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Date: 6 December 20

TECHNICAL MANUAL CONTRACT REQUIREMENT (TMCR)

SUBJECT: Electronic Equipment Interactive Electronic Technical Manual (IETM) for DIGITAL MODULAR RADIO / AN-USC-61(C).

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DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

This document prescribes the Technical Manual format, style, technical content, preparation, and delivery requirements. Instructions and guidance are provided to assist Technical Manual preparers in the development of accurate, adequate, comprehensible, and usable technical documentation that conforms to and complies with established NAVSEA policy.

This document is effective upon receipt and supersedes all previous information and instructions, regardless of source, related to the preparation of a NAVSEA Technical Manual for the subject equipment. Conformance with the requirements specified are mandatory. No changes or waivers are authorized without the express written NAVSEA approval.

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TECHNICAL MANUAL CONTRACT REQUIREMENT (TMCR)

DATE: 6 December 2007

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SUBJECT: Electronic Equipment Interactive Electronic Technical Manual (IETM) for DIGITAL MODULAR RADIO / AN-USC-61(C).

SCOPE: This TMCR contains specific integrated requirements and instructions for the preparation of the subject Interactive Electronic Technical Manual (IETM).

IETMs are to be in digital form and are designed for interactive display to the maintenance technician or system operator end user by means of a computer controlled Electronic Display System (EDS).

Technical content requirements for the subject technical manual were taken from the applicable specifications and standards specified in NAVSEAINST 4160.3A.

The requirements listed in the Contract Data Requirements List (DD Form 1423), in conjunction with the requirements of the specific contract line items as specified herein, constitute the data to be delivered, the products to be prepared, and the resulting tasks to be performed by the contractor.

1.0 DELIVERABLES.

The following deliverable items shall be prepared as specified in Section 3 of this document.

DATA ITEMS.

1.1 TECHNICAL MANUAL SCHEDULE, STATUS AND COSTS REPORTS.

1.2 QUALITY ASSURANCE PROVISIONS.

1.2.1 Validation Plan.

1.2.2 Validation Certification.

1.3 MANUAL, TECHNICAL, STANDARD.

1.3.1 Interactive Electronic Technical Manual (IETM).

2.0 APPLICABLE DOCUMENTS.

2.1 Specifications.

The following documents were used to establish the requirements of this document.

MIL-PRF-87268A	Manuals, Interactive Electronic Technical: General Content, Style, Format, and User-Interaction Requirements
MIL-DTL-24784B(SH)	Manuals, Technical: General Acquisition and Development Requirements
MIL-DTL-24784/14B(SH)	Associated Detail Specification Electronic, Experimental Electronic, Service Test Electronic, and Interior Communication (IC) Equipment Manual Requirements

2.2 Standards.

MIL-STD-17B-1	Mechanical Symbols
MIL-STD-1840C	Military Standard Automated Interchange of Technical Information

(Copies of standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.3 Handbooks and Manuals.

Government Printing Office.

United States Government Printing Office	Style Manual
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2.4 Defense Logistics Services Center (DLSC).

H4/H8	Commercial and Government Entity (CAGE) Codes
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Application for copies should be addressed to: Defense Logistics Services Center, (ATTN: DLSC-SBB), Federal Center, Battle Creek, MI 49107-3084

2.5 Department of Navy.

SL160-AA-LST-010/TM-WORDS or	Baseline Word Lists for NAVSEA/ SPAWAR Technical Manuals
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EL160-AA-LST-010/TM-WORDS

NAVSEA ST000-AG-IDX-010 Test Measurement Diagnostics
Equipment Index

SE000-01-IMB-010 Navy Installation and Maintenance
Book

Application for copies should be addressed to: The Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

2.6 Forms.

[Form NAVSEA 4160/1](#) NAVSEA (User) Technical Manual
Deficiency/Evaluation Report
(TMDER)

Copies of forms required by the preparing activity in connection with specific procurement functions should be obtained from: The Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

2.7 NON-GOVERNMENT PUBLICATIONS.

The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation.

Aerospace Industries Recommendation for Hazardous
Association, AIA-TR91-1 Materials Warnings in Technical
Publications DOD Liaison Data

(Application for copies should be addressed to the Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.)

2.7.1 American National Standards Institute, Inc.

The following standards shall apply:

ANSI X3.5 Flow Chart Symbols and Their
Usage in Information Processing

ANSI Y32.10 Graphic Symbols for Fluid Power
Diagrams

ANSI Z535.3 Criteria for Safety Symbols

Application for copies should be addressed to: American National Standards Institute, Inc. 25 West 43rd Street New York, N.Y. 10036

or <http://www.ansi.org>

2.7.2 American Society for Testing and Materials (ASTM).

The following standards shall apply:

ASTM D3951 Standard Practice for Commercial
Packaging

Application for copies should be addressed to: American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959

or <http://www.astm.org>

2.7.3 Institute of Electrical and Electronics Engineers (IEEE).

The following standards shall apply:

IEEE 200-75	Reference Designations for Electrical and Electronics Parts and Equipment
IEEE 945-84	IEEE Recommended Practice for Preferred Metric Units for Use in Electrical and Electronics Science and Technology

Application for copies should be addressed to: The Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, N.J. 08855-1331

or <http://www.ieee.org>

2.7.4 American Society of Mechanical Engineers (ASME).

The following standards shall apply: Application for copies should be addressed to: American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10017 or <http://www.asme.org>

2.7.5 National Institute of Standards and Technology (NIST).

The following standards shall apply:

NIST Special Publication 811	Guide for the Use of the International System of Units (SI).
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Application for copies should be addressed to: NIST 100 Bureau Drive, Stop 1070 Gaithersburg, MD 20899-1070

3.0 REQUIREMENTS.

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

Advertising. Technical manuals shall contain no advertising unless the contract or SEATASK specifies that the equipment manufacturer shall be identified on the cover.

Copyrights and proprietary information credit line. Technical manuals shall not contain copyrighted material except as specified in the Federal Acquisition Regulations and Defense Federal Acquisition Regulation Supplement. When copyrighted material is to be included in a technical publication, the developer shall obtain prior written permission from the copyright owner or authorized agent for its use. The signed, written permission shall be delivered together with the final reproducible copy. The written permission shall contain a statement declaring whether or not a copyright credit line is required. When it is necessary to include copyright and proprietary material, it shall be clearly identified and the following warning statement shall be included on the title page:

"This document contains copyright or proprietary materials. Infringement of copyright or proprietary material may violate existing Federal laws and statutes and result in criminal penalties, imprisonment, or removal from office."

Security classification, distribution statement and destruction notice. Security classification, distribution statement and destruction notice shall be in accordance with this document. The overall security classification assigned to a technical manual shall agree with the highest classification assigned to any portion within. The security markings shall be the same as for other title pages. For destruction notice see [3.3.1.2.3.1.1.2.1](#).

Source Data. The primary source data for technical manuals shall be engineering drawings and, if a requirement, Logistic Support Analysis (LSA) and Logistic Support Analysis Record (LSAR).

Maintenance coverage. Unless otherwise specified in this document, organizational, intermediate, and depot maintenance levels shall be covered in a combined single manual.

Distribution Statement. Each technical manual and modification thereto shall be marked, in accordance with DODD 5230.24, to denote its availability for distribution, release, and disclosure without additional approvals and authorizations (see [3.3.1.2.3.1.1.1](#)). This marking shall be in addition to a security classification marking. Additionally, a determination shall be made in accordance with DODD 5230.25 whether the technical manual contains export controlled technical data.

ETM and IETM Product Delivery. The level of ETM/IETM functionality shall be identified during Concept of Operations (CONOPS) planning, referenced in the Interactive Electronic Technical Manual Process Plan (S0005-AD-PRO-010). The range and depth of subject matter coverage and the method of delivering information, required by all potential users, must be considered for new, changed, or revised TMs. Special attention shall be given to the fleet, overhaul, and training community's need to have certain long-line diagrams (oversized schematics, timing circuit diagrams, test set-up diagrams, wiring diagrams, and the like) delivered as a separately packaged hardcopy supplement or reauthored to be easily viewed on screen and printed.

3.1 TECHNICAL MANUAL SCHEDULE, STATUS AND COSTS REPORTS.

3.1.1 Schedule and Status Reports.

A technical manual schedule and status report shall be supplied at the frequency determined by the contract or SEATASK. The report shall be in a narrative format and indicate the information necessary to provide a comprehensive management level analysis of all development activities.

3.1.2 Cost Reports.

Technical manuals shall be acquired in a cost-effective manner. Cost and pricing data shall be obtained for each new, revised or changed manual. A separate analysis shall be provided together with supporting documentation for each manual developed. The cost of technical manuals shall be limited to the effort and material needed to produce the manual from source data.

3.2 TECHNICAL MANUAL QUALITY ASSURANCE DATA.

3.2.1 Validation Plan.

A validation plan shall be developed and shall reflect compatibility with the overall maintainanc

- a. Validation methods by which the IETM is tested for technical adequacy, accuracy, and compliance with the provisions of this document and other technical contractual requirements.
- b. Detailed review of the final deliverable IETM to ensure it reflects the authorized, validated, verified, and corrected IETM material and, as applicable, complies with the functionality and display requirements.

3.2.1.1 Validation Plan Summary.

The validation plan shall include, as a minimum, the following items:

- a. Titles and identification numbers (when available) of all deliverables to be validated.
- b. Schedules for validation.
- c. Cognizant personnel responsible for accomplishing the validation effort.
- d. Site locations, support equipment, facilities, test equipment, materials, and tools required during validation.
- e. General characteristics relating to skill level of target audience type personnel to be used in validation of procedural technical information.
- f. Identification of next higher assembly(ies)/system(s) required to support the effort (e.g., if a procedure entails installing a black box on system, the system or a mock-up of one is the next higher assembly).
- g. Associated technical information recommended for concurrent or consecutive validation.
- h. Special safety precautions.
- i. Any special environmental requirements.
- j. Record keeping system to be used in validation.
- k. How validation of procedures is to be accomplished.
- l. A proposed troubleshooting procedures list for use in validation of troubleshooting procedures.
- m. Approach to evaluation of usability of the IETM as generated by the preparing activity. Specifically, establishment of the adequacy and accuracy of information access procedures and identification of any potential man-machine interface problems involving effective use of the IETM on the Government specified EDS.

3.2.1.1 Troubleshooting Procedures List.

The contractor shall prepare a list of troubleshooting branches for every fault identified during

- a. Fault symptoms.
- b. Fault simulated and results of the simulation.
- c. Unless otherwise specified, what condition was (or will be) inserted into the equipment to simulate the fault.

3.2.2 Validation Certification.

The contractor shall prepare a validation certification attesting to the IETM adequacy and accuracy

3.3 MANUAL, TECHNICAL, STANDARD.

3.3.1 Interactive Electronic Technical Manual.

The IETM shall be XML coded as specified by Government supplied Data Technical Description or Schema. The IETM must be capable of being read using a standard Web-Browser with any additional plug-ins available in the public domain. All IETM content must be capable of being printed. The use of XML should also allow the use of publishing to an Adobe Acrobat .pdf or other public domain format. The IETM shall be ATIS system compliant.

