can produce the AT fault symptom.

f. The AT branching and troubleshooting strategy must be efficiently developed to ensure against redundant steps, omissions, and overlapping tests and incomplete endings.

g. In the process of validating action trees, the contractor shall determine the full range of tolerance values given for testing suspect components for pressure, motion, voltage, current, resistance and waveform readings. The basis for these determinations shall be the tolerance ranges listed in the performance analysis and checkout summary. The full range for each reading shall be established by simulating the failure mode in a manner that allows the tolerance limits to be observed; i.e., the points in the range at which the fault symptom or symptoms appear. When approved by the Government, and at the option of the contractor, a set of design, engineering, test or production reports showing the required tolerance ranges can be inserted in the validation results in lieu of further trials.

4.6.4 Records. The contractor shall prepare and maintain records of validation proceedings, showing dates of validation, material reviewed, findings, actions taken, and names of participants. The procuring activity shall have the right to examine these records at the contractor's facility. If required by the contract, validation records shall be deliverable.

4.6.5 Correction of errors and revalidation. When corrections or revisions are required after any inspection, validation or review, all such corrections or revisions shall be reinspected, revalidated, or re-reviewed.

4.7 Government inspection. Material furnished in accordance with this specification shall be subject to inspection and approval or disapproval by the Government or its appointed representative prior to acceptance, in accordance with the contract requirements.

4.7.1 In-process reviews. Periodic in-process reviews and inspections may be performed by representatives of the procuring activity during development of MTI&A products, primarily as guidance to the contractor and to assure that the analysis conforms to contract and specification requirements. The reviews and inspections may be conducted at the contractor's facility at any time during the development of the analysis. To the maximum extent feasible, in-process reviews shall be scheduled to take place early in the development process when

guidance can have its greatest effect, and later when enough of each MTI&A product is completed (e.g. 30%, 60%) to permit useful sampling inspection and assessment.

4.7.2 Verification. All validated MTI&A products will be verified by representatives of the procuring activity prior to acceptance. The verification will ascertain the adequacy, accuracy and completeness of the products, their conformance with the contract and specification requirements, and their suitability for the intended use. As part of verification the procuring activity representatives may inspect the contractor's validation records and conduct a review of the MTI&A products. For the Task Analysis Worksheets and Action Trees this review may take either of the following forms: witnessing the contractor's validation; having Government personnel perform the task steps at the contractor's plant or at Government facilities; or similar suitable actions. The contractor shall correct errors and omissions found by the Government at no additional cost. Substantial corrections or additions shall be revalidated and reverified until they meet the requirements of the contract and this specification.

5. PACKAGING

5.1 Packaging. Packaging, packing, and marking shall be in accordance with MIL-M-38784.

6. NOTES

6.1 Intended use. Maintenance task analyses and the products of those analyses prepared in accordance with the requirements of this specification are intended for use as the preparatory phase of development of Job Performance Aids and other types of manuals. MTI&A is used to identify all maintenance tasks to be included in JPAs and to establish a firm, complete data base for their preparation.

6.2 Ordering data. When ordering or contracting for MTI&A the procuring activity will provide the following information and instructions to bidders and contractors:

a. The title, number, and date of this specification

b. Optional MTI&A products required, if any, and required content and format (3.1.4.2)

c. Data and data sources to be provided by the Government, if any (3.1.5)

d. Definition of which MTI&A products are to be delivered to a Government facility and which are to be delivered in place. Also include retention period for products delivered in place (3.1.7).

e. Instructions for availability and use of subject system/equipment for MTI&A development and validation (3.1.8)

f. Hardware indenture level of equipment breakdown in TIM (3.2.1.1)

g. GFE and standard off-shelf equipment to be included in, or excluded from, the MTI&A (3.2.1.1)

h. The current maintenance concept for the system/equipment (3.2.1.3)

i. Maintenance level to which task analysis shall be conducted: O, I, or both (3.3 and 3.4)

j. A Preliminary User Profile or date for furnishing it to the contractor (3.3.1.1)

k. Method of keying task steps to locator illustrations (3.3.4.4.7 g)

l. Whether an inspection system shall be required in accordance with paragraph 4.5

m. The Government's plan, procedures, and requirements for conducting in-process reviews.

n. Whether validation records shall be deliverable items (4.6.3)

6.3 Terms and definitions. The following important terms and definitions are used throughout this specification. An understanding of each is necessary to enable the contractor to perform effective MTI&A. Important terms that are adequately defined in the text are generally not repeated here.

6.3.1 Action Tree. A branching tree diagram for a fault symptom showing the procedural steps required to isolate each fault that can cause that symptom to a replaceable component.

6.3.2 Analyst (Task). An individual qualified by training and experience to perform the task analysis process. Personnel assigned this position (or are detailed to assist in this process) should have an understanding of: (1) analysis techniques; (2) documentation research techniques; and (3) interview techniques. An analyst need not be an equipment expert, but must have access to equipment experts.

6.3.3 Assembly. A number of parts or subassemblies, or combination, joined together to perform a specific function and which can be disassembled. (Examples: Power shovel-front, fan assembly, audio frequency amplifier.) NOTE: The distinction between an assembly and subassembly is determined by the individual application. An assembly in one instance may be a subassembly in another where it forms a portion of an assembly.

6.3.4 Automatic Test Equipment (ATE). Automatically sequenced test equipment used, usually at intermediate (shop) level, to check out and troubleshoot assemblies of a system, such as LRUs (Line Replaceable Units).

6.3.5 Built-In Test Equipment (BITE). Test equipment built into a system that enables it to perform a check on itself automatically.

6.3.6 Failure Mode. One of the ways in which a component can fail. A solenoid, for example, can have three failure modes: a) a broken coil, b) broken insulation, or c) restricted mechanical movement. Each of the three failure modes can produce a different fault symptom.

6.3.7 Fault Symptom. An observable or measurable abnormal indication, operation or function caused by a fault in an equipment or system. Note that in some systems, for any given system state the same symptom may appear as the result of any one of many possible faults.

6.3.8 Function. A group of functional entities and functional devices or circuit elements that work together to accomplish a portion of a system or an equipment assigned objective. For example: transmit, receive, display, hoist, train, generate power, and control actions.

6.3.9 In-Process Review. A review of an MTI&A project conducted at critical points for the purpose of evaluating the status of the project, accomplishing effective coordination, and facilitating proper and timely decisions required during the task analysis. Also includes evaluation of work in progress and provision of guidance.

6.3.10 Intermediate Maintenance. See 'Maintenance Level'.

6.3.11 Job. The composite of duties and tasks expected of an individual within a particular rating or specialty and at a particular skill level or rate.

6.3.12 Job Guide Manual (JGM). A specialized technical manual containing illustrated, highly detailed step-by-step procedures for the accomplishment of maintenance tasks other than Checkout and Troubleshooting.

6.3.13 Job Performance Aid (JPA). Illustrated, highly detailed step-by-step instructions for the performance of maintenance tasks, including both non-troubleshooting and troubleshooting tasks. The two types of JPA (Job Guide Manuals and Logic Tree Troubleshooting Aids) are designed to provide in one place all of the information that a technician needs to do all of the job tasks on a system/equipment.

6.3.14 Logic Tree Troubleshooting Aid (LTTA). A specialized troubleshooting manual based on logic trees and containing coordinated sets of troubleshooting aids such as checkout procedures, logic trees, fault symptom lists, locator diagrams, and sometimes supporting reference information and troubleshooting rationales.

6.3.15 Maintainable. Capable of being adjusted, aligned, calibrated, checked, tested, trouble-isolated, serviced, repaired, or replaced.

6.3.16 Maintenance Function. A group of maintenance tasks performed upon a system or a component of the system. Standard maintenance function verbs for use in the TIM are:

a. Adjust. 1) To bring to a specified position or state; 2) to bring to a more satisfactory state; to manipulate controls, levers, linkages, etc., to return equipment from an out-of-tolerance condition to an in-tolerance condition.

b. Align. To bring into line, to line up; to bring into precise adjustment, correct relative position, or coincidence.

c. Assemble. To fit and secure together the several parts of; to make or form by combining parts.

d. Calibrate. To determine, and restore if necessary, accuracy by special measurement or by comparison with a standard. Usually applied to test and measurement equipment but also applies to other highly accurate equipment.

e. Checkout. To perform specified operations to verify operational readiness of a subcomponent, component; subsystem, or system.

f. Disassemble. To take to pieces; to take apart to the level of the next smaller unit or down to all removable parts.

g. Install. 1) To perform operations necessary to properly fit an equipment unit into the next larger assembly or system; 2) to place and attach.

h. Operate. To control equipment in order to accomplish a specific purpose.

i. Reassemble. To refit and secure the parts of the item after they have been taken apart.

j. Reinstall. To perform operations necessary to properly refit into a system or subsystem, an item that was previously removed.

k. Remove. 1) To perform operations necessary to take an equipment unit out of the next larger assembly or system; 2) to take off or eliminate; 3) to take or move away.

l. Repair. To restore an equipment item to operable condition by means other than total replacement.

m. Replace. To substitute serviceable equipment for malfunctioning, worn out, or damaged equipment.

n. Service. Operations required periodically to keep an item in proper operating condition, such as the following:

(1) Balance. To equalize in weight, height, number, or proportion.

(2) Bleed. To extract from or let out some or all of a contained substance.

(3) Charge. To restore the active materials in a storage battery by the passage of a direct current through in the opposite direction to that of the discharge.

(4) Check. 1) To confirm or establish that a proper condition exists; to ascertain that a given operation produces a specified result; to examine for satisfactory accuracy, safety or performance; to confirm or determine measurements by use of visual or mechanical means; 2) To perform a critical visual observation or check for specific conditions; to test the condition of.

(5) Clean. To wash, scrub, or apply solvents to; remove dirt, corrosion, or grease.

(6) Coat. To cover or spread with a finishing protecting layer.

(7) Drain. To draw off (liquid) gradually or completely.

(8) Flush. To pour liquid over or through; to wash out with a rush of liquid.

(9) Inspect. To perform a critical visual observation or check for specific conditions; to test the condition of.

(10) Lubricate. To put lubricant on specified locations.

(11) Paint. To apply color or pigment (suspended in suitable liquid) to the surface of.

(12) Pressurize. To apply pressure within by filling with gas or liquid.

(13) Purge. 1) To free of sediment or trapped air by flushing or bleeding; 2) to remove fuel or fuel vapors from engine by motoring engine with fuel switch off.

(14) Tune. To adjust for precise functioning.

o. Test. To perform specified operations to verify operational readiness of a component, subcomponent, system, or subsystem.

p. Troubleshoot. To localize and isolate the source of a malfunction or breakdown.

6.3.17 Maintenance Levels. The three basic levels of maintenance – Organizational, Intermediate, and Depot (not covered in this specification) into which all maintenance activity is divided. The scope of maintenance performed within each level must be commensurate with the personnel, equipment, technical data, and facilities provided.

a. Organizational Maintenance. Maintenance which is the responsibility of, and performed by, a using organization on its assigned equipment. Its phases normally consist of inspecting, servicing, lubricating, adjusting, and the replacement of parts, assemblies, and subassemblies.

b. Intermediate Maintenance. Maintenance which is the responsibility of and performed by designated maintenance activities for direct and general support of using organizations. Its phases normally consist of calibration, repair or replacement of damaged or unserviceable parts, units or assemblies or subassemblies; the emergency manufacture of non-available parts; and providing technical assistance to using organizations. Intermediate maintenance is normally accomplished in fixed or mobile shops.

6.3.18 Maintenance Step. (See 'Task Step')

6.3.19 Maintenance Task. (See 'Task')

6.3.20 Maintenance Task Analysis. (See 'Task Analysis')

6.3.21 Maintenance Task Identification. (See 'Task Identification')

6.3.22 MTI&A Products. The recorded results of Maintenance Task Identification and Analysis. Includes: Task Identification Matrix (TIM) or Expanded TIM (optional); Definitized User Profile; Level of Detail Guide; Support Equipment Guide; Task Analysis Worksheets; Checkout Summary; Fault Symptom List; Action Trees; and Task Identification Summaries (optional).

6.3.23 Part. One piece, or two or more pieces joined together which are not normally subject to disassembly without destruction of designed use.

6.3.24 Performance Parameters. Range of acceptable values for a system or equipment function which when measured or observed indicate satisfactory operation.

6.3.25 Skill. The mastery of, or proficiency in, a technique. Skills involve physical or manipulative activities. They often require knowledge for their execution. All skills are actions having special requirements for speed, accuracy, or coordination.

6.3.26 Skill Level. The type and degree of skill representing the extent of qualification within the total AFSC. It reflects the skills typically required for successful performance at the grade with which the skill level is associated.

6.3.27 Subassembly. Two or more parts which form a portion of an assembly or a unit replaceable as a whole, but having a part or parts which are individually replaceable.

6.3.28 Subsystem. A major functional subassembly or grouping of items or equipment which is essential to the operational completeness of a system.

6.3.29 Subtask. Any group of related behaviors which fulfills a limited purpose within a task. For example, "open access doors" or "set up test equipment" may be subtasks within an inspection or checkout task.

6.3.30 Support and Test Equipment (SE). Referred to as 'support equipment' in this specification. One of the nine principal elements of ILS. Consists of tools, metrology and calibration equipment, performance monitoring and fault

isolation equipment, maintenance stands and handling devices required to support the operation and maintenance of systems. Items are categorized as peculiar (to the system under development) and common (commercially available or currently in the defense inventory). Includes equipment categorized as Ground Support Equipment (GSE) or Aerospace Ground Equipment (AGE).