3.3.1.1 General Requirements For Common User Interface.

IETMs and the associated EDS presentation software shall provide the display formatting and user interaction functions described herein. Required user interaction functions, written in uppercase throughout this document, shall not be employed as literal key names on an EDS device, but shall be treated as logical or "virtual" functions which shall be implemented as specified for the particular display system. For example, the cursor movement and selection functions can be optionally implemented by a mouse, a joystick, a track ball, a light pen, a touch panel, voice commands, or arrow keys with a selection key. An OK function can be implemented as a dedicated key labeled "enter" or a "soft" function key. This document identifies the logical user input functions which shall be supported by the display system, without specifying the exact keyboard or hardware requirements for the display system. Figure

[950](#)

provides a list of the minimum user interface virtual functions and general definitions of those functions. These

functions shall be implemented to permit the minimum functionality as described below. However, this shall not preclude additional detailed requirements in an IETM presentation software specification that further defines functionality.

3.3.1.1.1 Common User Interface Components.

A common set of components and presentation conventions shall be used to provide a consistent user interface across all presentation devices. Common user interface components described in this document shall be implemented on all types of presentation systems used. The components cursor, windows, menus, controls, dialogs, and optional pointer shall be implemented as follows.

3.3.1.1.1.1 Cursor.

If the information on the screen is capable of being selected, the system shall provide the user with the ability to select the information with a cursor. The cursor shall designate the position on the screen where the input is focused. The cursor shall be visually and consistently distinguishable from other information on the display. Selectable information shall be visually and consistently distinguishable from the cursor and other information on the screen (e.g., by the use of a border or frame around the selectable object).

3.3.1.1.1.1.1 Selection.

The user shall be able to select items in the client area with the cursor. The IETM shall provide the user with a visual feedback of the selection. Selecting an already selected item shall deselect that item. The user shall be provided with the capability to select a single item, a range of items, or additional noncontiguous items, including multiple ranges of items. Selecting the OK function will end the selection process. If a user is required to select only one option, the SELECT function shall activate the item without requiring the OK function.

3.3.1.1.1.1.2 Movement.

The cursor shall be capable of moving from one selectable information item to another, such as, from cell to cell in a table, from selectable word to selectable word in text, or from selectable object to selectable object in a graphic. If a free-form positioning device (e.g., mouse) is not provided, the capability to use the UP, DOWN, LEFT, and RIGHT functions to allow movement of the cursor to any selectable region shall be provided.

3.3.1.1.1.1.3 Shapes.

Each cursor mode shall use clearly discernable shapes or icons.

3.3.1.1.1.1.4 Tab Groups.

When several sets of selectable objects are displayed, they shall be formed into fields called "tab groups". Cursor movement (and associated focus for any input) shall be constrained within a single tab group. The TAB function shall allow a forward sequential movement of the cursor between tab groups. The BACK TAB function shall allow a reverse sequential movement of the cursor between tab groups. Examples of tab groups are: individual fill-in-the-blanks, groups of related choices, and dialog push buttons.

3.3.1.1.1.1.5 Pointer.

If the system provides a free-form positioning device it shall have a position designator (pointer) and a POINTER SELECT function. The pointer shall be used in conjunction with the cursor. The pointer shall be used to rapidly relocate the cursor on the display. The system shall provide the capability to move the cursor and select items with the pointer.

3.3.1.1.2 Windows.

A window shall be an area of the screen that displays information and provides the functional means to communicate with the IETM. The presentation system shall have the capability to display a minimum of three windows on the screen at one time, but only one window shall be active at any one time. An active window shall be designated by a highlighted title bar. The system shall provide the capability to open and close windows. The system shall allow windows to be displayed overlapping, adjacent (tiled), and cascading (overlapping with title bar showing). If a single window device is specified by the procuring activity, the IETM shall restrict the use of multiple windows.

3.3.1.1.1.2.1 Presentation.

The minimum window shall be composed of client area, title bar, menu bar, and window controls (see figure [951](#) and figure [952](#)). Window controls are not applicable to single window systems (see [3.3.1.1.1.2](#)).

3.3.1.1.1.2.2 Client Area.

The client area shall be the portion of the window in which the IETM content information is displayed. The client area shall be contained within the window frame and include one or more data panes or viewing areas displaying the text, tables, graphics, etc., of the IETM information. The IETM contents shall be displayed in the client area (see [3.3.1.2.1](#)).

3.3.1.1.1.2.3 Title Bar And Menu Bar.

The top area of every window shall consist of a horizontal title bar and a menu bar that, when displayed, appears immediately below the title bar. The title bar shall contain the title of the information being displayed. The title shall be displayed in uppercase letters. The menu bar (see [3.3.1.1.1.3](#)) shall appear only at the user's request. The title bar shall be highlighted when the window is active. When the single window option is specified by the procuring activity, the title bar shall be capable of being toggled on and off with a menu bar (see [3.3.1.1.1.3.1.1](#)). In this case, the title bar shall be initially displayed at the top of the window and the menu bar shall replace the title bar display when toggled.

3.3.1.1.1.2.4 Window Controls.

Whenever the information to be displayed requires a space larger than the available window area, the user shall be given the capability to manipulate the displayed information or window using the following window controls. The need for this capability shall be minimized.

3.3.1.1.1.2.4.1 Scroll Bars.

Vertical and horizontal scroll bars shall provide the capability to SCROLL UP, SCROLL DOWN, SCROLL LEFT, and SCROLL RIGHT to manipulate the displayed information (text, graphic, table, etc.). Scroll bars shall appear at the bottom of the data pane and at the right edge of the data pane with arrow marks at each corner. Scroll bars shall have the following components; a scroll region which is the background of the scroll bar and represents visually the length of the area that can be scrolled; a slider box which represents the displayed data; and stepper arrows which enable incremental scrolling through the display. When scrolled, the information shall appear to move in the opposite direction of the slider. For example, in a text data pane, if the slider of a vertical scroll bar moves up, a text display shall move down as previous lines in the information appear at the top of the data pane.

3.3.1.1.1.2.4.2 Window Control Options.

Additional window controls shall be included as described below.

3.3.1.1.1.2.4.2.1 Window Resize And Relocation.

The window resize function shall allow adjustment of individual window location and physical display size. Initially, resizable windows shall be displayed at the default size indicated for that display. The capability to alter the size of the active window shall be available at any time during the presentation. The control mechanism for the resize function shall be located inside the window frame on one or more corners of the frame. Any resizable window shall have a distinctive border or consistent indicator which signifies, that it can be resized. When the window is resized, the amount of information it contains shall increase or decrease (i.e., more of the text or graphic is shown when the window is enlarged). It shall not simply be rescaled. When changing the size of the window is not permitted, the resize border shall not be included as one of the window components.

3.3.1.1.1.2.4.2.2 Window Menu Button.

A window menu button shall be located in the upper left corner of the title bar and shall be used to activate the window menu.

3.3.1.1.1.3 Menu System.

The user shall be given the capability to access all of the functions available on the system through hard keys, a footer bar, or a menu system. The menu system shall consist of a menu bar which shall control a hierarchy of pull-down menus and a set of pop-up menus. The window menu shall provide the standard location for window

management functions.

3.3.1.1.1.3.1 Menu Bar.

When displayed, the menu bar shall be a single horizontal row of menu titles. Titles shall be unique descriptive textual labels, of one or more words, that clearly differentiate each menu item. All functions available on the system and not included on the footer bar or on the presentation system hard keys (e.g., ENTER, TAB) shall be listed in menus on the menu bar and shall be accessible at any time. Footer bar options may also be duplicated in the menu bar.

3.3.1.1.1.3.1.1 Menu Bar On Single Window Screen Device.

When a single window device is specified by the procuring activity, the title bar and the menu bar shall be located in the same area. Each shall have the capability to be toggled on and off through a MENU function (see [3.3.1.1.1.3](#)). Default information displayed in the top area of the window shall be the title bar. When the menu bar is displayed, the title bar shall disappear and vice versa. The user shall be given the capability to view either the title bar or the menu bar at all times.

3.3.1.1.1.3.1.2 Pull-Down.

Pull-down menus shall be displayed as a vertical column of selectable items. When active, titles on the menu bar of available pull-down menus shall always be visible to the user.

3.3.1.1.1.3.1.3 Pop-Up.

Pop-up menus shall be displayed as vertical columns of selectable items. Pop-up menus shall appear adjacent to the selectable item.

3.3.1.1.1.3.1.4 Cascading.

Cascading menus or submenus shall be used to add detail to pull-down and pop-up menus. Cascading menus shall provide a tree like structure for organizing information. If required, menu subfunctions shall appear and more selections shall be provided to the user.

3.3.1.1.1.3.1.5 Presentation Details.

Menus shall appear quickly and exist only while a selection is being made. Menu items shall be displayed in uppercase and lowercase characters. The user shall not be given the capability to interact with any other part of the data until the menu is removed. The user shall be given the capability to select or activate the menu item with the cursor or pointer. The user shall be allowed to exit any menu by activating the CANCEL function.

3.3.1.1.1.3.5.1 Width.

The minimum menu column width shall be no less than five text characters. Menu columns shall be wide enough to enclose all menu item labels or options so that no option is truncated. Whenever an individual menu item is too wide for display in the client area, it shall wrap to the next line. If the entire menu can not be presented within the client area, hidden menu data shall be indicated to the user.

3.3.1.1.1.3.5.2 Height.

The minimum menu height shall be the height of two menu items (i.e., the menu title plus at least one menu item). The maximum displayed menu height shall be the height of the client area. Fonts and font sizes, line spacing between menu items, and allowable margins between menu items shall conform to the requirements for the display and selection of text (see [3.3.1.1.2](#)).

3.3.1.1.1.3.5.3 Border.

The menu shall be drawn with a boundary extending beyond the menu cells.

3.3.1.1.1.3.5.4 Highlighting.

Highlighting shall be used to indicate the cursor is on a selectable menu item. Reverse video (or similar brightness coding) shall be used to highlight the menu item after the item is selected.

3.3.1.1.1.3.5.5 De-emphasis.

The system shall gray-out or dim menu selections which are unavailable. The user shall not have the capability to display a menu when all selections are unavailable.

3.3.1.1.3.5.6 Organization Of Selections.

Selections shall be grouped functionally or by frequency of use, alphabetically, or by some other clearly understood organizational scheme. Commands that change system status or enter other input and can not be reversed shall not be displayed next to frequently chosen selections.

3.3.1.1.3.5.7 Cursor Default Locations.

The cursor shall be positioned at the same default location in a menu every time that menu is accessed.

3.3.1.1.3.6 Command Interface.

The system shall provide a command interface using mnemonics or numeric entries as a means for making selections from menus in addition to navigation and selection functions. The command interface for selections from the menu bar shall be available at all times when the menu is active. When a single window device is specified by the procuring activity, the command interface shall be available only when the menu bar is displayed and active (see [3.3.1.1.2](#)). Users shall be given the capability to enter the required numeric key value(s) or mnemonic key combination that corresponds to displayed menu options to activate the command interface.

3.3.1.1.3.6.1 Mnemonics.

A mnemonic shall be a single character, usually the first letter of the selection. The mnemonic for the various menus shall provide a visual cue to the user. Two selections in a menu shall not begin with the same letter; a unique mnemonic for each selection shall be used. When the mnemonic of the selection does not appear within the text of the selection, it shall be included in parentheses after the text. Mnemonics shall only be available when the menu containing them is displayed.

3.3.1.1.3.6.2 Numeric Values.

Numeric values may be used, as an alternative to mnemonics. If numeric values are used, selection numbers shall be separated from their text descriptors by at least one blank space. The numeric code and descriptive label for each choice on the menu shall be left justified.

3.3.1.1.4 Dialogs And Dialog Controls.

A dialog box shall be used as the principal means to communicate with the IETM application software. See figure [953](#) for examples of different types of dialogs. Dialogs shall be displayed in a separate window, which may overlay the primary window, and shall contain a heading and one or more graphical controls (buttons). Dialogs shall be one of five kinds: alert, single/multiple choice, selection-in-list, combination, or data entry (data entry is depicted in the combination dialog box in figure [953](#)) and shall use check-boxes, radio buttons, data entry, etc., to determine the course of action required. Dialog boxes shall appear in a consistent and prominent location on the display. All dialogs shall contain the OK and CANCEL functions. However, information only alerts, e.g., system messages, shall include the appropriate push buttons to acknowledge the alert. The OK or CANCEL functions shall complete the dialog box interaction. Dialog boxes shall distinguish the information they contain from other information displayed.

- a. Dialog Cursor Movement. The cursor shall move only to items which require input from the user.
- b. Dialog Box Presentation. Headings used in dialog boxes shall be distinctive and not confused with other displayed material. Headings shall be placed in close proximity to their respective response alternatives (i.e., buttons). Dialog headings shall end in the appropriate punctuation depending on the response required.
- c. Dialog Push Buttons. Dialog boxes shall contain graphical controls called push buttons. A push button shall be a word or graphic icon on the screen used to select or initiate an action. Push buttons shall be large enough to allow positioning of the cursor on the push button. Push buttons or choices shall provide visual feedback when selected. Push buttons shall be found on every type of dialog box. They shall each be single action entities. Push buttons shall indicate selections made or invoke a general action (e.g., CANCEL or OK). Push button shapes shall be consistent, (e.g., box, circle, or arrow) with the name of the

selection or action written inside of the shape. Common push buttons (OK CANCEL) shall be displayed along the bottom of the dialog box. The common dialog buttons shall correspond to completing the last selection before leaving the dialog box.

- d. Use Of Push Buttons. Dialog transactions shall be completed by using push buttons. As a minimum, these buttons shall have the functions OK and CANCEL. CANCEL shall be equivalent to the CANCEL function and shall cancel the dialog box. The OK function shall communicate to the application software that the user has completed the dialog.

3.3.1.1.4.1 Alert Dialogs.

Alert messages shall include warnings, cautions, and notes; any message, communication, notice, or output which requires manual acknowledgment; or message generated as a result of erroneous inputs or sequence control actions. Alerts shall provide information regarding processing status. Alerts shall also provide status of the system internal components (e.g., low battery power, improper functioning of the operating system, or memory module).

3.3.1.1.4.1.1 Alert Information Content.

Alerts shall be brief, consistent, strictly factual, informative, and written in the active voice. Alerts shall not imply or ascribe blame to the user, "personalize" the computer, or attempt to make the content of the information humorous. Alerts regarding calls to erroneous or potentially destructive external systems shall be displayed. Following an interruption of data processing or database navigation/sequencing command (e.g., CANCEL), an advisory message shall be displayed indicating that the system has returned to its previous status.

3.3.1.1.4.2 Data Entry Dialogs.

Data Entry dialogs shall require entry of alphanumeric characters in response to displayed questions or data entry fields (e.g., inputting user identification data; entering the title or number of database frames containing errors or discrepancies). All Data Entry dialogs data entries shall be prompted explicitly by displayed labels for data fields. The user shall be given the capability to DELETE or otherwise change previous entries.

3.3.1.1.4.3 Choice Dialogs.

A choice dialog shall require one or more selections from a group of choices. Choice dialogs shall consist of a single choice dialog, multiple choice dialog, or a combination of the two. Radio buttons and check boxes shall be used to indicate choices and shall be left justified and separated from text descriptors by at least one blank space. If choices are placed in columns, the check box or radio button position shall be left justified with respect to the column. Each response alternative listed in a dialog box shall be given a short, unique, descriptive label.

3.3.1.1.4.3.1 Single Choice (Radio Buttons).

Selectable items that are mutually exclusive (i.e., only one can be selected at any time) shall be presented as a single choice dialog constructed using radio buttons. Radio buttons shall be grouped into lists of mutually exclusive choices. Each radio button shall appear as a consistent shape (e.g., a circle) and shall be marked with a visual indicator when the button is selected.

3.3.1.1.4.3.2 Multiple Choice (Check Boxes).

A multiple choice dialog shall be the type of dialog in which one or more selections are able to be made from a group of choices. Multiple selections shall be made using check boxes. Check boxes shall be grouped into lists of non-mutually exclusive choices. The user shall be given the capability to check one or more of these boxes as needed using the cursor or number selection technique. Each button shall appear as a consistent shape (e.g., a square) and shall be marked with a visual indicator when the button is selected. Check boxes shall employ different shapes from radio buttons.

3.3.1.1.4.4 Selection-in-list.

The selection-in-list shall provide the means of manipulating lists of data to a point where an item can be highlighted and an action on the item taken. The selection-in-list shall enable the user to choose from an existing list of items that is either long or variable in length. In addition to the standard features of all dialogs, the selection-in-list shall have at least two additional characteristics: a window containing the content listing and a vertical scroll bar when the entire list will not fit within the window.

3.3.1.1.1.4.5 Combination Dialog.

A composite of the previous types of dialogs shall be located together in one dialog box, when required.

3.3.1.1.2 Display Formatting And User Interaction Requirements.

The following paragraphs describe the standard data types (text, graphics, tables, and user prompts) that shall be displayable in the client area. When standard data types are individually displayed in data panes, those data panes shall have the capability to be linked to form one logical unit of technical information display within a single window frame.

3.3.1.1.2.1 Text.

Textual information shall consist of alphanumeric data consisting of letters, words, sentences, paragraphs, numbers, etc., in accordance with style guidelines described earlier in this document.

3.3.1.1.2.1.1 Display Of Text.

Textual information shall be displayed in data panes of the client area. Text shall be displayed in uppercase and lowercase characters.

3.3.1.1.2.1.1.1 Character Spacing.

Character spacing in textual displays shall be no less than 0.1 character height. Between word spacing for textual displays shall be one character width (em space).

3.3.1.1.2.1.1.2 Line Dimensions.

Between line spacing for textual displays shall be 0.33 of character height exclusive of superscripts and subscripts and no less than 0.15 character height when superscripts and subscripts are displayed.

3.3.1.1.2.1.1.2.1 Text Panes.

The width of the text pane shall range from 30-60 characters per line.

3.3.1.1.2.1.1.3 Margins.

Margins shall be required for all text panes to prevent information from being obscured by borders or information in adjacent panes.

3.3.1.1.2.1.1.4 Justification.

Left justification shall be used for all lines of text displayed as sentences or paragraphs.

3.3.1.1.2.1.1.5 Word Wrapping.

Lines of text shall wrap, so that no line extends beyond the limits of the pane or right margin, including when resized. Lines shall be broken only between individual words or within a word when that word is explicitly hyphenated. If resized text exceeds the text pane area, vertical scrolling shall be used (see [3.3.1.1.2.1.2.1](#)).

3.3.1.1.2.1.1.6 Hyphenation.

Hyphenation shall not be used to display normally non-hyphenated words on successive lines.

3.3.1.1.2.1.2 Selection Of Text.

The ability to highlight selectable textual information on the screen (e.g., by color change, brightness variance, image reversal, font change) shall exist. The capability to select a highlighted character string (i.e., one that is indicated as selectable) by positioning the cursor on or near that string and activating the SELECT function shall be provided.

3.3.1.1.2.1.2.1 Scrolling.

When the displayed text exceeds the length of the data pane, the text shall scroll and a visual cue shall be provided (vertical scroll bar). Manipulation of the displayed text shall be provided using the SCROLL function. The capability to move through textual information, one line at a time, shall be provided using the SCROLL UP and SCROLL DOWN functions.

3.3.1.1.2.2 Graphics.

The IETM shall display graphics in a data pane as follows.

3.3.1.1.2.2.1 Display Of Graphic Overlays.

Encoded graphics shall be displayed along with any associated callout overlays designed to indicate the specific components of the graphic.

3.3.1.1.2.2.2 Types Of Graphics.

Two types of graphics shall be displayed: static and interactive. Static graphics shall be displayed in full detail in the graphic area provided, with no ability for manipulation. Interactive graphics shall provide the capability for manipulation.

3.3.1.1.2.2.3 Scale.

Graphics shall be displayed to a scale at least as large as its designated minimum size so that all essential detail is legible.

3.3.1.1.2.2.4 Display.

Graphics shall be displayed in an assigned data pane of the displayed window. If a graphic can not be displayed in its entirety and in full detail, it shall be displayed using interactive graphic display techniques described in this document (e.g., scrolling, zooming).

3.3.1.1.2.2.5 Selection.

The user shall be given the capability to select a point area, or the entire graphic by positioning the cursor on or near that point and activating the SELECT function. Selectable regions of a graphic shall be visually distinct and shall not adversely affect the appearance of the graphic. The selection of graphical information shall include, but is not limited to, the following.

- a. Selecting an individual graphic object, such as a part, displayed in a graphic.
- b. Selecting a point or rectangular area in a graphic image.

3.3.1.1.2.2.6 Manipulation.

Graphics designated as scrollable shall have the capability to activate SCROLL, ZOOM, CENTER, or FULL SCREEN functions. These options shall be available whenever the graphic exceeds the size of the data pane.

3.3.1.1.2.2.7 Scroll Functions.

When required, the capability shall exist to scroll graphical information through the use of the SCROLL UP, SCROLL DOWN, SCROLL LEFT, and SCROLL RIGHT functions. When the graphic displayed exceeds the size of the data pane, it shall scroll and a visual cue shall be provided (vertical/horizontal scroll bar).

3.3.1.1.2.2.7.1 Zoom Functions.

The capability shall be provided to enlarge or reduce the displayed graphical information. Graphic enlargement shall be provided by activating a ZOOM IN function. Graphic reduction in size shall be provided by activating a ZOOM OUT function. The size of the data pane shall not change as a result of using the zoom functions.

3.3.1.1.2.2.7.2 Center.

The capability to activate a CENTER function shall be provided. The CENTER function shall relocate the center of a graphic to the point the cursor indicates, without scrolling.

3.3.1.1.2.2.7.3 Full Screen.

The capability to enlarge a graphic to the full size of a client area by activating the FULL SCREEN function, shall exist.