6.3.31 Symptom. (See 'Fault Symptom')

6.3.32 System/Equipment. The item under analysis, be it a complete system or any portion thereof being procured.

6.3.33 Target Population. (See 'User Population')

6.3.34 Task. A set of steps describing a complete start-to-finish, step-by-step maintenance action.

6.3.35 Task Analysis. Also referred to as "Maintenance Task Analysis". A systematic procedure for analyzing identified maintenance task to determine what the task consists of, what is needed to perform it, and how it should be performed. Includes defining the user population, support equipment requirements, and level of detail required. The recorded results of task analyses are the basis for development of Job Guide Manuals and Logic Tree Troubleshooting Aids.

6.3.36 Task Identification. Also referred to as 'Maintenance Task Identification'. The ascertainment and itemization of the troubleshooting and non-troubleshooting tasks required to maintain a system/equipment at the Organizational and Intermediate levels.

6.3.37 Task Step. The single, smallest logically definable maintenance action, such as setting a switch to the OFF position. Generally, a step is comprised of one action but in certain cases may be a series of identical actions, such as removing seven bolts.

6.3.38 Troubleshooting. The process of detection, diagnosis and isolation of equipment malfunctions for repair.

6.3.39 User Population. Also referred to as 'Target Population'. Representative members of the using commands, organizations or units for whom the Job Performance Aids will be developed, and therefore at whom the MTI&A is aimed.

6.3.40 Validation. The process by which the contractor ensures the adequacy, accuracy and completeness of the MTI&A products and their suitability for the intended purpose. Procedural data is validated by actual performance on the subject system/equipment, while non-procedural data is validated by such methods as comparison with source data, analysis by experts, etc.

6.3.41 Verification. The process by which the Government assures the accuracy, adequacy, completeness and suitability of the MTI&A products and their conformance with contract and specification requirements. This includes Government action to assure proper validation by the contractor, actual comparison with the hardware, and other suitable actions.

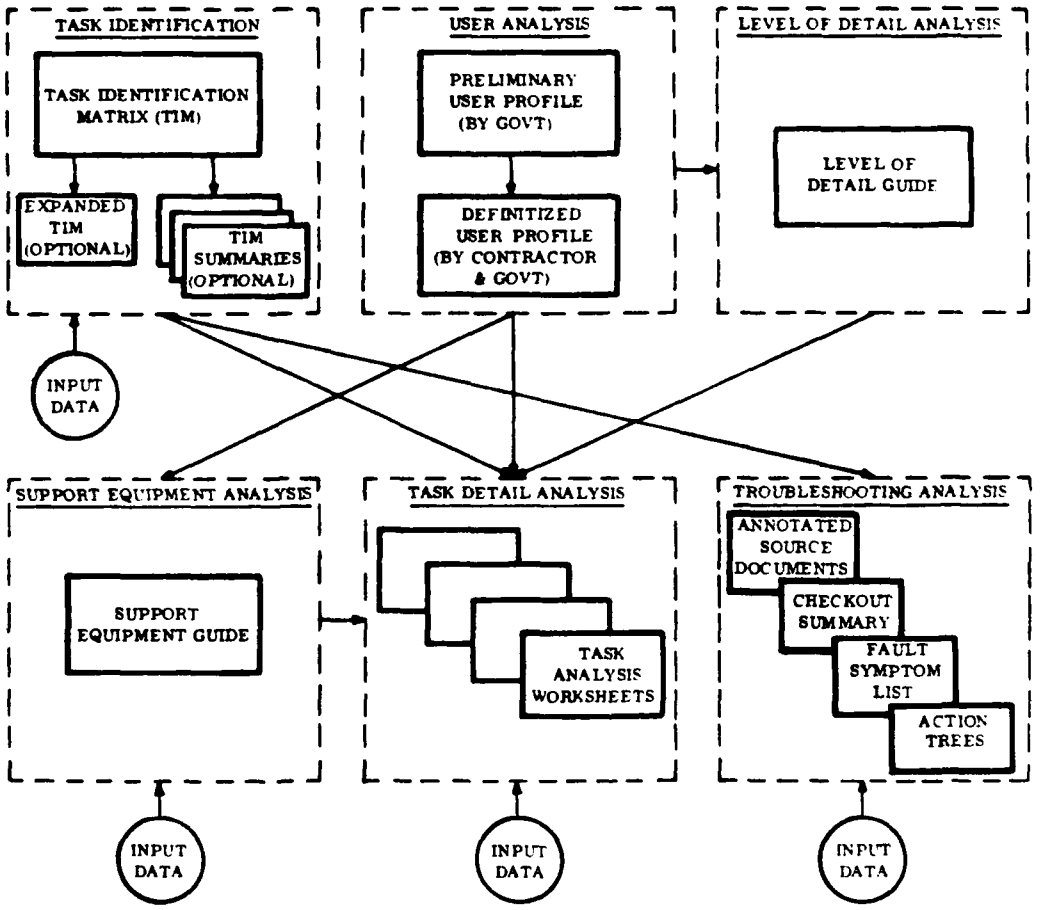


FIGURE 1. MTI&A relationships.

TASK IDENTIFICATION MATRIX – AIRCRAFT CANNON XG-88

CODE						DESCRIPTION	PART NO.	Align/Adjust	Calibrate	Checkout/ Troubleshoot	Disassemble/ Assemble	Clean	Lubricate	Replace	Remove/Install	Repair	Service	NOTES
1	2					20MM Gun mount assy XM161		O J		B L	1 J	O J	O J				O J	Ref dwg 100397 rev A
1	2	1				Mounting kit, boresight	105756	O J	1 J						O J	1 J		
1	2	2				Chute assy, return	184792				1 J	O J	O J			1 J	O J	
1	2	2	1			Cover, chute, upper	846223								O J			
1	2	2	2			Chute, feed	847739	O J							O J			
1	2	3				Inverter, power, static	443211	O J		1 L					O J	1 J		Ref dwg 400121 rev C
1	2	4				Distribution bx, electrical	677009				1 J	O J			O J	1 J		
1	2	4	1			Switch assy, azimuth	663290	O J						O J				
1	2	4	2			Cable assy, electrical	678035			O L		O J			O			
1	2	5				Mount, resilient	110228				1 J	O J		O J		1 J		
1	2	6				Motor, drive	105582			1 L	1 J	O J			O J	1 J	O J	Ref dwg 111007

FIGURE 2. Example of basic task identification matrix – manually prepared.

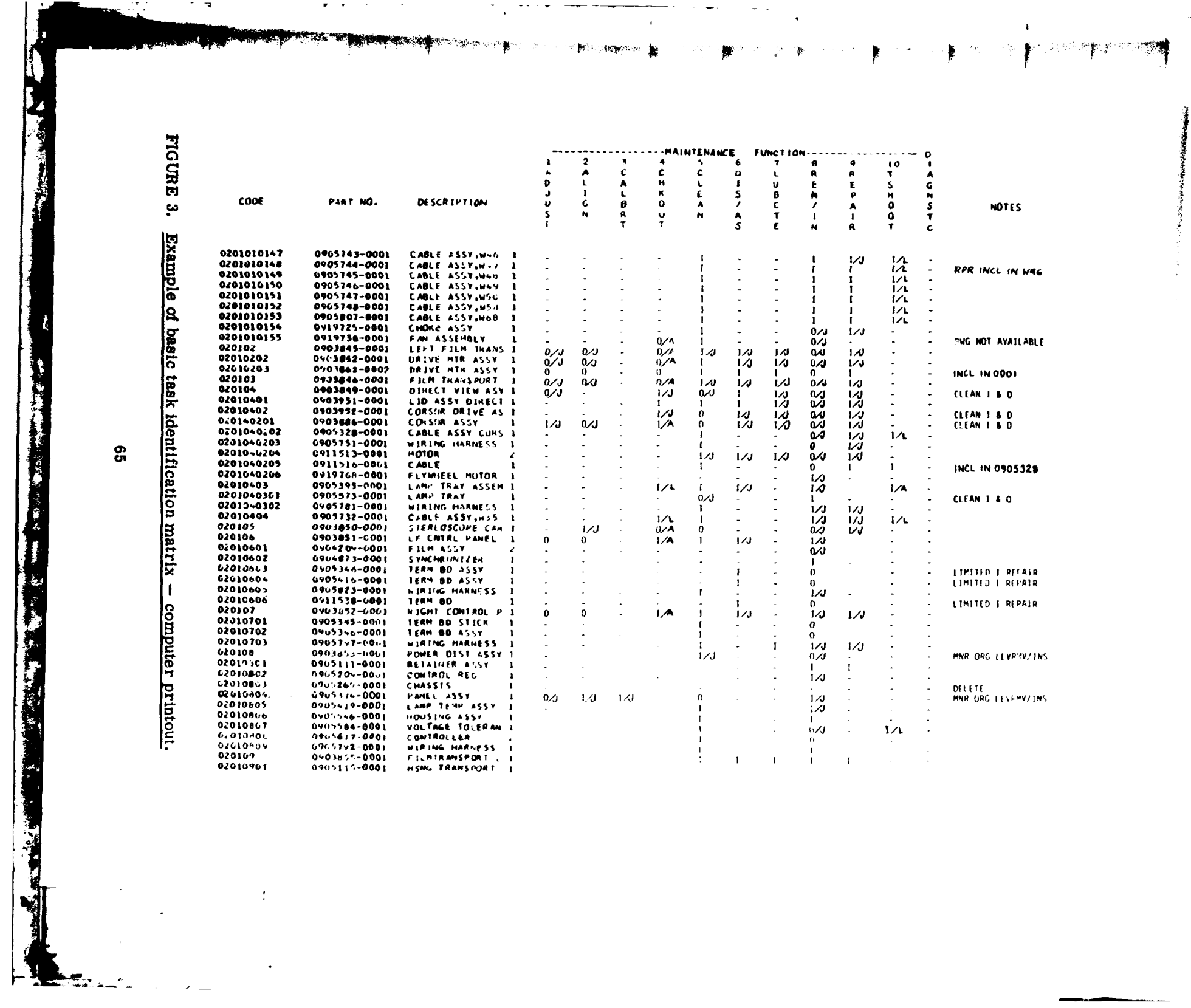


FIGURE 3. Example of basic task identification matrix — computer printout.