3.3.1.1.2.3 Tables.

Tabular information shall be displayed as cells of textual information or a graphic. When tables contain textual

elements, those elements shall conform to the requirements herein, for textual information. Graphical elements within a table shall conform to the requirements herein, for graphic material.

3.3.1.1.2.3.1 Display Of Tables.

Tables shall be displayed in a left-to-right, top-to-bottom array of cells. Tables shall have column headers and, if applicable, row headers.

3.3.1.1.2.3.1.1 Justification.

Lists of alphabetic data shall be vertically aligned with left justification. Numerical data shall be justified with respect to a fixed decimal point. In cases where there is no decimal point, the numerical data shall be right justified.

3.3.1.1.2.3.1.2 Column Spacing.

Consistent column spacing shall be maintained within a table. When more than one column of data is displayed, sufficient space shall be provided to clearly distinguish the data.

3.3.1.1.2.3.1.3 Row Spacing.

For dense tables with more than ten rows, a grouping feature (i.e., a solid or blank line) shall be inserted after every fifth row.

3.3.1.1.2.3.1.4 Highlighting.

The capability to highlight selectable text shall exist within a table. Tables shall display active selections as highlighted areas and the entire highlighted area shall be sensitive to selection by the pointing device. All selectable areas shall be displayed and visually highlighted before selection.

3.3.1.1.2.3.1.5 Selection Of Tables.

The capability to select an individual highlighted cell displayed in a table shall be provided.

3.3.1.1.2.3.1.6 Scrolling Of Tables.

The user shall have the capability to manipulate displayed tables by activating the SCROLL function if the table exceeds the size of the data pane. When a table is scrollable, the table headers shall not scroll within the pane. The capability to scroll tabular information a row or column at a time, through the use of the SCROLL UP, SCROLL DOWN, SCROLL LEFT, and SCROLL RIGHT function shall be provided. When the table displayed exceeds the size of the data pane, it shall scroll and a visual cue shall be provided (vertical and horizontal scroll bars).

3.3.1.1.2.3.1.7 User Prompts/Questions.

User prompts shall be displayed as dialogs (see [3.3.1.1.1.4.3](#)). Prompts shall be used to obtain any information required by the IETM. Prompts shall be presented as questions.

3.3.1.1.2.3.1.7.1 Display Of User Prompts.

A standard symbol or layout shall be used with prompts to indicate that an explicit response (e.g., entry) is required. The symbol or layout used shall be reserved only for this purpose. The data entry area shall be displayed in the immediate vicinity of the prompt or question.

3.3.1.1.2.3.1.7.2 Manipulation Of User Prompts.

When responding to multiple prompts in a single section of a procedure, the capability to change a previously entered response to the extent that the change does not alter the logic of the procedure shall be provided. When a response is changed to any given prompt, access to all of the current entries for that prompt shall be provided.

3.3.1.2 General IETM Formatting And User Interaction Display Features.

The IETM shall be displayed by an EDS which shall have the capability to form displayed windows of information in accordance with this paragraph and the common user interface requirements in [3.3.1.1](#). In addition the final IETM shall conform to the applicable special requirements specified in [3.3.1.2.5](#). The general formatting and user interaction requirements of the following paragraphs shall apply to all IETMs.

3.3.1.2.1 General Display Formats.

IETM content shall be displayed according to one of the presentation templates below. Individual data panes, footer bar (function-designation area), second header line (if required), message area (if required), alerts (warnings, cautions, and notes), and designation of classified information shall be displayed within the client area (see figure [955](#)).

3.3.1.2.1.1 Window Layout Templates For Data Panes.

Window components shall be displayed in one or more data panes within the client area. Data panes shall consist of rectangular display regions containing information in the form of text, tables, graphics, etc., displayed individually or in combination in the client area. All information shall be displayed in individual data panes and combined into a full window display in accordance with the window arrangement rules in [3.3.1.2.1.1.1](#). Divided panes need not be of the same size. Explicit lines shall be drawn between window panes. Upon initial presentation, data panes shall not overlap. No more than four panes shall be allocated, upon initial presentation, within the client area.

3.3.1.2.1.1.1 Arrangement Of Data Panes.

Windows shall be composed of one or more separate data panes (see figure [956](#)) and shall be combined or displayed according to the following rules:

- a. A window consisting of a single data pane composed of any combination of text, table, or graphics is permitted.
- b. A graphic pane shall be large enough to satisfy the minimum size designated for the individual graphic whenever possible. If the graphic pane is smaller than that minimum size, the graphic shall be made scrollable and the graphic shall be scaled so that the visible portion of the image appears as large as the designated minimum size.
- c. When displaying one text pane and one graphic pane (or table), the text and associated graphic shall be kept together in the same window.
- d. When displaying one text pane with multiple graphics (or tables), all text and graphics shall be arranged in one window whenever possible. If all graphics will not fit on a single window, the information shall be broken into a sequence of separate windows (each with the same text and as many graphics as will fit). There shall not be more than one user scrollable graphic pane active in a window.
- e. Text shall always begin in the upper left most corner of its data pane.
- f. When text refers to a graphic, the graphic shall be displayed whenever the associated text reference is displayed.
- g. When the preceding rule will not allow a text pane plus all of the associated graphics panes to fit in one window, the set of panes shall be split up into several separate windows, each retaining the same text pane but with differing graphic panes. The capability to move through the sequence of combined text and graphic windows without the relative position or the displayed content of the text pane changing shall be provided.
- h. Appropriate use of "white space" (i.e., space in the color of the background) shall be implemented so that the eye is guided horizontally or vertically through the window.
- i. Margins shall be at least one character width around any image.

3.3.1.2.1.2 Footer Bar (Function Designation Area).

The footer bar shall be located at the bottom of the window frame within the client area. All active selectable options (i.e., available interaction functions) shall be displayed in the footer bar area. Footer information shall be displayed in a region that is at least two character cell heights tall and as wide as the window. The footer bar shall be used in conjunction with the menu bar to display interaction options to the user.

3.3.1.2.1.2.1 Support Of Function Keys.

The footer bar shall support delivery devices which use programmable or dedicated function keys. The footer bar shall provide a cue that particular functions are assigned to physical keys and that those keys are active. It shall also support interfaces that use the marked region in the footer bar as an active function selection or button area. Active function selection areas of the frame shall only be in the footer bar area, unless a dialog box or other active window is superimposed on the frame. Inactive functions for the displayed window shall be visually distinguishable from active functions or not displayed.

3.3.1.2.1.2.2 Visual Prompts.

Selectable options shall be indicated using function name, icons, programmable function key labels (e.g., F2), or other visual prompts and shall be enclosed in a box outlined with a visual border (e.g., line, shadowed button image) in the footer bar area. Icons with no label shall be included without the surrounding border. Visual prompts shall be lined up horizontally.

3.3.1.2.1.2.3 Visual Prompt Labels.

When a software function is assigned to a particular function key, a label containing the hard key function label or the programmable function key number (such as "F8") along with a succinct description of the function shall be displayed in the footer bar area. The same function shall appear in the same region of the footer bar even if this requirement calls for blank space to be reserved in the bar when a particular function is not active.

3.3.1.2.1.2.4 Menus.

When required, footer bar menus shall be activated from the function designations in the footer bar and shall be attached (e.g., pull-down, pop-up) in accordance with the formats described in [3.3.1.1.1.3](#).

3.3.1.2.1.3 Optional Second Header Line.

The top line in the client area shall be reserved for additional header information. The format of this line shall be compatible with the title bar. If the MENU function is used to toggle the title bar, the toggle shall also apply to the second header line.

3.3.1.2.1.4 Optional Message Area.

A message area shall be reserved at the bottom of the client area above the footer bar. Requirements for messages to be displayed in this area shall be as specified by the procuring activity.

3.3.1.2.1.5 Display Requirements For Warnings, Cautions, And Notes.

Warnings, cautions, and notes and their associated icons shall be prominently displayed and shall be treated as an alert. The associated message shall appear in the approximate middle of the client area. Normal operation of the system shall not resume until the message is acknowledged in accordance with the requirements for an alert. Upon acknowledgment, the alert shall be eliminated and the procedural information presented. Combinations of warnings, cautions, and notes, shall be displayed in that order.

3.3.1.2.1.5.1 Color Display.

Where color is used for display, message colors shall be red for warnings, yellow for cautions, and cyan for notes.

3.3.1.2.1.5.2 Borders.

Borders for warnings and cautions shall consist of diagonal bars, alternating between the background color or white, and the designated message color. The appropriate word identifying the message type shall appear in capital letters, horizontally and vertically centered on the upper border (see figure [957](#)).

3.3.1.2.1.5.3 Icon And Title.

One or more icons representing a warning, caution, or note shall appear in the footer bar.

- a. Icons for hazardous materials shall be designed and used in accordance with the Aerospace Industries Association Service Publications Committee PUBS-119.
- b. An applicable icon shall remain displayed in the footer bar until the warning, caution, or note message it represents is no longer applicable. The user shall be given the capability to view the warning, caution, or note in its original appearance and functionality at any time by selecting the icon.
- c. A message title, when applicable, shall be horizontally centered one character cell height below or to the immediate right of the icon.

3.3.1.2.1.5.4 Text.

Text of warnings, cautions, or notes shall be displayed within the border. Messages containing two or more paragraphs shall have a blank line between paragraphs.

3.3.1.2.1.5.4.1 Danger From Several Sources.

When warnings or cautions exist in separate categories for the same set of technical information, they shall be successively displayed in decreasing order of severity: Warnings first, followed by cautions. Warnings or cautions in the same category shall be successively displayed. However, there shall be no requirement to determine an order of importance within the same category. When related warnings or cautions of the same category exist for the same block of technical information, it is permissible to group them within a common border but they shall be visually distinct. In such a case the title shall indicate the combined danger.

3.3.1.2.1.5.4.2 Health Hazards.

Procedures prescribed for the operation of equipment shall be consistent with the safety standards established by the Occupational Safety and Health Act (OSHA) Public Law 91-596 and Executive Order 12196. When exposure to hazardous chemicals or other adverse health factors or use of equipment cannot be eliminated, guidance pertaining to the exposure shall be included in the Safety Summary or a Warning.

3.3.1.2.2 User Interaction Functions.

In addition to the common user interface functions previously described, the presentation system software shall provide, as a minimum, the capability to activate the set of standard functions for selecting, manipulating, accessing, navigating, and entering data into the system. These functions shall be implemented as required by the presentation systems (e.g., one presentation device might have dedicated keys for each standard function, another may provide software programmable function keys, a third might use a pointing device to select the standard functions). The user shall be given the capability to select and activate all of the standard input functions described herein.

3.3.1.2.2.1 Required Navigation Functions.

A comprehensive set of commands to navigate and sequence through the information shall be provided. The minimum set of navigation and control functions available and common to all IETMs shall permit the minimum functionality as described below and in Figure [958](#).

3.3.1.2.2.1.1 NEXT.

The NEXT function shall display the next section or frame of information that the user requires, based on context.

3.3.1.2.2.1.2 BACK.

BACK shall be the opposite of NEXT. The BACK function shall display the previous module or frame of information. The BACK function shall reset to the previous window information, including all variables and settings. If relevant, a message box shall be presented explaining any special circumstances which cannot be reversed by invoking the BACK function.

3.3.1.2.2.1.3 BROWSE BACK, BROWSE NEXT, And BROWSE EXIT.

These functions shall be required for all systems for which the NEXT and BACK functions set interactive system variables that are used to effect subsequent navigation through the IETM. These navigation functions shall act as NEXT and BACK, but shall not set or reset system variables automatically or through dialogs. Once either BROWSE BACK or BROWSE NEXT is selected, other navigation functions shall not be available until the user returns to the originating window by invoking the BROWSE EXIT function. The presentation system shall provide a distinct visual indication that the system is in browse mode. When either the BROWSE BACK or the BROWSE NEXT function is not logical (such as at the beginning of a string or at a mandatory branch point), only the complementary BROWSE function shall be active. System variables shall still be set and shall be activated and logged to a temporary state table. It is not necessary to post system variables to the permanent state table when in browse mode.

3.3.1.2.2.1.4 RETURN.

The RETURN function shall restore the location prior to branching. Pressing RETURN shall perform an orderly exit from the branched information presentation, resetting all temporary system state information relative to the branched node. If a branch has not been previously taken, this function key shall be nonfunctional.

3.3.1.2.2.2 Required Data Access Functions.

There shall be multiple data access paths provided to the user including, as a minimum, the following access

methods:

3.3.1.2.2.2.1 CREATE, REMOVE, MODIFY, And GOTO Bookmarks.

The capability to mark displayed information for later recall shall exist. Bookmarks shall be used to recall specific information (e.g., a procedure). The capability to view bookmarks shall be provided. There shall be the capability to name a bookmark with a unique alphanumeric name.

3.3.1.2.2.2.2 SEARCH AND DIRECT ACCESS.

The SEARCH and DIRECT ACCESS functions shall enable, but not be limited to, searching for and directly accessing the following IETM information by entering search information into a dialog box.

3.3.1.2.2.2.3 System Index.

There shall be the capability to access IETM information by using a hierarchical outline or index.

3.3.1.2.2.2.4 Functional Diagrams.

There shall be the capability to access IETM information through the use of a functional diagram or graphic. Through the diagram, the capability to move the cursor to the graphic display of the function of interest and activate the SELECT function shall be provided.

3.3.1.2.2.2.5 CROSS REF.

The presence of and access to cross reference information shall be provided. When selected, a new data pane or window shall appear on the display. The capability to exit the cross reference and return to the original information displayed shall be accomplished using the RETURN function.

3.3.1.2.2.2.6 HELP.

The system shall provide a help information display function and shall permit access to the following help functions and descriptions, as required:

- a. Context. Shall provide context sensitive help about the specific situation that exists or the information being displayed on the system when help was requested.
- b. How to use help. Help shall include information on how to use the application's help facility.
- c. Window. Shall provide general information about the operation of the window from which the help was requested.
- d. Keys. Shall provide information about the function keys and other keyboard features.
- e. System. Shall provide help related to use of the computer system being used to view the IETM.
- f. Index. Shall provide an index with a search capability for all help information.
- g. Tutorial. Shall provide access to a tutorial.
- h. Glossary. Shall provide the meaning of terms, acronyms, and abbreviations contained in the IETM.

3.3.1.2.3 General Content Requirements Related To IETMs.

The following paragraphs present general requirements for technical information used for both IETM technical content and IETM use requirements. The following paragraphs on help information and for warnings, cautions, and notes shall relate to all aspects of the technical function of the IETM.

3.3.1.2.3.1 Help Related To Technical Content.

The help function shall permit the user to access context sensitive help which applies to the user's current activity and situation. It shall permit the user to access descriptive information to further explain technical points, define specific terms, or provide a fuller explanation of processes covered very briefly by the technical information. Help information shall be available for all sections of the IETM.

3.3.1.2.3.1.1 Administrative Information.

All IETMs shall contain the following administrative information for subsequent user selectable display:

- a. Identification of the technical manual title, assigned technical manual number, and document version, as applicable.
- b. Classification level of the IETM (also be presented upon initial entry into the IETM).
- c. Date, baseline date plus date of latest and all previous changes, if applicable.
- d. Verification, change, or revision status, as applicable.
- e. Preparing activity.
- f. Activity with technical control of the IETM.
- g. Activity responsible for configuration management of the equipment/system.
- h. Current information on contacting distance support (anchor desk) via the web (<http://www.anchordesk.navy.mil/>) and via the toll free number (1-877-4-1-TOUCH [86824]).

- i. Submittal and routing instructions for TM improvement reports. The following statement shall be included:

"Ships, training activities,

supply points, depots, Naval Shipyards and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals (TMs). All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA TMs shall be submitted as a Technical Manual Deficiency/Evaluation Report (TMDER). All feedback comments shall be thoroughly investigated and originators will be advised of action resulting there from.

(Use this statement for

printed hard copy TMs) Three copies of the NAVSEA/SPAWAR Technical Manual Deficiency/Evaluation Report form, NAVSEA 4160/1 are included at the end of each separately bound hardcopy TM.

(Use this statement

for a TM on CD-ROM) The NAVSEA/SPAWAR Technical Manual Deficiency/Evaluation Report form, NAVSEA 4160/1 is included as the last page of the TM.

(Include this statement for all TMs) Copies of form

NAVSEA 4160/1 may also be downloaded from: <https://nsdsa2.phdnswc.navy.mil/tmmp/forms/TMDER>

The following methods are available for generation and submission of TMDERs:

- The most expedient and preferred method of TMDER generation and submission is via the Technical Data Management Information System (TDMIS) website at: <https://mercury.tdmis.navy.mil>
TDMIS accounts can be requested at: <https://nsdsa2.phdnswc.navy.mil/>
 - Generate and submit TMDER via the Naval Systems Data Support Activity (NSDSA) website at: <https://nsdsa2.phdnswc.navy.mil/tmder/tmder-generate.asp?lvl=1>
 - When internet access is not available, submit TMDER via hardcopy to: COMMANDER CODE 310 TMDERs NAVSURFWARCENDIV NSDSA 4363 MISSILE WAY, BLDG 1388 PORT HUENEME, CA 93043-4307 - TMDERs against classified TMs must be submitted using the hardcopy method cited above. - Urgent priority TM deficiencies shall be reported by Naval message with transmission to Port Hueneme Division, Naval Surface Warfare Center (Code 310), Port Hueneme, CA. Local message handling procedures shall be used. The message shall identify each TM deficiency by TM identification number and title. This method shall be used in those instances where a TM deficiency constitutes an urgent problem, (i.e., involves a condition, which if not corrected, could result in injury to personnel, damage to the equipment or, jeopardy to the safety or success of the mission).

Complete instructions for TMDER generation and submission are

detailed on the NSDSA website at: <https://nsdsa2.phdnswc.navy.mil/tmder/tmder.asp?lvl=1>

- j. Method of obtaining additional copies and the format of those electronic copies.
- k. Distribution statement.
- l. Export control notice, if applicable.
- m. Summary of documents and/or technical manuals that are referenced but not included in the automatically accessible data available to the IETM

at the time it is used, if applicable.

- n. General notes describing the physical method for identifying the specific equipment to which this IETM applies, the method for identifying the change configuration status of equipment when not immediately obvious to a qualified user, and the relationship of the IETM to the particular equipment under maintenance.

3.3.1.2.3.1.1.1 Distribution Statement.

All TMs shall have a distribution statement placed on the cover and title page. The appropriate distribution statement, will be provided by the Government. Unless otherwise specified, Distribution Statement C shall be placed on the cover and title page

3.3.1.2.3.1.1.2 Export Control Notice.

When required, an Export Control Notice shall be placed on the cover and title page of each manual, manual supplement, revision or change:

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"WARNING: This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C. SEC 2751, et seq) or the Export Administration Act of 1979, as amended, Title 50, U.S.C., App 2401 et seq. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25(D)."
```

3.3.1.2.3.1.1.2.1 Destruction Notice.

All technical documents marked with distribution statements A, B, C, D, E, F or X shall be marked with the destruction notice from DOD 5230.24 on the cover and title page as follows:

"Destruction Notice: Destroy by any method that will prevent disclosure of contents or reconstruction of the document."

3.3.1.2.3.1.2 Applicability Statement.

The IETM shall contain a highly accessible applicability statement which explicitly identifies the system, equipment, or component to which the IETM applies, as well as the level of maintenance for which the IETM is intended (i.e., organizational, intermediate, or depot), as applicable. This information shall be in addition to the use of any automated feature of the EDS which displays only that information relating to one particular configuration. If the IETM applies only to specific members of an equipment class, this shall be stated, and relevant model numbers, serial numbers, aircraft tail numbers, etc., shall be clearly identified.

3.3.1.2.3.1.3 List Of Contents.

The IETM shall contain a list of contents and shall provide instructions for direct user access to each item at the lowest level cited. If the IETM is for proceduralized corrective maintenance, the list of contents shall provide all maintenance tasks included. The list of contents, while analogous to the table of contents of a paper manual, shall base sequencing on the logic of the logistics support function covered and shall contain branching as needed. The user shall be given the capability to access listed entries directly from the list of contents menu.

3.3.1.2.3.1.4 How To Use "Help" Information.

In addition to the technical information related help described in [3.3.1.2.3.1](#), the user shall be provided with help information involving the use of the IETM or the use of the EDS. This help information shall describe how to use the IETM; e.g., how to reach (access) specific information and how to employ user interaction functions. How to use this IETM information shall be incorporated as part of the content information for the IETM.

3.3.1.2.3.1.5 Instructions For Interactions With IETM Utility Functions.

Information shall be provided which describes procedures for all utility functions included as supplements to the primary functions of the IETM (e.g., preparation and submission of associated maintenance action reports;

accumulation and submission of the IETM deficiency reports citing IETM errors or problems in using the IETM; ordering of needed parts; work center maintenance management; use for on station training; acquisition of additional IETM data).

3.3.1.2.3.1.6 Definitions Of Acronyms And Unusual Terms.

A glossary including all acronyms, abbreviations, and unusual terms shall be incorporated into the IETM and shall be directly accessible at all times during the IETM presentation.

3.3.1.2.3.2 Danger, Warnings, Cautions and Notes.

Dangers, warnings and cautions shall precede the text but follow paragraph headings to which they apply. Notes may precede or follow applicable text, depending upon the material to be highlighted. Dangers, warnings, cautions and notes shall not contain procedural steps nor shall the headings be numbered. When a danger, warning, caution or note consists of two or more paragraphs the heading DANGER, WARNING, CAUTION, or NOTE shall not be repeated above each paragraph. If it is necessary to precede a paragraph by both a danger and a note, a warning and a note, or a caution and a note, and so forth, dangers shall precede warnings, warnings shall precede cautions, which in turn shall precede notes.

DANGER

WARNING

CAUTION

Dangers, warnings, cautions and notes shall be short, concise and used only to emphasize important or critical data. Dangers, warnings and cautions may be worded positively or negatively and shall state the hazard and result or reason, unless obvious. Paragraphs [3.3.1.2.3.3](#) through [3.3.1.2.3.3.4.1](#) provides additional requirements for inclusion of warnings and cautions. Icons shall be used as described in paragraphs [3.3.1.2.3.3](#) through [3.3.1.2.3.3.4.1](#).

3.3.1.2.3.2.1 Health Hazards.

Procedures prescribed for the operation of equipment shall be consistent with the safety standards established by the Occupational Safety and Health Act (OSHA) Public Law 91-596 and Executive Order 12196. When exposure to hazardous chemicals or other adverse health factors or use of equipment cannot be eliminated, guidance pertaining to the exposure shall be included in the Safety Summary or a Warning.

3.3.1.2.3.3 Scope.

This document identifies standard practices for the inclusion of Occupational Safety and Health guidance in the text of technical manuals. The intent is to provide sufficient information to allow a standardized approach to the task, eliminate confusion, and improve the technical manual development process overall. The criteria for safety symbols in technical documents are in conformance with ANSI Z535.3.

3.3.1.2.3.3.1 General Requirements.

3.3.1.2.3.3.1.1 Human factors.

Technical manual procedures are subject to being overlooked or circumvented when they are deemed unworkable or impractical. Careful consideration of environmental factors, equipment design or layout, human nature, and other human factors will help ensure the overall integrity of the task procedures.

3.3.1.2.3.3.1.2 When to use Danger, Warning, or Caution statements.

3.3.1.2.3.3.1.2.1 Danger.

Danger is used to indicate a location, equipment, or system where imminent hazard exist, capable of producing immediate injury or death to personnel or threatens the primary mission of the ship.

3.3.1.2.3.3.1.2.2 Warning.

Warning is used to indicate a location, equipment, or system where a potential hazard exist, capable of producing injury to personnel, if approved procedures are not followed.

3.3.1.2.3.3.1.2.3 Caution.

Caution is used to indicate where hazard exist, that could severely damage equipment, a system, or the ship, causing loss of mission capability if approved procedures are not followed.

3.3.1.2.3.3.1.3 General.

Operating, maintenance, and safety instructions are used to indicate procedures to be followed in operating and maintaining equipment and complex systems normally tended by trained technicians. General safety information provides notice of general safe practice or rules related to health, first aid, sanitation and housekeeping.

3.3.1.2.3.3.1.4 Design criteria.

Danger, warning and caution icons or symbols shall be in accordance with ANSI Z535.3. These signs shall be compatible with precautions in applicable manuals.

- a. As indicated by the definition in this document, DANGER statements are used to indicate imminent hazard to personnel or equipment, WARNING statements are reserved for the protection of personnel and CAUTION statements are reserved for equipment or system protection. Do not use CAUTIONS for health hazards.
 1. WARNINGS and CAUTIONS should be used for those unique conditions, steps or processes that require additional emphasis because of the inherently dangerous nature of the task or the potential for a "surprise" not otherwise readily obvious from the procedure.
 2. A WARNING should be used to advise of injury or occupational illness potential, but only based on the reasonable likelihood that the reader's health or safety will be impacted in such a manner as to cause immediate concern and a disabling injury or occupational illness will result if the task procedure or stated precaution are not closely followed. Injury is defined as a traumatic bodily harm caused by a single or 1-day exposure to an external force, toxic substance (usually associated with accidents and spills in work places where the specific agent is not normally in the environment), or physical agent which will result in restricted duty, lost time, or worse. The occupational illness is defined as any abnormal physical condition or disorder, other than one resulting from an injury (as defined above), caused by repeated exposure to chemical, biological, or physical agents associated with the occupational environment which will result in restricted duty, lost time, or worse.
 3. Specific direction as to which specific procedures require the use of warnings or cautions should be obtained from the LSAR and system safety. The responsible safety office also should be requested to review technical manual procedures for compliance with safety concerns.
- b. Risk assessment - and the related issue of whether or not additional emphasis is required - is somewhat subjective. Decisions concerning these issues should be based on as much information as possible including historical mishap data from related systems, research, and the experience of all those involved in the technical manual development process. Often, the latter is the best indicator of the need for additional comment. Through the acquisition phase of major weapon

systems, the decision to include a DANGER, WARNING or CAUTION statement in the text can often be made by consulting the Operating and Support Hazard Analysis or other system safety engineering analysis.

- c. DANGERS, WARNINGS or CAUTIONS are not to be used for environmental protection concerns or security information.

3.3.1.2.3.3.1.5 Wording and Structure of Danger, Warning, and Caution Statements.

- a. A DANGER, WARNING or CAUTION statement should consist of four parts: a signal word (Danger, Warning, Caution), a concise statement of the hazard, minimum precautions, and the possible result if the DANGER, WARNING or CAUTION is disregarded, unless obvious. An icon is optional. In cases where hazardous materials are being used and the conditions on [3.3.1.2.3.3.1.7e.2](#) exist, a hazardous material icon(s) shall be used. See paragraph [3.3.1.2.3.3.4](#) for guidance on constructing the icons.
 1. The signal word will always be included using one of the styles, or similar, referenced in this document. Whichever style is used, it must be used consistently.
 2. The remaining parts can be arranged in any way that gets the point across; however, following the format of statement first, precaution second, and result third is often the most clear and concise method. Brevity is important. If the possible result is obvious, it need not be included.
 3. A precaution is a short statement of hazard mitigation that tells the reader to take care, for example "use eye protection", or "keep arms and hands clear". Certain precautions may reference other publications or direct people to consult with another agency (for example, "...consult Bioenvironmental Engineering"). However, guidance of this nature should be considered for inclusion in a safety summary (see [3.3.1.2.3.3.1.7](#)).
- b. DANGER, WARNING or CAUTION statements shall never contain procedures critical to the effective and safe completion of the task. For example:

"WARNING

Cleaning with compressed air can create airborne particles that may enter eyes or penetrate skin. Pressure shall not exceed 30 psig. Wear goggles. Do not direct compressed air against skin."

- c. Negatively worded statements (for example, "Failure to adhere..." or "Do not use ...") are acceptable and sometimes the best way to convey the message.
- d. Multiparagraph or excessively long DANGER, WARNINGS and CAUTIONS are not specifically disallowed by this document but lengthy statements are a good indication that the task procedures are not written with the needed safety steps or procedures included.
- e. Pay strict attention to the definitions of "shall", "will", "should", and "may" in this document. The use of these words must be consistent with exposures or conditions which require comparable DANGER, WARNINGS or CAUTIONS.

3.3.1.2.3.3.1.6 Placement of Danger, Warning, or Caution Statements.

- a. This document contains general requirements.
- b. DANGER, WARNINGS or CAUTIONS should be placed in the text immediately prior to the step or procedure to which they apply. The same DANGER, WARNING or CAUTION need not be repeated within a procedure as long as the emphasis and impact of the DANGER, WARNING or CAUTION is not lost because of a break in the procedures.
- c. There is no stated maximum on the number of unrelated DANGER, CAUTIONS or WARNINGS that can be placed on a page. Under no conditions should they be so numerous so as to obscure the procedures. Properly written procedures should eliminate the need for consecutive WARNINGS. Sandwiching short (one line or two line) procedures between WARNINGS and CAUTIONS should be avoided.

3.3.1.2.3.3.1.7 Safety summary sheets or sections.

- a. All technical manuals containing dangers, warnings, or cautions shall have a Safety Summary. In conjunction with properly written procedures, the Safety Summary, which can contain general safety precautions, can eliminate the need for many DANGER, WARNINGS or CAUTIONS.
- b. Provide a Safety Summary in accordance with this document in the front of the manual preceding the first text page. The safety summary provided on figure [1129](#) is only an example of the type, depth, and format of general shop safety information necessary. It is not all inclusive. Only the first two paragraphs (see figure [1129](#)), or similar wording detailing the significance and use of DANGER, WARNING and CAUTION statements, should be considered common to all Safety Summaries. Additional paragraphs can be added depending upon the class of hazard found in the technical manual.
- c. Nearly any topic can be considered for inclusion in a Safety Summary: mechanized material handling equipment; overhead lifting devices; wood or metal working machine use and guarding; and so forth. General precautions related to storage, and so forth, can also be included.
- d. Safety summaries are an excellent place to provide general safety or health instructions, but they must be tailored to the technical manual.
 1. Live circuitry guidance is probably not applicable to a corrosion control technical manual. This does not preclude the possibility, however, of a WARNING in the text of a corrosion control technical manual if the text establishes the likelihood of exposure to injurious current.