CODE	PART NO.	DESCRIPTION		MAINTENANCE FUNCTION											NOTES
				1 ADJUST	2 ALIGN	3 CALBRT	4 CHKOUT	5 CLEAN	6 DISASS	7 LUBCTE	8 REMOVE/INSTALL	9 REPAIR	10 TSHOOT	DIAGNSTC	
0201010147	0905743-0001	CABLE ASSY,W46	1	-	-	-	-	I	-	-	I	I/J	I/L	-	
0201010148	0905744-0001	CABLE ASSY,W47	1	-	-	-	-	I	-	-	I	I	I/L	-	RPR INCL IN W46
0201010149	0905745-0001	CABLE ASSY,W48	1	-	-	-	-	I	-	-	I	I	I/L	-	
0201010150	0905746-0001	CABLE ASSY,W49	1	-	-	-	-	I	-	-	I	I	I/L	-	
0201010151	0905747-0001	CABLE ASSY,W50	1	-	-	-	-	I	-	-	I	I	I/L	-	
0201010152	0905748-0001	CABLE ASSY,W51	1	-	-	-	-	I	-	-	I	I	I/L	-	
0201010153	0905807-0001	CABLE ASSY,W68	1	-	-	-	-	I	-	-	I	I	I/L	-	
0201010154	0919725-0001	CHOKE ASSY	1	-	-	-	-	I	-	-	0/J	I/J	-	-	
0201010155	0919738-0001	FAN ASSEMBLY	1	-	-	-	0/A	I	-	-	0/J	-	-	-	DWG NOT AVAILABLE
020102	0903845-0001	LEFT FILM TRANS	1	0/J	0/J	-	0/A	I/J	I/J	I/J	0/J	I/J	-	-	
02010202	0903852-0001	DRIVE MTR ASSY	1	0/J	0/J	-	0/A	I	I/J	I/J	0/J	I/J	-	-	
02010203	0903862-0002	DRIVE MTR ASSY	1	0	0	-	0	I	I	I	0	I	-	-	INCL IN 0001
020103	0903846-0001	FILM TRANSPORT	1	0/J	0/J	-	0/A	I/J	I/J	I/J	0/J	I/J	-	-	
020104	0903849-0001	DIRECT VIEW ASY	1	0/J	-	-	I/J	0/J	I	I/J	0/J	I/J	-	-	CLEAN I & O
02010401	0903951-0001	LID ASSY DIRECT	1	-	-	-	I	I	I	I/J	0/J	I/J	-	-	
02010402	0903952-0001	CURSOR DRIVE AS	1	-	-	-	I/J	0	I/J	I/J	0/J	I/J	-	-	CLEAN I & O
020140201	0903886-0001	CURSOR ASSY	1	I/J	0/J	-	I/A	0	I/J	I/J	0/J	I/J	-	-	CLEAN I & O
0201040102	0905328-0001	CABLE ASSY CURS	1	-	-	-	-	I	-	-	0/J	I/J	I/L	-	
0201040203	0905751-0001	WIRING HARNESS	1	-	-	-	-	I	-	-	0	I/J	-	-	
020104-0204	0911513-0001	MOTOR	2	-	-	-	-	I/J	I/J	I/J	0/J	I/J	-	-	
0201040205	0911516-0001	CABLE	1	-	-	-	-	I	-	-	0	I	I	-	INCL IN 0905328
0201040206	0919768-0001	FLYWHEEL MOTOR	1	-	-	-	-	-	-	-	I/J	-	-	-	
02010403	0905395-0001	LAMP TRAY ASSEM	1	-	-	-	I/L	I	I/J	-	I/J		I/A	-	
0201040301	0905573-0001	LAMP TRAY	1	-	-	-	-	0/J	-	-	I	-	-	-	CLEAN I & O
0201040302	0905781-0001	WIRING HARNESS	1	-	-	-	-	I	-	-	I/J	I/J	-	-	
02010404	0905732-0001	CABLE ASSY,W55	1	-	-	-	I/L	I	-	-	I/J	I/J	I/L	-	
020105	0903850-0001	STEREOSCOPE CAM	1	-	I/J	-	0/A	0	-	-	0/J	0/J	-	-	
020106	0903851-0001	LF CNTRL PANEL	1	0	0	-	I/A	I	I/J	-	I/J		-	-	
02010601	0904704-0001	FILM ASSY	2	-	-	-	-	-	-	-	0/J		-	-	
02010602	0904873-0001	SYNCHRONIZER	1	-	-	-	-	-	-	-	I	-	-	-	
02010603	0905346-0001	TERM BD ASSY	1	-	-	-	-	-	I	-	0		-	-	LIMITED I REPAIR
02010604	0905416-0001	TERM BD ASSY	1	-	-	-	-	-	I	-	0		-	-	LIMITED I REPAIR
02010605	0905823-0001	WIRING HARNESS	1	-	-	-	-	I	-	-	I/J	-	-	-	
02010606	0911538-0001	TERM BD	1	-	-	-	-	-	I	-	0		-	-	LIMITED I REPAIR
020107	0903852-0001	NIGHT CONTROL P	1	0	0	-	I/A	I	I/J	-	I/J	I/J	-	-	
02010701	0905345-0001	TERM BD STICK	1	-	-	-	-	I	-	-	0		-	-	
02010702	0905346-0001	TERM BD ASSY	1	-	-	-	-	I	-	-	0		-	-	
02010703	0905747-0001	WIRING HARNESS	1	-	-	-	-	I	-	I	I/J	I/J	-	-	
020108	0903853-0001	POWER DIST ASSY	1	-	-	-	-	I/J	-	-	0/J	-	-	-	MNR ORG LEVR'MV/INS
02010801	0905111-0001	RETAINER ASSY	1	-	-	-	-	-	-	-	I	I	-	-	
02010802	0905204-0001	CONTROL REG	1	-	-	-	-	-	-	-	I/J	-	-	-	
02010803	0905269-0001	CHASSIS	1	-	-	-	-	-	-	-	-	-	-	-	DELETE
02010804	0905374-0001	PANEL ASSY	1	0/J	I/J	I/J		0	-	-	I/J	-	-	-	MNR ORG LEVR'MV/INS
02010805	0905419-0001	LAMP TEMP ASSY	1	-	-	-	-	I	-	-	I/J	-	-	-	
02010806	0905546-0001	HOUSING ASSY	1	-	-	-	-	I	-	-	I	-	-	-	
02010807	0905584-0001	VOLTAGE TOLERAN	1	-	-	-	-	I	-	-	0/J	-	I/L	-	
0201080[illegible]	0905617-0001	CONTROLLER	1	-	-	-	-	I	-	-	0	-	-	-	
02010809	0905772-0001	WIRING HARNESS	1	-	-	-	-	I	-	-	I	-	-	-	
020109	0903855-0001	FILM TRANSPORT	1	-	-	-	-	I	I	I	I	I	-	-	
02010901	0905114-0001	HSNG TRANSPORT	1												

O J	Organizational level task to be included in a JGM
I J	Intermediate level task to be included in a JGM
O L	Organizational level task to be included in a LTTA
I L	Intermediate level task to be included in a LTTA
O	Organizational level task not to be included in a JGM or LTTA
I	Intermediate level task not to be included in a JGM or LTTA
B J	Task to be included in both Organizational and Intermediate level JGMs, but method of accomplishment/procedure differs for each
B L	Task to be included in both Organizational and Intermediate level LTTAs, but method of accomplishment/procedure differs for each
O A	Organizational level task performed by automatic self-test equipment (BITE)
I A	Intermediate level task performed by automatic test equipment (ATE)
	No such task required at O or I level
?	A decision is needed – "Is there such a task?" "At what level?" (Interim code)
O ?	Organizational level task – A decision on JGM or LTTA inclusion is needed (Interim code)
I ?	Intermediate level task – A decision on JGM or LTTA inclusion is needed (Interim code)
? J	Task to be included in a JGM – A decision as to maintenance level is needed (Interim code)
? L	Task to be included in a LTTA – A decision as to maintenance level is needed (Interim code)

FIGURE 4. Basic TIM codes.

RADIO SET AN/GRC-XXX
SUPPORT EQUIPMENT GUIDE

Date 3-3-78
Analyst J. Gealogite

FUNCTIONS	EQUIPMENT IDENTIFICATION	PERSONNEL ASSUMPTIONS	STANDARD STATEMENTS
Measure DC Voltage	Multimeter AN/PSM-68	1. Recognize meter for use in making DC voltage measurements. 2. Knows how to make function and range settings. 3. Knows how to read meter scales. 4. Is aware of safety precautions. 5. Knows where to connect leads to meter and how to take actual readings.	"Connect multimeter leads between _____ and _____. Check that meter indicates +_____ VDC." (or: "more than ___ VDC; or "less than ___ VDC"; or "between ___ and ___ VDC")
Remove/replace Connector Pins	Extractor/Insertion Tool KS-12	1. Recognizes tool by name and sight. 2. Knows how to use tool to remove and replace connector pins.	"Using Extractor/Insertion Tool KS-12, remove (insert) pin(s) _____ from (in) connector _____."

FIGURE 5. Example of support equipment guide.

Date 5/12/78
Analyst R. Muff

AIR COMBAT FIGHTER XF-12

LEVEL OF DETAIL GUIDE

1. DISCRIMINATIONS AND PERCEPTIONS CRITICAL TO SUCCESSFUL TASK PERFORMANCE

a. Observing Gross Indications. The task step will name the indicator and will state the condition to be observed (for example, a light on or off; a motor running or not running). The illustration will depict the indicator's location; wherever practical and necessary to communicate an instruction, the illustration will also show the state of the indicator.

b. Reading Quantitative Values. The task step will state a range of acceptable values by naming the inclusive limits of the range. The location of the indicator (scale, counter) will be illustrated (with the exception of some common pieces of test equipment see the Support Equipment Guide). Counter readings will not be illustrated. Necessary scale reading and interpolation skills are assumed to be present in the user.

c. Noting Relative Motion. When relative motion is an important cue, the task step will describe the relevant dimensions of motion (direction and/or rate) of objects with respect to one another, and will include a statement of the observer's position relative to the objects whenever position is necessary for correct interpretation of the text (e.g., a fan rotating clockwise when viewed from the front). Illustration of the moving components will indicate the direction of motion with the use of an arrow pointing from each object along its path of motion.

d. Reading or Interpreting Oscilloscope Patterns or Waveforms. The task step text will require the technician to compare display with a standard provided in the illustration. The illustration will be a line drawing or rendering of the nominal expected display, with the frequency, amplitude, and/or shape tolerance range indicated with dimension lines, and a statement of the tolerance (e.g., "greater than 10 divisions").

FIGURE 6. Example of level of detail guide.

TASK ANALYSIS WORKSHEET

(1) SHEET 1 OF 4

(2) FUNCTION TITLE: Removal & Installation of Fuselage Tank Units

(3) EQUIPT NOMENCLATURE & APPLICABILITY: Tank, Fuel 23G462-001, 003-006 Air Combat Fighter XF-12 Serial 001-010

(4) TASK INTERVAL: N/A

(5) DATE COMPLETED: 2-15-78 Rev: 5-3-78

(6) ANALYST: T. Frederick

INPUT CONDITIONS

(7) REQUIRED CONDITIONS:

Aircraft safe for maintenance (see Worksheet 012)
Aircraft defueled (see Worksheet 035)
Aircraft drained and purged (see Worksheets 101 and 102)
Access panels 2413, 3406, 3417 thru 3429 removed (see Worksheet 114)

(8) PERSONNEL REQUIRED: Two

Person A - remove and install fuel tank units (at unit access)
Person B - act as safety guard and be available for fire extinguisher duty (in a position of quick access to both Person A and extinguisher)

(9) SUPPORT EQUIPMENT:

Fire extinguishers (Two)
Maintenance platform, Type 43JG, P/N 1281302

(10) SUPPLIES:

NOMENCLATURE	SPECIFICATION	PART NO.	Quantity
Protective Device	MIL-C-5501	—	AR

(11) SAFETY CONDITIONS:

WARNING

The removal and installation of the fuselage tank units require that work be accomplished inside the fuel tanks. To prevent

FIGURE 7. Example of task analysis worksheets (sheet 1 of 4).

TASK ANALYSIS WORKSHEET

SHEET 2 OF 4

possible injury to personnel, all safety precautions outlined in T.O. 1-1-3 shall be followed

CAUTION

The quantity of bolts, nuts and washers must be noted both before and after removal and installation to guard against leaving loose parts in the tank.

NOTE

Removal of access panels depends upon the tank unit or units to which access is required. All access panels may not require removal to perform a specific task.

TASK STEPS

(12) PRELIMINARY TASKS: None

(13) SUBTASKS:

Removal of Tank Units
Installation of Tank Units

(14) STEP DESCRIPTIONS:

Removal of Tank Units

(All steps performed by Person A)

1. Remove screws to disconnect electrical connection.
2. Loosen screws in strain relief clamps and remove ferrule.
3. Remove bolt, nut and washer from two clamps holding the tank units to structure.
4. Carefully remove tank unit.

FIGURE 7. Example of task analysis worksheets (sheet 2 of 4).

TASK ANALYSIS WORKSHEET

SHEET 3 OF 4

Installation of Tank Units
(All steps performed by Person A)

1. Position tank unit in place; connect clamps with bolts, nuts, and washers and torque to 12-25 inch pounds.
2. Thread each wire through strain relief clamps and position strain relief ferrules under clamps. Insure wire is in groove provided in clamp.
3. Connect wires to proper terminals.
4. Adjust ferrules so that wires are straight but under no strain, and tighten clamp screws.

FOLLOW-ON MAINTENANCE

- Engage (accompanel) screws. Tighten as required to clamp up and fair-in panel to match adjacent structure.
- Install applicable access panels and secure as follows:
  3406 with 34 screws. Maximum torque 60 inch-lbs
  3417 with 19 screws. " " 35 " "
  3421 thru 3428 with 19 screws. " " 60 " "
- Refuel aircraft (Worksheet 034). Press TEST button on fuel quantity select panel and check for proper indication on fuel quantity indicator.
- Perform leak test of fuel tanks (wet). (Worksheet 067).

FIGURE 7. Example of task analysis worksheets (sheet 3 of 4).

TASK ANALYSIS WORKSHEET

SHEET 4 OF 4

NOTES

Drawing refs for procedures:

12D4302 rev. D
2462260 rev. B
2056622 rev. B
23D1401 rev. C
16C3512 rev. A
16C4220 rev. F

See attached sketches (S1 thru S4) and photos (P1 thru P3) for location and position refs.

Procedure checked OK on aircraft no. 002 (5/5/78).

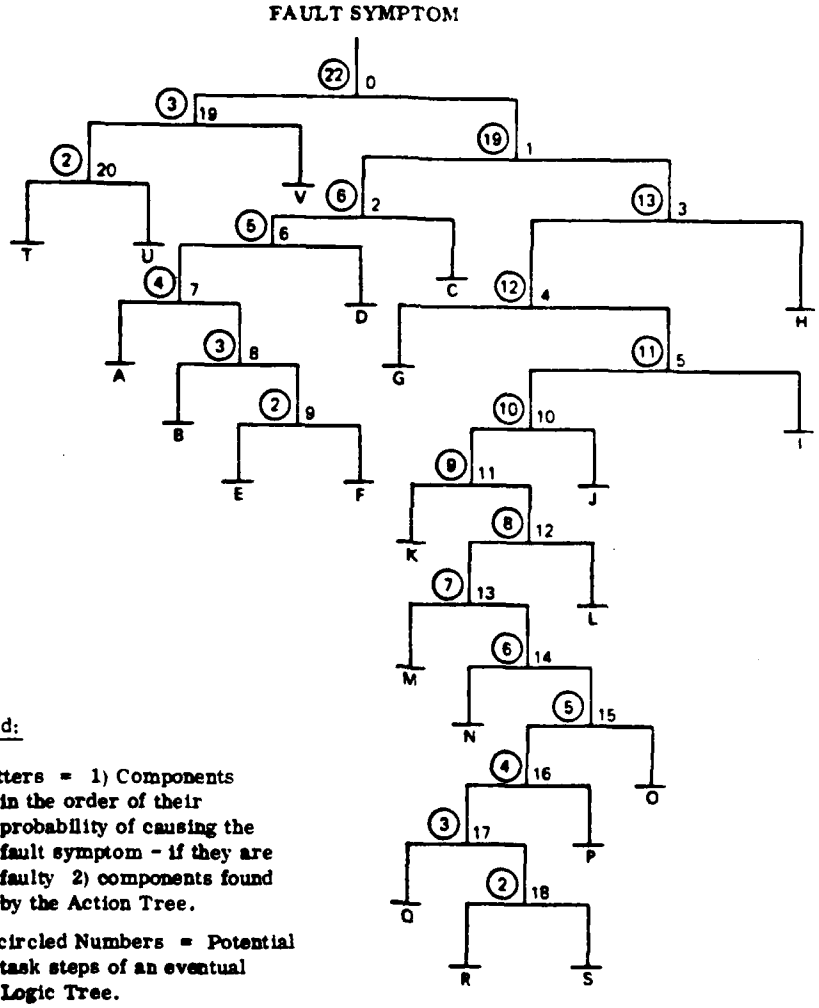
FIGURE 7. Example of task analysis worksheets (sheet 4 of 4).

DATE 4/18/78
ANALYST B Haight

CHECKOUT SUMMARY
GUIDANCE AND CONTROL SYSTEM MB-I

CHECKS	PERFORMANCE PARAMETERS
DETECTION SUBSYSTEM	
STARTUP CHECK	
1. Control position	1. STANDBY light on
2. DC power input	2. 24 VDC ± 1.2 VDC
3. Gyro erection	3. Vertical within .005 deg. within 15 ± .25 minutes
4. Ready for operation	4. READY light on.
WIDE SCAN MODE CHECK	
1. Control position	1. WIDE light on
2. Antenna scan position	2. 85 ± 1.5 degrees (resolver output)
3. Indicator presentation	3a. horizontal scan 5 ± .15 in. b. vertical scan 4 ± .10 in. c. transmitter pulse present d. target/clutter video present
NARROW SCAN MODE CHECK	
1. Control position	1. NARROW light on
2. Antenna scan position	2. 12 ± 0.5 degrees (resolver output)
3. Indicator presentation	3a. Horiz. scan = same as WIDE b. vert. scan = " " " c. transmitter pulse present d. target/clutter video present (expanded)
SHUTDOWN CHECK	
1. Control position	1. STANDBY light on

FIGURE 8. Example of checkout summary



Legend:

- Letters = 1) Components in the order of their probability of causing the fault symptom - if they are faulty 2) components found by the Action Tree.
- Uncircled Numbers = Potential task steps of an eventual Logic Tree.
- Circled Numbers = Number of components isolated downstream of each step in the action tree.

FIGURE 9. Sample outline of an action tree for a complex fault symptom (without component names and procedural information).

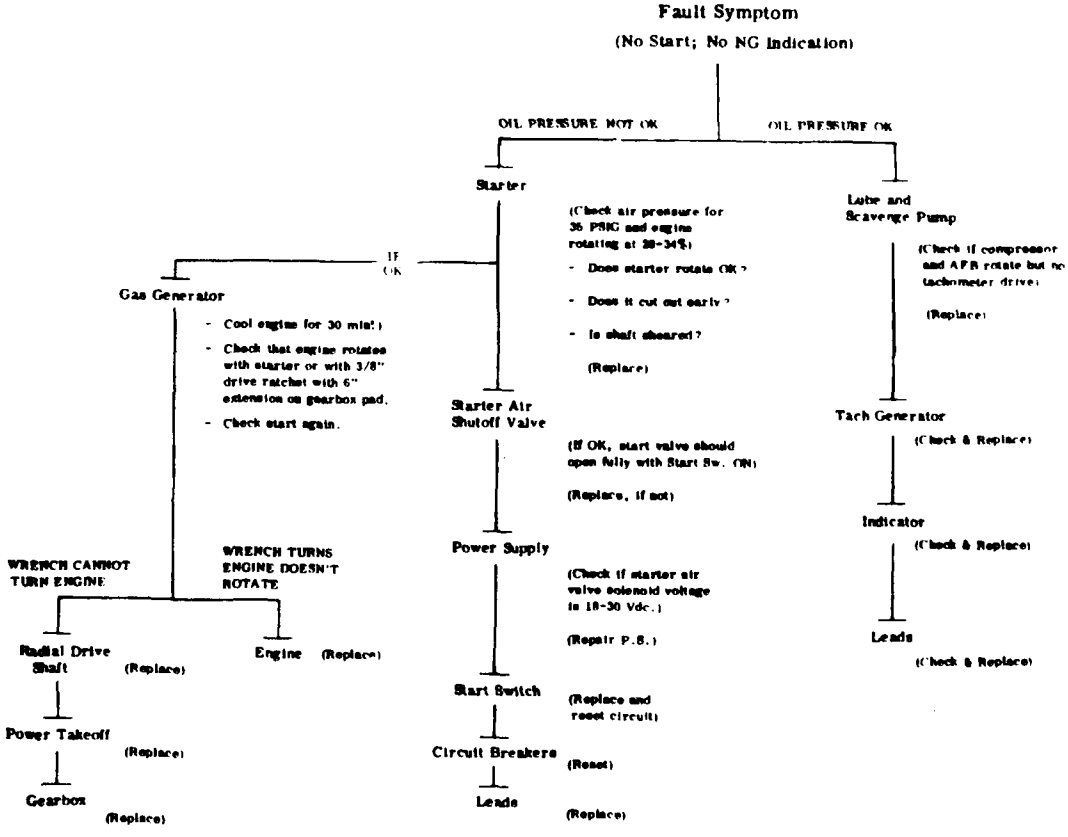


FIGURE 10. Sample action tree with procedural annotations.

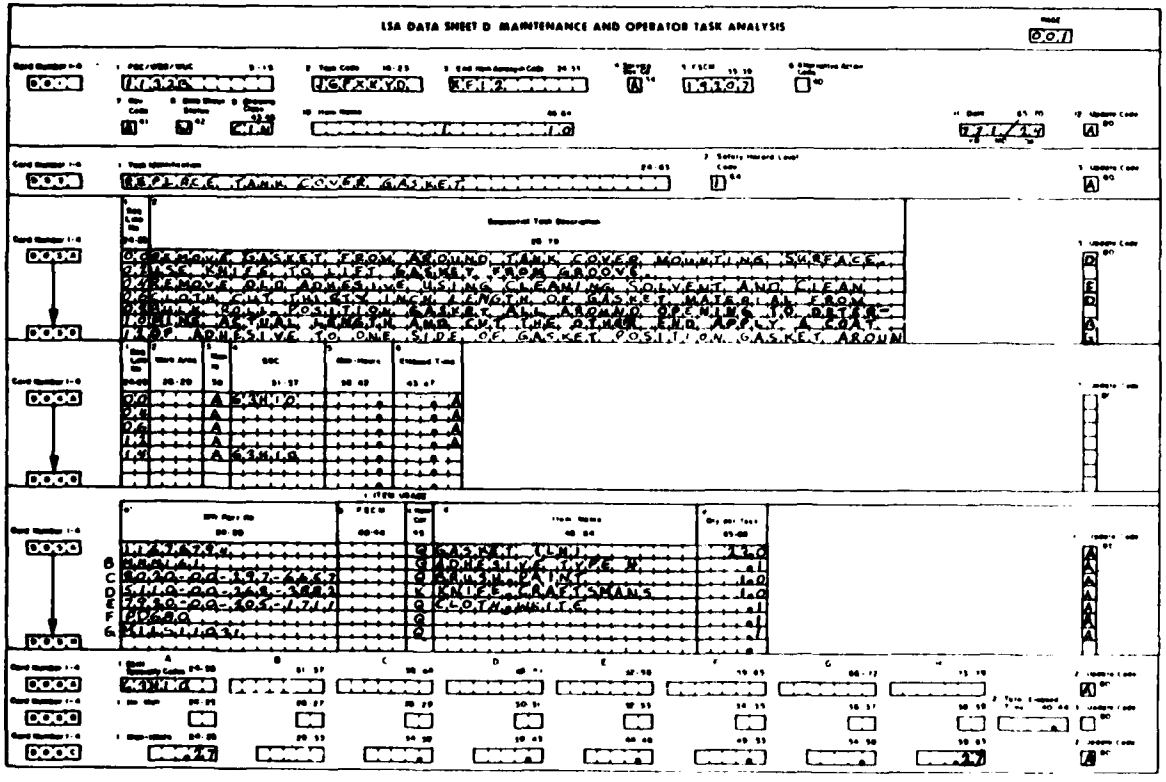


FIGURE 11. Example of LSA input data sheet 'D' used for task analysis worksheet development.

APPENDIX A

LSA DATA ELEMENTS APPLICABLE TO MTI&A

7. SCOPE

7.1 Scope. Appendix A is a summary of the LSA standard data elements of MIL-STD-1388-2 that have a direct or indirect application to MTI&A, as described in 3.5. Each element is defined and cross-referenced to the LSA Input Data Sheet on which it usually appears and the analysis products to which it applies. Some data elements can be used directly as an entry, or can be adapted as an entry, in the MTI&A product. Others are used indirectly, for sequencing purposes or as source or background information.

7.2 List of data elements. The definition of the data elements listed below are those given in MIL-STD-1388-2, modified in some cases for purposes of brevity. Other data elements that may apply to MTI&A may also be used for a particular program as directed by the procuring activity. The codes used below to designate the 'MTI&A Product Used For' are:

TIM	- Task Identification Matrix	TAW	- Task Analysis Worksheets
DUP	- Definitized User Profile	TTA	- Troubleshooting Task Analysis
SEG	- Support Equipment Guide	GA	- General Application

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Additional Skill Requirement — G,E — DUP, SEG

Indicates why present Skill Specialty Code (SSC) is inadequate, requires modification, or that a new SSC is required.

Additional Training Requirements — G — DUP

Narrative description of additional training required for operator, maintenance and instructor personnel of Using Service.

Duty Position Requiring a New or Revised Skill — G — DUP

Title of occupation for which a Skill Specialty Code has not been assigned.

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Educational Qualifications — G — DUP

Narrative description of educational prerequisites recommended to acquire skill necessary to perform the task or attain the Skill Speciality Code.

Failure Effects & Criticality — B — TTA

Narrative description of probable effects of failure for each failure mode. Includes criticality of the failure; e.g., completely inoperable, inoperable in some modes, or operable at a degraded level of performance.

Failure Mode — B — TTA

Description of each mode of failure in order of probability of occurrence.

Failure Symptoms — B — TTA

Identification of the symptoms for each failure mode, that would assist in diagnosing the failure and isolating to indenture level where repair is to be accomplished.

Functional Group Code — All — GA

Standard numerical indexing system establishing a sytematic breakdown of end item or article into its functional systems, subsystems, components/assemblies, and parts.

Item Function — B — TTA

Detailed description of item's function, specificiations and tolerances in the system.

Item Name — B,D,E — TIM, TAW, SEG

The item name, as contained in Federal Cataloging Handbook H6-1, or name assigned by manufacturer in accordance with MIL-STD-100.

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Maintenance Concept — B — GA

The broad, planned approach to be employed in sustaining the system/equipment at a defined level of readiness or in a specified condition in support of the operational requirement. Initially stated by the Government for design and support planning purposes, and expanded by contractor prepared inputs during full-scale development. Provides the basis for The Maintenance Plan. Usually includes guidelines pertaining to projected maintenance tasks, levels and locations; organic/contractor maintenance workload mix; condition monitoring, fault isolation and testing approach; compatibility with existing support and test equipment, etc.

Person Identifier — D — TAW

Identifies each person required to perform the task. If a person is used to perform more than one task, the same character will identify that person throughout the task analysis.

Manufacturer's Part Number — B,D,E — TIM, TAW, SEG

Numbers assigned to uniquely identify a specific item. May or may not be the same as drawing number.

Means of Detection — TTA

The means by which a system, subsystem, assembly or subassembly is checked to verify its operational state or condition. First letter identifies primary means of detection and second indicates the secondary means of detection.

BITE	– Built-In Test Equipment	– A
MTE	– Manual Test Equipment	– B
ATE	– Automatic Test Equipment	– C

Physical and Mental Requirements — G — DUP

Identifies any unique physical or mental personnel attributes required or recommended as prerequisites to full qualification in the applicable task.

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Reference Designation — H — TIM

Letters or numbers, or both, used to uniquely identify and locate discrete units, portions thereof, and basic parts of a specific set. The FGC/WBS/WUC is used instead of the Reference Designation Prefix. (A reference designation is not a letter symbol, abbreviation, or functional designation for an item.) For electrical and electronic parts and equipment, the reference designation number is in accordance with ANSI Y32.16, utilizing either the Unit (preferred) or Block Numbering Method. For a non-electronic system/equipment the provisioning activity may request the volume, figure and index number if available.

Sequence Line Number — D — TAW

Identifies the sequence of steps required to satisfy each task.

Sequential Task Description — D — TAW

A step-by-step narrative description of the complete effort to accomplish a specific maintenance or operator task. Description includes details as to removal of connectors or attachments, checkout, fault isolation and safety precautions. Details include procedures, tolerances, qualifying notes, special training required, all requirements for power, compressed air, and environmental considerations.

Skill Level Code — C — DUP

Indicates skill level required to accomplish each maintenance task.

Basic	-	E-4 and below
Intermediate	-	E-5
Advanced	-	E-6 and above

Skill Specialty Code — C,D,G — DUP

Describes maintenance or operator skill required to accomplish the task.

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Support and Test Equipment or Training Material Description and Function — E — SFG

Narrative definition of the performance, physical, installation, etc., parameters of the support and test equipment or training material necessary to support the Task Code identified. Includes all pertinent information concerning type of measurements to be performed, parameters to be evaluated, accuracy, stability requirements of measurements, etc.

Task Code — B, C, D, G — TIM, TRW, TTA

Uniquely identifies each maintenance or operator task for a particular item. Used to identify and relate associated LSA data to the specific requirement. A 7- or 8-digit data chain made up of Task Function, Task Interval, Maintenance (Level), Operability, Task Sequence and Task Sequence Suffix Codes.

Task Function Code

Denotes any one of a number of specific maintenance, operator or supporting functions necessary to the operation and maintenance of an item. (See Task Code)

TASK FUNCTION CODE (1st Digit)

A - Inspect
B - Test
C - Condemn
D - Adjust
E - Align
F - Calibrate
G - Install
H - Remove/Replace
J - Repair
K - Overhaul
L - Rebuild
M - Mission Profile Change
N - Fault Location
O - Operate
P - Lubricate
Q - Disassemble/Assemble
S - Service

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Task Interval Code

Identifies the scheduled or unscheduled timing of the task occurrence. (See Task Code.)

TASK INTERVAL CODE (2nd Digit)

A - Preoperative/Preflight	J - Emergency
B - Scheduled	K - Normal
C - Daily	L - Weekly
D - Intermediate/Phase Inspection Minor	M - Quarterly
E - Periodic/Phase Inspection Major	N - Semiannually
F - Special	P - Monthly
G - Unscheduled	Q - Calendar
H - Post Operative/Post Flight	R - Overhaul Cycle

Maintenance (Level) Codes

Indicate the maintenance levels authorized to perform the required maintenance functions. First space indicates lowest level of maintenance authorized to remove, replace and use the item. Second space indicates whether item is to be repaired and identifies lowest level of maintenance with capability to perform complete repair. (See Task Code.)

MAINTENANCE (Level)
CODE (3rd, 4th, and 5th Digits)

FIRST SPACE OF MAINT CODE

O - Organizational

F - Intermediate/Direct Support/Afloat

H - Intermediate/General Support/Ashore

G - Intermediate/Ashore & Afloat (Navy)

D - Depot/Specialized Repair Activity/Shipyards

X - Not Applicable

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Operability Code

Indicates the operational status of the item during the maintenance task. (See Task Code.)

OPERABILITY CODE
(6th Digit)

A - System Inoperable during Equip Maint

B - System Operable during Equip Maint

T - Turnaround

Y - Off Equip Maint

Task Sequence Code

Uniquely identifies a Task Code if the combination of Task Function, Task Interval, and Maintenance (Level) is insufficient. (See Task Code.)

TASK SEQ CODE
(7th Digit)

Alpha-Numeric Codes

(A-Z, 1-9)

for

All Similar Tasks

Task Sequence Suffix Code
for 9th Digit If Necessary

Task Sequence Suffix Code

Uniquely identifies a Task Code if the combination of Task Function, Task Interval, Maintenance (Level) and Task Sequence are insufficient. Specifically, provides identification of identical Task Codes related to different Skill Specialty Codes. (See Task Code.)

TITLE	INPUT SHEET(S) USED ON	MTI&A PRODUCT USED FOR
DEFINITION		

Task Frequency — C — TAW

The frequency of performance or occurrence of the task identified by the Task Code. Expressed as number of annual occurrences based on the annual system operating requirements. For example, the frequency of monthly inspection is recorded as Ø12.Ø.

Task Identification — D — TIM, TAW

Narrative description of the Task to be performed; e.g., 'service strut or replace brake assy'.

Tool Requirement Code — C — SEG, TAW

Denotes when tools are required and whether tools are common or special (peculiar).

Common Tool - C Special (Peculiar) Tool - S Not Req'd - N

Work Breakdown Structure — All — GA

Identification system which relates hardware, software, services and other work tasks to their position or location in a system/equipment, and thus completely defines the project or program.

Work Unit Code (WUC) — All — GA

A 5- or 7-character code that identifies the system, subsystem, component, or part of the end item being worked on. Assigned to every repairable item and to nonrepairable mission essential or time change items. Five-digit codes are assigned to items normally removed, replaced, tested, adjusted or repaired by maintenance personnel while performing "on equipment" work; i.e., work at or on the end item which does not require the use of shop equipment other than portable test or repair equipment. Seven-digit codes are assigned to repairable component subassemblies, modules, cards and significant parts in order to facilitate the reporting of "in shop" component repair work.

APPENDIX B

VERB LIST

8. SCOPE

8.1 Purpose. Appendix B adds a verb list to this specification.

8.2 Applicable documents. There are no additional applicable documents.

8.3 Requirements. In the attached Verb List, each verb is defined in terms of one or more meanings associated with maintenance. A simple sentence has been provided for each usage. A number entry in the preference column indicates the standing of that verb compared to others with the same or similar meaning (highest ranking is 1). Any synonyms with which the verb was ranked are listed in terms of their own ranking. If a synonym holds first rank, it is underlined. Where necessary, special notes are also included. Lower ranking verbs can be used when the first ranked verb is particularly awkward or misleading in a given statement.

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Accomplish	To do, carry out or bring about; to reach an objective.	Accomplish a periodic inspection on the landing gear.	2	1. Perform 3. Effect	
Actuate	To put into mechanical motion or action; to move to action.	Actuate the handpump until the pressure gauge indicates 3000 psi.	-		
Adapt	To make fit a new situation or use, often by modifying.	Use the bushing to adapt the fuse to the projectile.	-		
Add	To put more in.	Add water to the battery.	-		
Adjust	1. To bring to a specified position or state. 2. To bring to a more satisfactory state; to manipulate controls, levers, linkages, etc.; to return equipment from an out-of-tolerance condition to an in-tolerance condition.	1. Adjust the micrometer to the given measurements. 2. Adjust cable tension using the turnbuckles.	-		
Advise	To give information or notice to.	Advise Person B that the brakes have been set.	4	1. Report to 2. Inform 3. Notify 5. Tell	
Advance	To move forward; to move ahead.	Advance the throttle	-		
Agitate	To move with a jerky, quick, or violent action.	Agitate the container so that the paint will be well mixed.	2	1. Shake	
Aid	To give help or support to; to assist.	Aid Person B to lift the load.	3	1. Assist 2. Help	
Alert	To warn; to call to a state of readiness or watchfulness; to notify (a Person) of an impending action.	Alert personnel that area will be cleared.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Align	To bring into line, to line up; to bring into precise adjustment, correct relative position or coincidence.	Align slot in turnbuckle barrel with slot in cable terminal. Align receiver IF strip.	-		
Allocate	To apportion for a specific purpose or to particular persons or things.	Allocate the various maintenance tasks to technicians.	3	1. Assign 2. Distribute	
Allow	1. To permit, to give opportunity to.	1. Allow the sediment to settle out.	1	2. Let	
	2. To allot or provide for.	2. Allow a 2-inch slack in the rope.	1	2. Leave	
Alternate	To perform or cause to occur by turns or in succession.	Alternate between pilot's and copilot's instrument test.	-		
Analysis	To examine and interpret test or inspection results to determine system or equipment condition or capabilities.	Analyze engine inspection findings to determine need for repairs.	-		
Apply	1. To lay or spread on.	1. Apply sealant to gap between the windshield and the aircraft structure.	1	2. Put	Use "lubricate" rather than "apply lubricant."
	2. To energize	2. a. Apply power or load. b. Apply pressure to cylinder.	-		
Arrange	To group according to quality, value, or other characteristics; to put in proper order.	Arrange components by size from smallest to largest.	1	2. Order	
Ascertain	To find out with certainty that a proper condition exists.	Ascertain that the light is off.	5	1. Be sure 2. Verify 3. Check 4. Determine	
Assemble	To fit and secure together the several parts of; to make or form by combining parts.	Assemble a jet engine in accordance with specified procedures.	1	2. Construct	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Assess	To determine the importance, size or value of; to evaluate.	Assess the success of the maintenance action.	2	1. Evaluate	
Assign	To apportion to for a specific purpose or to particilar persons or things; to appoint to a duty.	Assign the various maintenance tasks to technicians.	1	2. Distribute 3. Allocate	
Assist	To give support or help; to aid.	Assist Person B to lift the antenna.	1	2. Help 3. Aid	
Assure	To make someone sure or certain; to inform positively.	Assure other technicians that all warning lights are off.	1		
Attach	To join or fasten to.	Attach electrical leads to the multimeter.	2	1. Connect 3. Mate 4. Join	Use "tag" in preference to "attach" a tag.
Back off	To cause to go in reverse or backward.	Back off nut to the nearest castellation	-		
Balance	To equalize in weight, height, number, or proportion.	Balance aircraft so that it is stable.			
Be sure	To confirm that a proper condition exists; to find out with certainty.	Be sure that the light is off.	1	2. Verify 3. Check 4. Determine 5. Ascertain	
Be careful	To exercise caution; to take care.	Be careful not to inhale the fumes of the solvent.	-		
Bend	To turn or force from straight or even to curved or angular; or to force back to an original straight or even position.	Bend wire until it lays flat against the turnbuckle wall.	-		
Bleed	To extract or let out some or all of a contained substance from.	Bleed off tank air pressure.	-		
Blow	To send forth air, particularly from the lungs through the mouth.	Check for obstructions by disconnecting the hose at the air inlet and blowing through it.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Break	1. To separate into parts with suddenness or violence.	1. Never break safety wire to release air pressure.	-		
	2. To pull away.	2. Break the bead of the tire.	-		
Buck	To reseat or tighten rivets from the shank side.	Buck rivets to stop the leak.	-		
Calculate	To determine by arithmetic processes.	Calculate the voltage in a circuit with 10 amp of current and 5 ohms of resistance.	1	2. Figure 3. Compute	
Calibrate	To determine accuracy, deviation, or variation by special measurement or by comparison with a standard.	Calibrate torque handles at least once each month so that the accuracy can be depended upon.	-		
Cap	To provide with a covering; to install or provide with a device for closing off the end of a tube which has a male fitting.	Cap all lines which have exposed male fittings.	1	2. Install caps	
Care for	To take responsibility for the proper handling and upkeep of.	A mechanic cares for his tools.	-		
Catch	To prevent from falling to the ground; to capture.	Catch any fluid drippings in a drip pan.	-		
Categories	To put into categories or general classes.	Categorize components by their function.	2	1. Classify	For determining the classification of a supply item, use "identify."
Center	1. To adjust so that axes coincide.	1. Center the nose wheel of the aircraft.	-		
	2. To place in the middle of.	2. Center the pointer on the dial.	-		
Change	To replace with another comparable item; to substitute serviceable equipment for malfunctioning, worn out, or damaged equipment.	Change the switch contact points.	2	1. Replace	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Channel	To form, cut, or wear a groove in.	Channel the rods so that they can be inserted easily.	-		
Charge	To restore the active materials in a storage battery by the passage of a direct current through, in the opposite direction to that of the discharge.	Charge the battery for a short time before making a specific gravity check.	1	2. Cycle	
Check	1. To confirm or establish that that a proper condition exists; to ascertain that a given operation produces a specified result; to examine for satisfactory accuracy, safety, or performance; to confirm or determine measurements by use of visual or mechanical means.	1. Check that the light is off.	3	1. Be sure 2. Verify 4. Determine 5. Ascertain	
	2. To perform a critical visual observation or check for specific conditions; to test the condition of.	2. Check the components for wear, deterioration, or defects.	3	1. Inspect 2. Examine	
Check out	To perform specified operations to verify operational readiness of a subcomponent, component, subsystem, or system.	Check out the landing gear.	1	2. Test	
Chock	To place a blocking device, designated by the Air Force as a chock, adjacent to, in front of, and behind, to keep from moving.	Chock main and nose landing gear wheels.	-		
Choke	To enrich the fuel mixture of a motor by partially shutting off the air intake of the carburetor.	Choke engine as required to start.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Clamp	To fasten or press two or more parts together so as to hold them firmly.	Clamp the tensiometer to the cable by releasing the handle slowly.	-		
Classify	To put into categories or general classes.	Classify components by their function.	1	2. Categorize	For determining the classification of a supply item, use "identify".
Clean	To wash, scrub, or apply solvents to; remove dirt, corrosion, or grease.	Clean petroleum products from oxygen equipment.	-		
Clear	1. To move people and/or objects away from.	1. Clear the area.	-		
	2. To open the throttle of an idling engine to free it from carbon.	2. Clear the engine.	-		
Close	1. To block against entry or passage; to turn, push, or pull in the direction in which flow is impeded.	1. a. Close the valve. b. Close the access panel.	-		
	2. To set a circuit breaker into the position allowing current to flow through.	2. Close the circuit breaker.	-		
Coat	To cover or spread with a finishing, protecting layer.	Coat battery cables with grease.	-		
Code	To put into the form or symbols of a system used to represent words; to mark with identifying symbols.	Color code equipment parts.	-		
Collect	To bring together into one body or place; to accumulate.	Collect the required handtools.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Communicate	1. To exchange information.	1. Communicate with Person B during the entire procedure.	-		
	2. To make known.	2. Communicate to Person B that the brakes have been set.	5	1. Report to 2. Inform 3. Notify 4. Advise	
Compare	To examine the character or qualities of two or more items to discover resemblances of differences.	Compare the readings from protractor and template.	-		
Compile	To compose or put together out of materials from several sources.	Compile the records of all maintenance on the specified aircraft.	-		
Comply	To conform with directions or rules; to accept as authority; to obey.	Comply with directions.	2	1. Follow	
Compute	To determine by arithmetic processes.	Compute the voltage in a circuit with 10 amps of current and 5 ohms of resistance.	3	1. Calculate 2. Figure	
Condition	To put into a proper state for work or use.	Condition components before installing them.	-		
Conduct	To lead, manage, or direct.	Conduct the class in proper servicing procedures.			
Confer	To consult; to exchange views.	Confer with maintenance supervisor if necessary.	-		
Connect	1. To bring or fit together so as to form a unit, to couple keyed or matched equipment items.	1. Connect the antenna cable to the radio transmitter.	1	2. Attach 3. Mate 4. Joint	
	2. To attach or mate (an electrical device) to a service outlet.	2. a. Connect the soldering iron to the service power outlet. b. Connect VOM leads to test jacks.	2	1. Plug in	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Consolidate	To join together into one whole; to form into a compact mass.	Consolidate contents of both containers.	-		
Construct	To make or form by combining parts; to fit and secure together the several parts of.	Construct a jet engine in accordance with specified procedures.	2	1. Assemble	
Control	To exercise restraining or directing influence over, to fix or adjust the time, mount or rate of.	Control electrical current generation and distribution.	2	1. Regulate	
Coordinate	To bring into a common action, movement or condition.	Coordinate the activities of Person B and Person C.	-		
Copy	To make an imitation transcription, or reproduction of.	Copy the tail number on the record form.	-		
Correct	To make or set right; to alter or adjust so as to bring to some standard or required condition.	Correct any error before proceeding with activity.	-		
Cover	To protect or shelter by placing something over or around.	Cover tires whenever maintenance is done on the aircraft.	-		
Crack	To open slightly (the throttle) of an aircraft engine preparatory to starting the engine.	Crack and lock the throttle to 1/8 open.	-		
Crimp	To compress or deform a connection barrel around a cable to make an electrical connection.	Crimp a connector on the yellow wire.	-		
Cut	To divide into parts using a sharp instrument such as scissors or a knife.	If the prongs of the cotter pin are too long, they should be cut to proper length.	-		
Cycle	To charge (a battery) for a short time.	Cycle the battery before making the specific gravity check.	2	1. Charge for a short time.	
Deflate	To release air or gas from.	Deflate the shock strut to check fluid level.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Deflect	To move aircraft control surfaces (elevators, ailerons, etc.) to a position different from the major axes of the aircraft.	Deflect the surface upward to the mechanical stops.	-		
Deplete	To lessen markedly in quantity, content or power.	Deplete system pressure.	-		
Depress	To press or push down.	a. Depress both brake pedals. b. Depress pushbutton switch and then release.	-		
Depressurize	To release gas or fluid pressure from.	Depressurize the hydraulic system.	-		
Destroy	To *ruin, demolish,* or *put out* of existence; to make unfit for further use.	*Destroy* used hydraulic fluid containers.	-		
Detect	To discover or determine the *existence, presence, or fact* of.	Watch very carefully so as to *detect any needle movement.*	-		
Determine	1. To obtain definite and firsthand knowledge of; to confirm or establish that a proper condition exists.	1. Determine that the light is off.	4	1. Be sure 2. Verify 3. Check 5. Ascertain	
	2. To investigate and decide to discover by study or experiment.	2. Determine the amount of tension on a cable by following specified procedures.	1	2. Find	
Develop	To set forth or make clear by degrees or in detail.	Develop procedures fully.	-		
Device	To form by new combinations or applications of ideas or principles; to invent.	Devise new methods of troubleshooting the system.	-		
Diagnose	To recognize and identify the cause or nature of a condition, situation, or problem by examination or analysis.	Diagnose the malfunction.	-		

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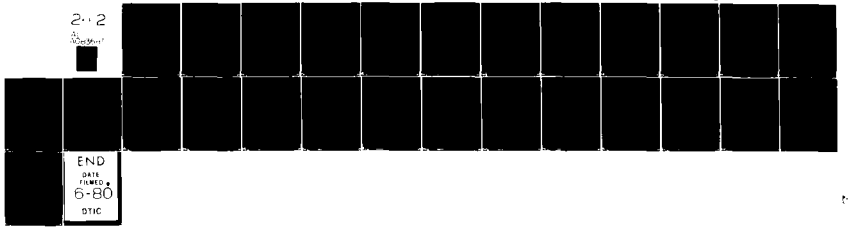

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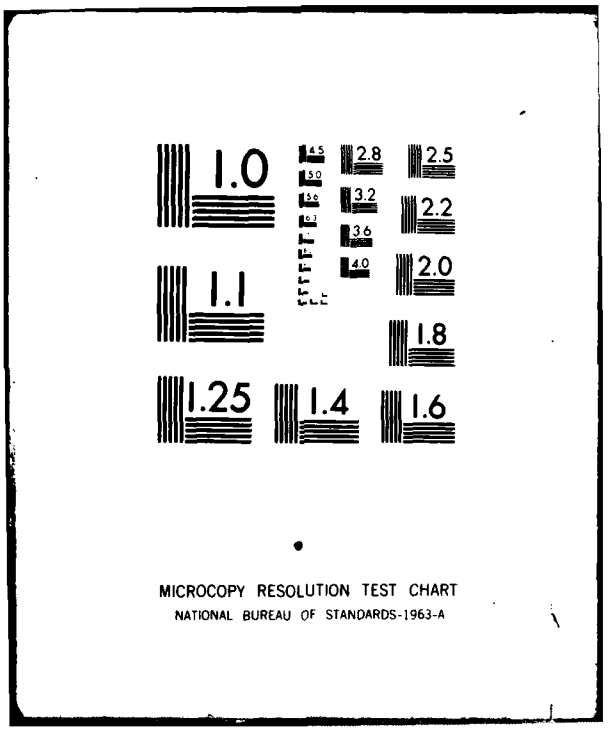
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Disassemble	To take to pieces; to take apart to the level of the next smaller unit or down to all removable parts.	Disassemble the No. 1 engine.	1	2. Dismantle	
Dismantle	To take to pieces; to take apart to the level of the next smaller unit or down to all removable parts.	Dismantle the No. 1 engine.	2	1. Disassemble	
Disconnect	1. To sever the connection between; to separate keyed or matched equipment parts.	1. Disconnect the bleed air hose from the leading edge anti-icing system.	-		
	2. To detach or separate (an electrical device) from a service outlet.	2. Disconnect the soldering iron from the service power outlet.	2	1. Unplug	
Disengage	To release or detach interlocking parts; to unfasten; to set free from an inactive or fixed position.	Disengage the parking brake.	2	1. Release 3. Unlock	For circuit breaker, use "open".
Dispatch	To send off or away with promptness or speed.	Dispatch report to supervising technician.	-		
Dispose of	To get rid of.	Dispose of unused hydraulic fluid left in the can.	-		
Distribute	1. The apportion for a specific purpose or to particular persons or things.	1. Distribute the various maintenance tasks to technicians.	2	1. Assign 3. Allocate	
	2. To divide among several or many; to divide or separate, especially into kinds.	2. Distribute paint for various sections of the aircraft.	-		
Drain	To draw off (liquid) gradually or completely.	Drain servicing hose after removing it from the filter valve.	-		
Draw in	To pull (liquid) up into a container through suction.	Fill hydrometer by drawing in electrolyte.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Dry	To cause to be free from water or liquid.	Dry bearings with low-pressure air.	-		
Effect	To do, carry out, or bring about; to reach an objective.	Effect a periodic inspection on the landing gear.	3	1. Perform 2. Accomplish	
Eliminate	To expel; to ignore or set aside as unimportant.	Eliminate all unnecessary movement.	-		
Employ	To put into action or service; to carry out a purpose or action by means of; to avail oneself of.	Employ only antimagnetic fasteners.	3	1. Use 2. Utilize	
Enforce	To compel or constrain.	Enforce safety regulations.	-		
Engage	To cause to interlock or mesh.	Engage threads of turnbuckle with threads of cable terminal.	-		For circuit breakers, use "close".
Enter	1. To go in or come in.	1. Enter the aircraft through the troop doors.	-		
	2. To put on record.	2. Enter the data on the form.			
Erase	A process to remove stored data from a storage medium such as a CRT display or magnetic tape.	Erase image from CRT screen.	-		
Erect	To put up by the fitting together.	Erect a special maintenance stand.	-		
Establish	To set on a firm basis.	Establish safety rules.	-		
Estimate	To judge or determine roughly the size, extent, or nature of.	Estimate amount of cleaning solvent which will be necessary.	-		
Evaluate	To determine the importance, size, or nature of; to appraise; to give a value or appraisal to on the basis of collected data.	Evaluate an operating engine.	1	2. Assess	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Examine	To perform a critical visual observation or check for specific conditions; to test the condition of.	Examine the component for wear, deterioration, or defects.	2	1. Inspect 3. Check	
Expedite	To accelerate the process or progress of.	Expedite the activity by assigning two men.	-		
Extend	To cause to be drawn out to fullest length.	Extend the main landing gear.	-		
Extract	To draw forth; to pull out forcibly.	Extract the cotter pin.	-		
Fabricate	To construct from standardized parts.	Fabricate rig pins from 0.25 in. rod.	-		
Figure	To determine by arithmetic processes.	Figure the voltage in a circuit with 10 amps of current and 5 ohms of resistance.	2	1. Calculate 3. Compute	
File	To rub smooth or cut away with a file (i.e., a tool with cutting ridges for forming or smoothing surfaces).	File one end of the rod to a point.	-		
Fill	To put into as much as can be held or conveniently contained or to a specified level.	Fill oil and de-icing tanks.	-		
Find	1. To discover or determine by search; to indicate the place, site, or limits of.	1. Find the No. 9 fitting.	2	1. Locate	
	2. To discover by study or experiment; to investigate and decide.	2. Find the amount of tension on a cable by following specified procedures.	2	1. Determine	
Flush	To pour liquid over or through; to wash out with a rush of liquid.	Drain and flush the hydraulic system if it is serviced with a wrong fluid.	-		
Fold	To lay one part over another part of; to reduce the length or bulk by doubling over.	Fold sides of curtain on creases.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF REFERENCE	NOTES
Follow	To accept as authority; to obey; to conform with directions or rules.	Follow directions.	1	2. Comply with	
Form	To give a particular shape to; to shape or mold into a certain state; to make up.	Form the compound so that it will fill the hole completely.	-		
Furnish	To supply what is needed, to equip.	Furnish a flashlight for Person B.	2	1. Provide	
Go to	To proceed to; to transport oneself to a given destination.	Go to the control pedestal and position switches appropriately.	-		
Ground	To connect a current, wire, or a piece of electrical equipment to a land or other specified surface.	Ground the servicing cart.	-		
Guard	To protect from danger; to defend.	Guard the area while maintenance is taking place.	-		
Guide	To manage or direct the movement of.	Guide the maintenance stand safely to its new position.	-		
Hand	To give, pass, or transmit with the hands.	Hand the refueling hose to the technician stationed on the wing.	-		
Handle	To manipulate (load, turn, raise, etc.) objects and equipment manually or with specially designated equipment, such as hoists.	Handle charger cylinders carefully.	-		
Hang	To fasten to some elevated point without support from below; to suspend.	Do not hang tools on projecting parts of the aircraft.	-		
Help	To give support, aid, or assistance to.	Help Person B lift the load.	2	1. Assist 3. Aid	
Hold	To have or keep in the grasp.	Hold the power switch in position until the voltmeter stabilizes.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Identify	1. To establish the identity of.	1. Identify components by name and function.	-		
	2. To determine the classification of a supply item.	2. Identify the component to be ordered from supply.	-		
Idle	To run an aircraft engine under reduced power without sufficient power being developed for movement of the aircraft.	Idle the engine for five minutes at 800 rpm.	-		
Immerse	To plunge into something that surrounds or covers, especially to plunge or dip into a fluid.	Immerse component in solvent.	-		
Improve	To make greater in amount or degree; to make better.	Improve procedures whenever feasible.	-		
Indicate	To point out.	Indicate which dial should be monitored.	-		
Inflate	To fill with a given amount of gas or air.	Inflate tire to desired pressure.	-		
Inform	To make known to; to give notice or report the occurrence of.	Inform Person B that the brakes have been set.	2	1. Report to 3. Notify 4. Advise 5. Tell	
Initiate	To perform actions necessary to set into operation, to set going, to begin.	Initiate operation of the powered AGE.	2	1. Start 3. Originate	
Inject	To throw, drive, or force in.	Inject lubricant into proper joint.	-		
Insert	To put or thrust in, into, or through.	Insert a wire through the hole in the turnbuckle.	1	2. Put	
Inspect	To perform a critical visual observation or check for specific conditions; to test the condition of.	Inspect the components for wear, deterioration or defects.	1	2. Examine 3. Check	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Install	1. To perform operations necessary to properly fit an equipment unit into the next larger assembly or system.	1. Install fuel manifold.	-		a. For wiring a circuit, use either "install wiring" or "wire".
	2. To place and attach.	2. Install nuts on bolts.			b. For safety wiring use either "safety wire" or "install safety wire".
					c. For screws, use "install screws" rather than "screw".
					d. Use "cap" "plug" rather than install caps (plugs).
Insure	To make certain, to ensure.	Insure that the area is clear of unnecessary personnel and equipment.	-		
Intercept	To stop or interrrupt the progress or course of.	Interrupt messages between flight station and tail section technicians.	-		
Interchange	To put each in the place of the other.	Interchange printed circuit cards A2 and A3.	-		
Interpret	To explain the meaning of.	Interpret instructions for inexperienced technicians.	-		
Investigate	To observe or study by close examination and systematic inquiry.	Investigate the cause of the breakdown.	-		
Isolate	To use test equipment to identify or select a source of trouble.	Isolate the source of the malfunction using pressure gauges.	-		
Jack	To use one or more jacks (i.e., mechanisms for exerting pressure to lift all or part of an aircraft).	Jack and level the aircraft in accordance with specified procedures.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Join	To bring or fit together so as to form a unit; to couple keyed or matched equipment items.	Join the transmitter to the receiver with the power cable.	4	1. Connect 2. Attach 3. Mate	
Keep	To remain, to continue in a place.	Keep away from the danger area.	2	1. Stay	
Kick	To strike against with a foot.	Kick the wheel lightly if the strut binds.	-		
Latch	To catch with a device which holds a door when closed, even if not bolted.	Close and latch the aft petal doors.	-		
Leave	1. To go away from, depart.	1. Do not leave the area until *this activity* is complete.	-		
	2. To allot or provide for.	2. Leave a two-inch slack in the rope.	2	1. Allow	
Let	To permit; to give opportunity to.	Let the engine stabilize.	2	1. Allow	
Level	To cause an aircraft to become even or parallel with the plane of the horizon.	Jack and level the aircraft in accordance with specified procedure.	-		
Lift	To move or cause to be moved from a lower to a higher position; to elevate.	Lift the spoiler control lever to the ARMED position.	2	1. Raise	
Light	To cause to illuminate.	Light the field indicator light.	-		
Listen	To pay attention to sound.	Listen to the engine while it is operating.	-		
Load	To place in or on a means of conveyance; to place cargo or aircraft components on an airplane or other vehicle.	Load and secure aircraft *components on specified truck*.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Locate	1. To find, determine or indicate the place, site, or limits of.	1. Locate the No. 9 fitting.	1	2. Find	
	2. To set or establish in a particular spot, to station.	2. Locate the test equipment so that it can be seen by both technicians.	3-4	1. Position 2. Place 3-4. Set 5. Put	
Lock	To hold fast or inactive, to fix.	Lock the throttle after it has been properly set.	-		
Lock for	To visually search for.	Look for cracks, corrosion and damage during inspection of wheels and tires.	-		
Loop	To make into the form or shape of a loop (i.e., a fold or doubling of line leaving an aperture between the parts through which another line can be passed).	Loop the wire.	-		
Loosen	To release from restraint; to cause to become less tight fitting.	Loosen the locknut on the relief valve.	-		
Lower	To cause to move down; to depress as to direction.	Lower the exhaust stack into the stowed position.	-		
Lubricate	To put lubricant on specified locations.	Lubricate the wheel bearings.	1	2. Apply lubricant	
Maintain	1. To hold or keep in any particular state or condition, especially in a state of efficiency or validity.	1. An aircraft mechanic maintains aircraft.	-		
	2. To sustain or keep up.	2. Maintain standard forms on power plant operations.	-		
Make	To carry out or cause to occur.	Make corrections where necessary.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Mark	To label, to provide with an identifying or indicating symbol.	Mark each component before removing it.	-		If marking is to be done on a tag, use "tag".
Mate	To join or fit together; to couple.	Mate the proper transmitter and receiver.	3	1. Connect 2. Attach 4. Join	
Measure	To determine the dimensions, capacity, or amount by use of standard instruments or utensils.	a. Measure voltage drop across each unit of resistance. b. Measure input between TB-4 and ground.			
Mix	To combine or blend into one mass.	Never mix oxygen with other gases.	-		
Modify	To alter or change somewhat the form or qualities of.	A jet engine mechanic modifies turbofan engines.	-		
Monitor	1. To visually take note of; to pay attention to in order to check on action or change.	1. Monitor the indicator for changes in airspeed.	3	1. Observe 2. Watch	
	2. To continually or periodically attend to displays to determine equipment condition or operating status.	2. Monitor all engine instruments while starting the engines.	-		
Moor	To secure an aircraft to the ground by tying it down by ropes or cables.	Moor the aircraft when it is to be parked for an extended period of time.	-		
Mount	To attach to a support.	Mount the split-type wheel.	-		
Move	To change the location or position of.	Move and position a B-4 maintenance stand.	-		
Neutralize	To destroy the effectiveness of; to nullify; to make chemically neutral or electrically inert.	Neutralize the solution before applying it to aircraft surface.	-		
Notify	To make known to; to give notice or report the occurrence of.	Notify Person B that the brakes have been set.	3	1. Report to 2. Inform 4. Advise 5. Tell	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Observe	1. To conform one's actions of practice to.	1. Observe precautions.	-		
	2. To visually take note of; to pay attention to.	2. Observe the indicator for changes in airspeed.	1	2. Watch 3. Monitor	
Obtain	1. To get or find out by observation or special procedures.	1. Obtain a reading on the outside circle of the tensiometer.	2.	1. Take	
	2. To gain or attain.	2. Obtain the necessary supplies before starting on maintenance.			
Open	1. To move from closed position; to make available for passage by turning in an appropriate direction.	1. Open the valve.	-		
	2. To make available for entry or passage by turning back, removing, or clearing away.	2. Open the troop door.	-		
	3. To disengage or pull.	3. Open the appropriate circuit breakers.	-		
Operate	To control equipment in order to accomplish a specific purpose.	Operate crew stands and auxiliary power equipment.	-		
Order	1. To requisition or request from supply.	1. Order three cans of appropriate solvent.			
	2. To group according to quality, value, or other characteristics.	2. Order components by size from smallest to largest.	2.	1. Arrange	
Organize	To arrange elements into a whole of interdependent parts; to form into a coherent unity; to integrate.	Organize the activities of the assisting technicians.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Orient	1. To acquaint with the existing situation or environment.	1. Orient new techniques to location of shops and supplies.	-		
	2. To set or arrange in any determinate position.	2. Orient the aircraft away from wind direction.	-		
Originate	To give rise to, to set going, to begin.	Originate a new procedure.	3	1. Start 2. Initiate	
Overhaul	The act of disassembling equipment units down to all removable parts; cleaning; critically inspecting, repairing, restoring, and replacing where necessary; assembling, adjusting, aligning, recalibrating, and verifying operational readiness by test or Checkout; and packaging for transportation storage.	Overhaul the No. 2 engine.	-		
Pack	To fill completely with grease.	Pack the bearings.	-		
Paint	To apply color or pigment (suspended in suitable liquid) to the surface of.	Paint all exposed surfaces.	-		
Park	To bring (an aircraft) to a stop and leave it standing for atime, usually without pilot, in a specified area.	Park the aircraft between the yellow lines.	-		
Patch	To mend, cover, or fill up a hole or weak spot.	Patch the tubes where necessary.	-		
Perform	To do, carry out, or bring about; to reach an objective.	Perform a periodic inspection on the landing gear.	1	2. Accomplish 3. Effect	
Place	To put or set in a desired location or position.	Place the test equipment so that it can be seen by both technicians.	2	1. Position 3-4. Set 3-4. Locate 5. Put	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Plan	To devise or project the achievement of.	Plan the day's schedule for the technicians.	-		
Plug	To provide with a device for closing off and end of a tube which has a female fitting.	Plug all lines which have exposed female fittings.	1	2. Insert plugs 3. Install plugs	
Plug in	To attach or mate (an electrical device) to a service outlet.	Plug in the soldering iron at the service power outlet.	1	2. Connect	
Position	To put or set in given place, to locate.	Position the test equipment so that it can be seen by both technicians.	1	2. Place 3-4. Set 3-4. Locate 5. Put	
Post	To station at a given place.	Post one man in front of the aircraft.	-		
Prepare	To make ready; to arrange things in readiness.	Prepare the surface for paint.	-		
	To prepare or make ready for a maintenance activity.	Prepare the Trunion Shaft Kit for removal of the MLG shock strut.	1	2. Set up 3. Ready	
Prescribe	To lay down as a guide, direction, or rule of action; to specify with authority.	Prescribe repair activities to correct the malfunctions.	-		
Pre-set	To put in a desired position, adjustment, or condition beforehand.	Pre-set tension indicator dial to size of cable being checked.	-		
Press	To act upon through thrusting force exerted in contact.	Press the blower start button.	1	2. Push	For circuit breakers, use "close".
Pressurize	To apply pressure within by filling with gas or liquid.	Pressurize the booster hydraulic system.	-		
Prevent	To keep from happening or existing.	Prevent oil from spilling over on components.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Probe	To investigate thoroughly with a long, pointed device or by direct feeling.	Probe the tube with fingers.	-		
Process	To submit to a series of actions or operations leading to a particular end.	Process the forms so they will be compatible with new recording methods.	-		
Program	To work out a plan or procedure or a sequence of operations to be performed.	Program the maintenance activity in logical sequence.	-		
Provide	To supply what is needed; to equip.	Provide a flashlight for Person B.	1	2. Furnish	
Pull	To exert force upon an object so as to cause motion toward the force.	Pull out knob No. 6 on the oxygen servicing cart.	-		For circuit breakers, use "open".
Pump	1. Raise or lower by operating a device which raises, transfers, or compresses fluids by suction, pressure or both.	1. Pump up the ramp several inches.	-		
	2. To move up and down or in and out as if with a pump handle.	2. Pump engine primer knob.	-		
Puncture	To pierce with pointed instrument or object.	Be careful not to puncture tube while probing the inside of it.	-		
Purge	1. To free of sediment or trapped air by flushing or bleeding.	1. Purge fuel tanks.	-		
	2. To remove fuel or fuel vapors from engine by motoring engine with fuel switch off.	2. Purge engines.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANKS	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Push	1. To press against with force so as to cause motion away from the force.	1. Push the blower start button.	2	1. Press	For circuit breakers, use "close".
	2. To move away or ahead by steady pressure.	2. Push the servicing cart toward the aircraft.	-		
Put	1. To place in or through.	1. Put a wire through the hole hole in the turnbuckle.	2	1. Insert	
	2. To place or set in a desired position or location.	2. Put the test equipment where it can be seen by both technicians.	5	1. Position 2. Place 3-4. Set 3-4. Locate	
	3. To deposit or leave.	3. Put tools out on the bench.	-		Use "store" instead of "put away" for depositing or leaving in a specified place for future use.
	4. To lay or spread on or in.	4. Put sealant in the gap between *the windshield and the aircraft* structure.	1	1. Apply	
Quality	To declare competent or adequate.	Qualify components which check out successfully.			
Raise	To move or cause to be moved from a lower to a higher position, to elevate.	Raise the spoiler control lever to the ARMED position.	1	2. Lift	
Read	To interpret the meaning of by visual observation.	Read the ammeter.	-		
Readjust	To adjust again, to move back to a specified condition; to bring back to an in-tolerance condition.	Readjust the voltage after performing an operational check of the system.	-		
Ready	To prepare for a maintenance activity.	Ready for Trunnion Shaft Kit for removal of the MLG shock strut.	3	1. Set up 2. Prepare	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Reassemble	To refit and secure together the parts of after they have been taken apart.	Reassemble component before installation on aircraft.	-		
Recall	To call back.	Recall parts which have not been modified.	-		
Recap	To cap again; to replace a covering; to reinstall a fitting for closing the end of a tube.	Recap the filler valve.	-		
Recapitulate	To repeat briefly.	Recapitulate the task sequence.	-		Use "repeat briefly".
Receive	To come into possession of; to get.	Receive supplies as they arrive.	-		
Recognize	To perceive to be something previously known or designated.	A jet engine mechanic recognizes troubles through evaluation of engine operational checks.	-		
Recommend	To urge the acceptance or use of.	Recommend procedure changes where appropriate.	-		
Recondition	To renew; to bring or put back into good condition.	Recondition the pilot's and copilot's seats.	1	2. Renovate	
Reconnect	To rejoin or refasten that which has been separated.	Reconnect aft pistons to forward pistons.	-		
Record	To set down in writing.	Record maintenance time on appropriate form.	-		
Reduce	To cause to be diminished in strength, density, or value.	Reduce pump flow.	-		
Refuel	To put fuel into the tanks of (an aircraft) again.	Refuel the system as outlined from applicable technical manuals.	-		
Regulate	To fix or adjust the time, amount or rate of; to exercise restraining or directing influence over.	Regulate electrical current generation and distribution.	1	2. Control	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Reinflate	To refill with a given amount of gas or air after deflation has occurred.	Reinflate tires to specified psi value.	-		
Reject	To refuse to have, use or take for some purpose.	Reject components which show excessive wear.	-		
Relay	To pass along by stages.	Relay the message to Person B.	-		
Reinstall	To perform operations necessary to properly refit an item that was previously removed into a system.	a. Reinstall covers. b. Reinstall interconnecting hose.	-		
Release	1. To set free from an inactive or fixed position; to unfasten or detach interlocking parts.	1. Release the parking brake.	1	2. Disengage 3. Unlock	
	2. To let go of.	2. Release tensiometer handle.	-		
	3. To set free from restraint or confinement.	3. Release pressure.	-		
Relieve	To ease or set free of a burden, to partially release.	Relieve hydraulic pressure before working on a system.	-		
Remove	1. To perform operations necessary to take an equipment unit out of the next larger assembly or system.	1. a. Remove bleed air shutoff valves. b. Remove bolts from nuts.	-		For screws, use "remove" rather than "unscrew".
	2. To take off or eliminate.	2. Remove paint.			
	3. To take or move away.	3. Remove covers.			
	4. To take off devices for closing off and end of a tube.	4. Remove caps (plugs) from all hydraulic lines.	1	2. uncap (unplug)	
Renovate	To renew; to bring or put back into good condition.	Renovate the pilot's and copilot's seats.	2	1. Recondition	

VERBS	DEFINTIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Repair	To restore an equipment item to operable condition by a means other than total replacement of a part.	Repair connector by resoldering leads.			Repair includes such methods as gluing, reattaching, patching, welding, splinting, building up (a surface), sanding smooth, straightening, resoldering. Repair does not involve isolation of a fault. In accomplishing repair, no items are drawn from supply except consumables, attaching parts, or reinforcing parts.
Repeat	To make, do or perform again.	If keys do not engage lugs, remove wheel assembly and repeat procedure.	-		
Replace	To substitute serviceable equipment for malfunctioning, worn out, or damaged equipment.	Replace the switch contact	1	2. Change	
Replenish	To fill or build up again.	Replenish drinking water when supply runs low.	-		
Report	To describe as being in a specified state.	Report when ready.	1	2. Inform 3. Notify 4. Advise 5. Tell	
	To make known to; to give notice or report the occurrence of.	Report to Person B that the brakes have been set.			
Repressurize	To reapply pressure within by filling with gas or liquid after pressure has been released.	Repressurize the utility hydraulic system.	-		
Request	To ask for.	Request further information if necessary.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Reset	To put back into a desired position, adjustment or condition.	Reset the field after performing an operational check of the generator.	-		
Resolve	To clear up or find an answer to; to reach a decision about.	Resolve the inconsistency before proceeding with maintenance activity.	-		
Restore	To bring back or put back into a former or original state.	Restore hydraulic pressure.	-		
Retard	To manipulate so as to hold back or slow down; to hold back or slow down.	Retard the throttle.	-		
Retract	To draw up against or into the aircraft.	Retract the landing gear.	-		
Return	To bring, send, or put back to a former or proper place.	Return the horizontal stabilizer to the neutral position.	-		
Review	To examine again; to go over or examine critically or deliverately.	*Review procedures which have* not been performed for more than two months.	-		
Rework	To reprocess for further use; to revise.	Rework the report forms.	-		
Rig	To assemble, adjust, and align the major components of an aircraft (i.e., airfoils or other surfaces); to fit out (an aircraft) with control cables, bracing cables, pulleys, turnbuckles, etc.	Rig and adjust the mechanical linkage in the flight control system.	-		
Rinse	To cleanse (as from soap used in washing) by clear water.	Rinse the battery after cleaning it with soap water solution.	-		
Rope off	To partition, separate, or divide by a rope (i.e., a large stout cord of strands of fibers or wire twisted or braided together).	Clear and rope off an area around the aircraft and post warning signs.	-		

VERBS	DEFINTIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Rotate	To cause to revolve about an axis or center.	Rotate the door handle counter clockwise until catches retract.	1	2. Turn	
Route	To send by a selected course of travel; to divert in a specified direction.	Route the memo to all affected personnel.	-		
Rub	To move along the surface of a body with pressure.	Rub hands around connections.	-		
Safeguard	To provide a technical contrivance to prevent accident; to comply with precautionary measures or stipulation.	Safeguard technical manuals.	-		
Safety	1. To secure an aircraft part against loosening from vibration.	1. Safety the lock nut on the relief valve.			
	2. To use safety wire to make an aircraft component fast or safe or secure against loosening from vibration.	2. Safety the bolts with wire.	3	1. Safety wire 2. Secure (with wire) 4. Install (with wire)	
	3. To use a cotter pin to make an aircraft component fast or safe or secure against loosening from vibration.	3. Safety the bolt with acotter pin.	3	1. Secure 2. Install	
Safety wire	To use safety wire to make an aircraft component fast or safet or secure against loosening from vibration.	Safety wire the bolts.	1	2. Secure (with wire) 3. Safety 4. Install (with wire)	
Salvage	To rescue or save (as from discard, wreckage or ruin).	Salvage fuel which is drained from tanks.	-		
Scan	To make a wide, sweeping search of; to look through or over hastily.	Scan the flight engineer's panels before beginning maintenance activity.	-		
Schedule	To appoint, assign, or designate for a fixed future time; to make a timetable of.	Schedule maintenance activities for the day.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Screw	1. To attach, fasten, or close by means of a screw.	1. Screw the ram safety lock to the ram.	-		
	2. To attach by means of a twisting motion in the proper direction.	2. Screw in jack pad.	-		
	3. To attach screws by means of a twisting motion in the proper direction.	3. Screw in twelve screws around cover.	2	1. Install	
Scrub	To clean with hard rubbing.	Scrub all metal parts with a white powder deposit on them.	-		
Secure	1. To make fast or safe.	1. Load and secure components on trucks.	-		
	2. To safety (with safety wire or cotter pin) to make aircraft component fast or safe or to keep it from loosening during vibration.	2. a. Secure bolts with safety wire.	2	1. Safety wire 3. Safety 4. Install (with wire)	
		b. Secure the bolt with a cotter pin.	1	2. Install 3. Safety	
Select	To take by preference or fitness from a number or group, to pick out, to choose.	Select a battery cell and insert hydrometer nozzle in the cell.	-		
Service	To replenish consumable supplies, such as fuel, oil, filters, air, liquid oxygen, and related items.	Service each battery cell to only 3/8 inch above the plates.			Service is applicable when consumables are drained and filled. Service does not apply to scheduled lubrication or replenishment of consumables as part of another maintenance function.

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Set	1. To put a switch, pointer, or knob into a given position; to put equipment into a given adjustment, condition, or mode.	1. a. Set PWR switch to ON. b. Set the vehicle brakes.			
	2. To put or place in a desired orientation or location.	2. Set the test equipment so that it can be seen by both technicians.	3-4	1. Position 2. Place 3-4. Locate 5. Put	
Set up	To prepare or make ready for a maintenance activity.	Set up the Trunnion Shaft Kit for removal of the MLG shock strut.	2.	1. Prepare 3. Ready	
Shake	To move or cause to move to and fro in a quick, jerky manner.	Shake the container so that the paint will be well mixed.	-		
Shut down	To perform operations necessary to cause an equipment to cease or suspend operation.	Shut down the air conditioning.	1	2. Stop	
Signal	To notify or communicate by signals (i.e., a prearranged sign, notice or symbol conveying a command, warning, direction or other message).	Signal the pilot to move the aircraft to the left.	-		
Simulate	To give the appearance or effect of.	Simulate doppler radar signals.	-		
Slide	To cause to move in a smooth manner over a surface.	Slide the stand in close enough to do the work.	-		
Speak	To utter words or articulate sounds with the ordinary voice.	Speak the words one through ten into the microphone.	-		
Specify	To name or state explicitly or in detail.	Specify the manufacturer's number of the multimeter.	-		
Spill	To cause or allow to fall, flow or run out.	Be careful not to spill battery acid on clothing, hands.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Spin	To cause to revolve rapidly.	Spin wheel by hand until a bearing drag is noticed.	-		
Spray	To apply with a device which disperses a jet of finely divided liquid.	Spray the fuselage and tail sections moving from center to ends.	-		
Start	To perform actions necessary to set into operation, to set going, to begin.	Start the powered AGE.	1	2. Initiate 3. Originate	
Stay	To remain, to continue in a place.	Stay away from the danger area.	1	2. Keep	
Stimulate	To excite to activity or greater activity.	Stimulate flow by warming the lines.	-		
Stop	To perform actions necessary to cause an equipment to cease or suspend operation.	Stop the air conditioning.	2.	1. Shut down	
Store	To deposit or leave in a specified place for future use.	Store the wheel covers after maintenance activity is completed.	1	2. Stow 3. Put away	
Stow	To deposit or leave in a specified place for future use.	Stow the wheel covers after maintenance activity is completed.	2	1. Store 3. Put away	
Strike	To deliver or aim a blow or thrust; to hit.	Strike the designated spot with a hammer.	-		
Submit	To make available, to offer.	Submit request for modification of procedures.	-		
Suggest	To propose as desirable or fitting; to offer for consideration.	Suggest any changes which might be helpful.	-		
Superintend	To oversee; to have or exercise the charge of.	Superintend the repair of the the engines.	2	1. Supervise	
Supervise	To oversee; to have or exercise the charge of.	Supervise the repair of the engines.	1	2. Superintend	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Support	To hold up or provide a foundation or prope for.	Support the elevator at both ends.	-		
Survey	To examine comprehensively as to condition, situation or value.	Survey entire aircraft surface.	-		
Synchronize	To cause to happen at the same time.	Synchronize the activities of Person A and Person B.	-		
Tabulate	To set up in the form of a table (with rows and columns); to compute by means of a table.	Tabulate maintenance times for each occurrence of the various maintenance activities.	-		
Tag	To provide with an identifying or indicating symbol with or as if with a tag (i.e., a cardboard, plastic or metal marker used for identification or classification); to label.	Tag each hydraulic line before removing it.	1	2. Attach a tag. 3. Mark 4. Connect a tag to	
Take	1. To get into or carry in one's hands or one's possession.	1. Take supplies out to the aircraft.	-		
	2. To get or find out by observation or special procedures.	2. Take a reading on the outside circle of the tensiometer.	1	2. Obtain	
Tap	To strike lightly.	Tap the eye of the cotter pin to seat it.	-		
Test	To perform specified operations to verify operational readiness of a component, subcomponent, system or subsystem.	Test the true airspeed indicator.	2	1. Checkout	
Throw	To move (a switch) so as to make or break a connection.	Throw switch to ON position.	-		Use "set" for all switches.
Tie	To fasten, attach or close by means of a line or cord.	Tie mooring ropes to tie points under wing and on nose.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Tighten	1. To perform necessary operations to fix more firmly in place.	1. Tighten all screws.	-		
	2. *To apply a specified amount* of force to produce a rotation or twisting motion to fix more firmly in place.	2. *Tighten the nut to a torque* value of 1000 in/lbs.	2	1. *Torque*	
Tilt	To cause to slope, lean or incline. incline.	Tilt maintenance stand backwards until wheels contact the ground.	-		
Torque	To apply a specified amount of force to produce a rotation or twisting motion to fix more firmly in place.	Torque the nut to 1000 in/lbs.	1	2. Tighten	Torque (noun) = length of wrench handle times applied force.
Tow	To pull along (an aircraft) by means of a towing vehicle and tow bar.	Tow aircraft to the washrack.	-		
Trace	To follow or study out in detail or step by step.	Visually trace the wiring diagram.	-		
Transfer	To convey or cause to pass from one place to another.	Transfer fuel and oil from one place to another.	-	2-3. Transport 2-3. Transmit	
Transmit	1. To convey or cause to pass from one place to another.	1. Transmit fuel and oil from one place to another.	2-3	1. Transfer 2-3. Transport	
	2. To send out a signal by radio waves or wires.	2. Transmit message to control tower.	-		
Transport	1. To convey or cause to pass from one place to another.	1. Transport fuel and oil from one tank to another.	2-3	1. Transfer 2-3. Transmit	
	2. To carry by hand or in a vehicle or hoist, or in a container, etc.	2. Transport landing gear to shop on dolly.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Trim	1. To free of excess or extraneous matter by or as if by cutting.	1. Trim patch to fit.	-		
	2. To adjust (a jet engine) to compensate for wear.	2. Trim the No. 1 engine.	-		
Troubleshoot	To localize and isolate the source of a malfunction or break down.	Troubleshoot the landing gear control circuit.	-		
Tune	To adjust for precise functioning.	Tune the transmitter for maximum output.	-		
Turn	To cause to revolve about an axis or center.	Turn the door handle counter clockwise until latches retract.	2	1. Rotate	
Turn off	To shut off or stop the flow of by or as if by moving a control to its OFF position.	Turn off power to the signal generator.	1		
Turn on	To cause to flow or operate by or as if by moving a control to its ON position.	Turn on power to the signal generator.	-		
Uncap	To remove a device for closing off the end of a tube with a male fitting.	Uncap and unplug all hydraulic lines.	2	1. Remove caps	
Unlock	To set free from an inactive or fixed position, to unfasten, to detach interlocking parts.	Unlock the parking brake.	3	1. Release 2. Disengage	
Unplug	1. To detach or separate (an electrical device) from a service outlet.	1. Unplug the soldering iron.	1.	2. Disconnect	
	2. To remove a device for closing off the end of a tube with female fittings.	2. Unplug and uncap all hydraulic lines.	2	1. Remove plugs	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Unscrew	1. To loosen or withdraw by turning in the proper direction.	1. Unscrew the jack pad.	-		
	2. To draw the screws from.	2. Unscrew twelve screws around cover.	2	1. Remove	
Unwind	To cause to uncoil or unroll.	Unwind hoses from hose rack.	-		
Use	To put into action or service; to avail oneself of; to carry out a purpose or action by means of.	Use only antimagnetic fasteners.	1	2. Utilize 3. Employ	
Utilize	To put into action or service; to avail oneself of; to carry out a purpose or action by means of.	Utilize only antimagnetic fasteners.	2	1. Use 3. Employ	
Verify	1. To confirm or establish that a proper condition exists.	1. Verify that the light is off.	2	1. Be sure 3. Check 4. Determine 5. Ascertain	
	2. To establish the truth or accuracy of.	2. Verify the readings before recording them.	-		
Wait	To suspend activity in a sequence of activities until a given condition occurs or a given time has elapsed.	Wait five minutes before performing the next task.	-		
Wash	To cleanse by or as if by the action of liquid; to remove (dirt) by rubbing or drenching with liquid.	Wash the battery with a cleaning solution and a stiff brush.	-		
Watch	To visually take note of, to pay attention to in order to check on action or change.	Watch the indicator for changes in airspeed.	2	1. Observe 3. Monitor	
Wire	To provide with wire, to use wire on.	Wire the circuit.	1	2. Install wiring	

VERBS	DEFINITIONS	EXAMPLES	PREF RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Withdraw	To take back, away, or out.	Withdraw the bar *magnet from* the center of the coil.			
Wrap	To wind, coil or twine as to encircle or cover something.	Wrap the wire around the terminal.	-		
Zero	The act of nulling a device or system.	Zero the meter with the leads disconnected.	-		

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