 2. The converse is also true. It would be appropriate to include live circuitry guidance in the Safety Summary of a maintenance manual. However, WARNINGS inserted in the text prior to every point of potential current exposure would not be required, as long as the procedures identify the proper controls, for example, "discharge capacitor XXXX," or "...turn off power and tag out (lock out) switch." It is reasonable to assume a trained maintenance technician is fully aware of the hazards of live circuitry; emphasis beyond a Safety Summary would be needed only in the event that the equipment, procedures or work environment presented an unusual situation to the technician.
- e. Inclusion of general guidance in a Safety Summary does not preclude the need for a DANGER, WARNING or CAUTION if the text calls out a nonroutine use or application.
 1. For example: in a parts cleaning technical manual, general guidance in the Safety Summary related to air pressures (30 psig), chip

guarding, eye protection, and so forth, would suffice as long as the task procedures include the minimum required controls (pressure regulation, and so forth) as procedural steps. A CAUTION may still be required, however, if the text specifies 15 psig for a delicate piece of equipment that would be damaged if the technician proceeded under the general guidance included in the Safety Summary.

2. Many industrial hygiene and occupational health concerns can be addressed in the same manner. In technical manuals that frequently call for routine solvent applications, WARNINGS would not be needed throughout the text as long as the minimum required controls are called for in the task procedures. General guidance regarding solvents could be included in the Safety Summary. Additional emphasis would then be required only if a procedure calls for a nonroutine application, such as heating the solvent, or an unusual, potentially more toxic solvent. In that event, a DANGER or WARNING could be used depending on the ability of the process to cause immediate safety or health concerns. This approach can be used for many of the occupational health concerns associated with commonly used substances, for example, hydraulic fluids, oils, fuels, paints, thinners, adhesives, sealants, and so forth.

- f. DANGER, WARNINGS or CAUTIONS should not simply be extracted from the text and inserted verbatim in a Safety Summary. An acceptable approach would be to provide a general summary of guidance, classed by exposure. DANGER, WARNINGS or CAUTIONS must still be placed in the text, however, based on the risk associated with the steps or procedure.
- g. Excessively long Safety Summaries are discouraged. If a technical manual requires extensive safety or health guidance, a safety section or chapter should be considered.

3.3.1.2.3.3.2 Quality Control.

3.3.1.2.3.3.2.1 Rewrite.

The Government will recommend rewrite under the following conditions:

- a. When any part of a procedure, DANGER, WARNING, CAUTION, or Safety Summary is not consistent with existing Occupational Safety and Health Administration and Service safety requirements or is detrimental to existing Service safety and health programs.
- b. When WARNING statements are misused for equipment protection or otherwise misused outside of the intent of this document.
- c. When CAUTION statements are misused for personnel protection, or otherwise misused outside of the intent of this document.
- d. When DANGER, WARNING or CAUTION statements contain procedural steps, they should be included in the task description. Minimum protective equipment requirements or minimum precautions are allowable.
- e. When DANGER, WARNING, or CAUTION statements are excessively long.
- f. When DANGER, WARNING, or CAUTION statements are so numerous on a page that necessary task procedural steps are visually obscured.
- g. When Safety Summaries are used to the exclusion of DANGER, WARNINGS and CAUTIONS in the text unless indicated by the nature and class of hazard associated with the text, or when otherwise used outside of the intent of this document (that is, they should provide tailored, general guidance).
- h. When DANGER, WARNINGS or CAUTIONS are extracted from the text verbatim and inserted in the Safety Summary.
- i. When statements detailing the significance and use of DANGER, WARNING

and CAUTION statements are not provided in the Safety Summary.

- j. When the wording of DANGER, WARNINGS or CAUTIONS varies throughout the text even though the same or very comparable conditions are being emphasized.
- k. When a DANGER/WARNING does not serve to prevent disabling injury or death, or a DANGER/CAUTION does not serve to prevent damage or destruction of equipment.
- l. When a procedure lacks required emphasis because of its inherently dangerous nature or a step requires additional emphasis because of its critical safety impact.
- m. When WARNINGS or CAUTIONS contain vague precautionary statements such as "avoid all contact", or rely too frequently on references to other technical manuals or outside agencies. In these cases, inclusion in a Safety Summary or input conditions page will be recommended as appropriate.
- n. When WARNING or CAUTION statements contain general safety precautions.

3.3.1.2.3.3.3 Points of Contact.

3.3.1.2.3.3.3.1 Coordination.

All those involved in the technical manual development process must remember that the OSH guidance included in technical manuals is not the only line of defense against serious mishaps, but it is sometimes the last. The effective inclusion of OSH guidance can almost never be accomplished by a single individual with a distinct background. It must be a coordinated effort among system experts, safety professionals, technical writers, and the potential user. Questions arising from this process should be referred to the appropriate Safety Office and the Government acquiring activity. Do not ignore existing contractual or Command requirements.

3.3.1.2.3.3.4 Construction of Health Hazard Icons/Safety Symbols.

3.3.1.2.3.3.4.1 Hazard Icons.

Icons/safety symbols may be used to save space in the manuals while still conveying a clear message of the hazard to the technician using the manual. Since the icon presents a visual image of the hazard rather than a more abstract message, recognition should be much faster than with a worded warning. ANSI Z535.3 provides general criteria for the design evaluation and use of safety symbols to identify and warn against specific hazards and provide information to avoid personnel injury and damage to equipment.

3.3.1.2.3.3.5 Safety Summary.

Every IETM which contains warnings or cautions shall contain at least one safety summary conforming to the requirements of this document. When an IETM contains multiple major procedures, each of which is intended to be used independently of the other procedures in the IETM, there shall be a safety summary for each major procedure.

3.3.1.2.3.4 Health Hazard Precaution Data.

When hazardous chemicals or other adverse health factors are present in the environment or will appear during the performance of the procedure, and these health hazards can not be eliminated, appropriate warning and caution information shall be included in the technical information. Necessary protective devices for personnel shall be listed in the initial setup (input conditions) of the procedure and referred to in the appropriate subtask steps or warning/caution message.

3.3.1.2.3.5 Hazardous Material Icons.

Aerospace Industries Association Pubs-119 Publication shall be used to construct warnings, cautions, and applicable icons relating to hazardous substances.

3.3.1.2.4 General Style Requirements.

IETMs shall be prepared in accordance with the general style requirements contained in the following paragraphs. These requirements shall apply both for the language to be used in textual technical information and for the graphics supplementing the textual portions.

3.3.1.2.4.1 Level Of Detail.

Technical information shall contain all of the information necessary for a user to perform the task involved or to comprehend a description. The criteria required to define the specific level of detail shall be for a Petty Officer 1st Class at the I-Level and a Petty Officer 2nd Class at the O-Level. The IETM shall not contain unnecessary detail above or below this level. However, in all cases the IETM shall retain enough information to permit the user to perform the documented maintenance without error or loss of time due to insufficient information. Procedures within steps shall be implemented as follows. When a general purpose procedure which can be performed without reference to technical information by a technician experienced in this procedure (e.g., "Open access panel") is referenced by a step, the user shall be given the option either to access the procedure before continuing with the current task or to bypass the procedure. When a procedure is peculiar to a task, or involves use of a peculiar piece of equipment, it shall be included in the procedural data and not made optional.

3.3.1.2.4.2 Comprehensibility.

To ensure comprehensibility of the IETM data, the following principles shall be followed in authoring technical information:

- a. Essential information in narrative text shall:
 - (1) Describe the system, components, etc., identifying special or outstanding features.
 - (2) Describe what functions are performed, including inputs, outputs, interface with other systems, etc.; emphasize end results.
 - (3) Describe how the functions are performed, including associated principles of operation.
 - (4) Describe at what point in an overall system process the function is performed.
 - (5) Describe the location of the component or part.
- b. When procedural text is combined with graphics, the following rules shall be used to abbreviate, so long as the meaning is not altered or obscured.
 - (1) Eliminate articles.
 - (2) Begin sentences with transitive verbs (action verbs).
 - (3) Use the imperative mood whenever appropriate. The only time subjects shall be implied is when they are unknown and the passive voice is being used or when the imperative mood is being used to give an instruction, order, or command, in which case the subject shall always be omitted (i.e., implied).
- c. When it is necessary to indicate time, begin sentences with "when" clauses.

Example: "When power supply voltage stabilizes..."

- d. Limit paragraphs to a single idea. Limit sentences to a single thought; use no compound or complex sentences. Whenever possible, limit words to those that are short and familiar to the target audience. Eliminate long, complex sentences and paragraphs through the use of lists. The resulting parallel portions of sentences shall be individually listed as in the following example:

The beat frequency oscillator has three components

(1)...

(2)...

(3)...

- e. Sentence length shall not exceed an average of 20 words. The average paragraph shall not exceed six sentences. The desired paragraph length is three to four sentences. Each paragraph shall have a topic entry or sentence. All material in the paragraph shall relate to and develop the topic sentence.

- f. Except in unusual circumstances, text modules (e.g., construct steps and

explanations) shall be fully integrated with graphics modules. Associate explanatory text to the graphic.

- g. Present descriptive text in a logical order (e.g., in operational sequence or in signal flow sequence) and include summary headers for individual paragraphs whenever needed for clarity.
- h. Keep descriptive text consistent in terminology, style, and format throughout the IETM.

3.3.1.2.4.3 Readability.

Unless otherwise specified, the Reading Grade Level (RGL) shall be nine. IETMs shall be written

3.3.1.2.4.3.1 Sample Selection.

Samples of text shall be analyzed for readability. Select samples as follows:

- a. Count the number of topics (or data modules) contained in the IETM (e.g., General Information and Safety Precautions; Operation; Functional Description; Scheduled Maintenance; Troubleshooting; Corrective Maintenance; Parts List or IPB).
- b. Count the number of data panes (or screens) of text within each topic or data module. The count shall include all full and partial data panes that contain text in the form of consecutive sentences. The count shall not include data panes containing only illustrations, tables, lists, and so forth. Record the number of data panes.
- c. The basic number of samples is determined as follows.

Basic Number of Samples
90 and above
54 to 89
32 to 53
1 to 31

Number of Data Panes Divisor Divided by "N" Basic No. of Samples

		Min	Max
90 and above	10	9	30
54 to 89	9	6	9
32 to 53	8	4	6
1 to 31	6	2	4

- d. Divide the number of data panes by the appropriate divisor, "N". Round off the quotient to the next lowest whole number.
- e. For IETMs that contain fewer than 12 data panes, randomly select two samples and mark them for analysis.
- f. For IETMs that are 12 data panes or more, randomly select a number between one and "N". The number selected shall be marked as the first data pane of text to be analyzed. Starting at the selected data pane, mark every "Nth" data pane of text to the end of the IETM. The marked data panes shall identify starting points for the basic samples to be analyzed.
- g. Mark the data panes to verify that at least one sample has been selected for each topic of the IETM. If any topic has been missed, randomly select one data pane of text from that topic and add it to the basic samples to be analyzed.

3.3.1.2.4.3.2 Raw Data Collection.

For each sample marked, raw data shall be collected. Data collection shall consist of counts of

3.3.1.2.4.3.3 Word Count.

For each sample, count the number of words as follows:

- a. For each sample, count all words up to the end of the sentence containing the 200th word. If the marked sample contains fewer than 200

words, the sample can be extended to the next data pane of text; but, do not extend the sample into a new topic, or text pertaining to a completely new subject.

- b. Count as a word all numbers, letters, symbols, and groups of letters surrounded by white spaces. Hyphenated words and contractions count as one word.
- c. Record the number of words in each sample.

3.3.1.2.4.3.4 Sentence Count.

For each sample, count the number of sentences as follows:

- a. Count all sentences in sample including the sentence that contains the 200th word.
- b. Count as a sentence each unit of thought that can be considered grammatically independent of another sentence or clause. A period, question mark, exclamation point, and semicolon usually denote independent clauses and thus mark the end of a sentence.
- c. Record the number of sentences in each sample.

3.3.1.2.4.3.5 Syllable Count.

For each sample, count the number of syllables as follows:

- a. For most words, count syllables the way the word is normally pronounced aloud.
- b. Count all numbers as one syllable. However, if a numeric expression contains several numbers separated by hyphens, count each number as a syllable.
- c. Acronyms and abbreviations are counted as one syllable unless they actually spell out a word of more than one syllable.
- d. Count as one syllable all words that are included in a baseline word list for Navy TMs (see SL160-AA-LST-010/TM-WORDS) and all expanded versions of those lists that are authorized for TM acquisitions.
- e. Record the number of syllables in each sample.

3.3.1.2.4.3.6 Grade Level Calculations.

3.3.1.2.4.3.6.1 Sample Grade Levels.

Calculate the GL of each sample as follows:

- a. Calculate the average sentence length (L). Divide the number of words in the sample (V) by the number of sentences in the sample (T): $(L = V/T)$. Round off quotient to the nearest one hundredth.
- b. Calculate the average number of syllables per word (D). Divide the number of syllables (C) in the sample by the number of words (V) in the sample: $(D = C/V)$. Round off quotient to the nearest one hundredth.
- c. Calculate the GL of each sample by the following formula. Round off each GL to the nearest integer.

$$GL = 0.39(L) + 11.8(D) - 15.59$$

3.3.1.2.4.3.6.2 OGL.

The OGL of an IETM is calculated as follows:

- a. Add the total number of words (W) from all samples combined. Record total.
- b. Add the total number of sentences (S) from all samples combined. Record

total.

- c. Add the total number of syllables (P) from all samples combined. Record total.
- d. Calculate the average sentence length (A). Divide total number of words (W) by total number of sentences (S): $(A = W/S)$. Round off quotient to the nearest one hundredth. Record quotient.
- e. Calculate the average number of syllables per word (B). Divide total number of syllables (P) by total number of words (W): $(B = P/W)$. Round off quotient to the nearest one hundredth. Record quotient.
- f. Calculate the OGL of the manual by the following formula. Round off the OGL to the nearest integer.
$$\text{OGL} = 0.39(A) + 11.8(B) - 15.59$$

3.3.1.2.4.4 General Style Requirements For Text.

IETM text shall be developed in accordance with the following style requirements.

3.3.1.2.4.4.1 Language Considerations.

Writing shall be factual, specific, terse, clearly worded, and simply illustrated, so that a user who has the required aptitude, training, and experience will understand it.

3.3.1.2.4.4.2 Proper Amount Of Technical Information.

The IETM shall provide all the technical information required by a technician to perform the task. It shall not contain extraneous material. Helpful, but not required, information shall be included only in the form of user accessible HELP (see [3.3.1.2.3.1](#)).

3.3.1.2.4.4.3 Nomenclature.

Nomenclature used for names of equipment item assemblies, parts, etc., shall be in agreement with the approved nomenclature list prepared as part of the supportability analysis records or other official maintenance specification, as applicable. Use of this nomenclature or its substitution with a standard shortened identifier (i.e., acronym, common name) shall be consistent throughout the entire IETM and among all IETMs which apply to the weapon system or equipment involved. Standard shortened identifiers shall be substituted at all times so no confusion will result.

3.3.1.2.4.4.4 Nomenclature For Tools And Test Equipment.

The official nomenclature shall be used in the first occurrence in a task or procedure, for all titles, parts lists, support/test equipment lists, consumable/expendable lists, and work unit codes. When a common name exists for the same item, it may be used in place of the official name. Official and common name usage shall be consistent, as described above, throughout the IETM (see [3.3.1.2.4.4.10](#)).

3.3.1.2.4.4.5 Nomenclature For Controls And Indicators.

Controls and indicators identified in a procedure shall be identified exactly as placarded on the equipment. Component reference designators (R105, C56, etc.) shall be omitted unless the reference designator itself appears on the equipment or if two or more controls/indicators have identical nomenclature. If variations in panel or chassis nomenclature exist, a comment explaining that the panel nomenclatures are typical and may vary slightly from one unit to another shall be included. Controls and indicators with functional names only (no panel names) shall be identified by functional name.

3.3.1.2.4.4.6 Abbreviations.

Use of abbreviations (including abbreviations for common units) shall be held to a minimum. Standard abbreviations shall be in accordance with MIL-STD-12. Each abbreviation shall be defined in the IETM glossary.

3.3.1.2.4.4.7 Metric Symbols.

Metric symbols shall be in accordance with NIST Special Publication 811 and IEEE 945.

3.3.1.2.4.4.8 Unit Of Measure.

Unit of measure shall be consistent throughout the IETM. If not otherwise specified on the equipment, measurements shall be in U.S. standard units (ounces, pounds, gallons, inches, feet, knots, miles, etc.). Units of

measure shall be used as follows:

- a. Temperature readings as marked on the equipment. If other than Fahrenheit, the equivalent in Fahrenheit shall follow parenthetically. General ambient temperature references, such as room temperature, shall be given in degrees Fahrenheit.
- b. Speed, distance, and meter readings as marked on the equipment. When the metric system is used on the equipment, conversion to U.S. standards of measurement shall follow in parentheses. Conversion of U.S. standards of measurement to metric standards of measurement shall follow in parentheses.
- c. Switch positions and panel markings exactly as marked on the equipment. However, symbols on panel markings, such as the symbols for "ohm" or "infinity," may be spelled out in textual references when they cannot be produced by the presentation system.

3.3.1.2.4.4.9 Numerical Expression Of Tolerances.

The optimal value shall be expressed, along with associated tolerances (e.g., 15 +4/-2 VDC), for numeric measurement values. Tolerances shall not be expressed in percentages. All numerical values given shall match the number of decimal places indicated on the affected instruments. Torque measurement values shall conform to the calibration of the required tool.

3.3.1.2.4.4.10 Vocabulary (Permitted Words).

Permitted word lists for preparation of IETM textual and procedural steps are contained in SL160-AA-LST-010/TM-WORDS. Words initially used by the IETM author, and identified during the contractor's Quality Assurance (QA) process, which are not on these lists, shall be eliminated and replaced with the "permitted" words, unless the comprehensibility of a given passage requires the use of a "non-permitted" word. In such a case, the exception shall be submitted to the Government for approval of any "non-permitted" word. Terminology shall be used consistently throughout the IETM; e.g., the same word for a given tool must be used throughout the IETM.

3.3.1.2.4.5 General Style Requirements For Graphics.

Graphics for IETMs shall be developed in accordance with the general style requirements of the following paragraphs as they relate to individual graphics or to associations of both graphics and text. The requirements of these paragraphs shall apply to the display of the IETM on the least capable device (i.e., smallest screen) which is specified for use with the weapon system or equipment to be supported by the IETM.

3.3.1.2.4.5.1 Graphic Conventions.

Displayable graphics shall have a means for designating the minimum size at which that graphic is capable of being discerned when physically displayed and whether that graphic is permitted to be displayed using interactive functions. The particular encoding standards shall conform to the system specific IETMDB implementation and the designated presentation system. Non-interactive graphics shall be viewed in full detail without manipulation. Interactive graphics shall allow the user to either manipulate the graphic for better view or allow the user to choose selectable areas within the graphic.

3.3.1.2.4.5.2 Minimum Size For Graphics.

Graphics shall be displayed no smaller than required to meet the minimum displayable size which has been designated for each individual graphic.

3.3.1.2.4.5.3 Graphic Density.

Graphics shall show only that detail needed to support the action being described.

3.3.1.2.4.5.4 Quality Of Graphics.

Graphics shall be prepared to a scale that ensures legibility of all essential detail. Line widths shall be of sufficient density to register sharply and clearly when displayed at the designated minimum size EDS.

3.3.1.2.4.5.5 Level Of Detail In Graphics.

Graphics shall present only the equipment items referred to by the action statements, plus sufficient surroundings to permit the user to correctly locate the item.

3.3.1.2.4.5.6 Measurements And Tolerances.

Numerical measurements and tolerances shall be expressed in the same manner as that required for text (see [3.3.1.2.4.4.9](#)).

3.3.1.2.4.5.7 Textual Citations Of Panel Nomenclature.

In all references to controls, control positions, test points, and indicating devices which have panel or chassis nomenclature, the nomenclature used in the textual label shall be displayed exactly as it appears on the panel or chassis (e.g., all capitals if used, spacing, and special symbols). Nomenclature shall not be enclosed in quotation marks unless required for clarity. Functional names shall be used in procedures involving controls and indicators with no panel names. All nomenclature used in graphics shall be identical to the nomenclature for the corresponding item in the related text.

3.3.1.2.4.5.8 Angle Of View.

Graphics shall be drawn from the same general angle of view that the user sees the equipment, (e.g., during a given step of a procedure). Cutaways and hidden lines shall be used as required in conjunction with details that are accessible, but not visible, to the user (e.g., as seen after removal of an access cover or after opening a cabinet door). In situations where the user is able to view the hardware from more than one angle, the view which provides the most pertinent and necessary information shall be used. An item or part removed from the system may be rotated to show important features; the axis, direction, and degrees of rotation shall be indicated in the graphic. Perspective and isometric graphics shall be used for a more realistic view. Orthographic projection may be used if the view is head-on.

3.3.1.2.4.5.9 Use Of The Human Figure.

When it is necessary to illustrate an operation or procedure, graphics may include a human figure or parts of the body. Jewelry shall not appear in any graphics. The human figure shall not obscure details of the equipment necessary for a complete understanding of its operation. The human figure shall be clothed in a Navy enlisted working uniform. Clean, neat, dungarees are preferred but may use Undress Blues with either a second or first class petty officer emblem. A cross section of races and sexes shall be used.

3.3.1.2.4.5.10 Types Of Graphics.

Where required to present maintenance procedures or descriptions, an IETM shall contain graphics to include, but not be limited to, such types as frontispiece (assembled view), isometric, perspective, and orthogonal.

3.3.1.2.4.5.11 Drawings.

When engineering drawings are used as a baseline in the development of graphics, details which reduce the comprehensibility and clarity of the graphic shall be removed. Electrical and engineering diagrams shall be laid out functionally. Where information must be presented by means of a signal flow chart or circuit diagram, such visual aids shall be divided into discrete units, simplified, and standardized.

3.3.1.2.4.5.12 Schematic And Wiring Diagrams.

Wire lists, schematics, and wiring diagrams initially displayed along with an associated text pane shall be simplified to contain only the information referenced by the accompanying text. However, the technician shall have access to the entire wire list, schematic, or wiring diagram when that full graphic is available in the IETM.

3.3.1.2.4.5.13 Functional Flow Diagrams.

Functional flow diagrams shall be drawn as flowcharts indicating the direction of system interaction. The information shall flow from left-to-right and top-to-bottom on diagrams. The diagrams shall indicate the detail referenced by the accompanying text.

3.3.1.2.4.5.14 Locator Graphics.

A locator graphic shall consist of a labeled graphic together with required callouts. Locator graphics, when used, shall either be an option, or an automated part of the procedural or descriptive information presented.

3.3.1.2.4.5.14.1 Placement.

Placement of locator graphics shall be fully integrated with the associated technical information.

- a. The individual equipment items (e.g., parts, switches, controls, indicators, and other items) shall be shown in physical context to the major equipment components of the illustrated hardware. The nomenclature of the major equipment component shall be shown on the graphic.
- b. Index numbers on callouts shall be assigned, if required, on the equipment item locator graphic either: in clockwise sequence, or in the sequence that the item is discussed in the procedural steps.
- c. When reference is made to an illustrated equipment item in a procedural step, the step reference shall be keyed directly to the relevant equipment item (e.g., part, switch, control, indicator, or other item) by a callout reference citation from the text (e.g., item name) or an index number and a leader line pointing to the referenced item.

3.3.1.2.4.5.14.2 Successive Graphics.

Successive locator graphics may be used in lieu of a single graphic to lead the user systematically from a large overall (general) view to successively lower level (specific) views in a logical presentation sequence. Item exploded views shall be used as locator graphics only where further disassembly is required.

3.3.1.2.4.5.14.3 Format.

The minimum size of the locator graphics shall provide sufficient resolution to enable the user to quickly identify the surroundings and the item to be located with respect to the surroundings. A callout shall be used to emphasize the item to be located.

3.3.1.2.4.5.15 Callouts And Leader Lines.

Callouts and leader lines shall be provided to identify specific features of interest on graphics. The following provisions for callouts shall be followed:

- a. Callouts shall be keyed to the procedural steps or descriptive information displayed.
- b. Callouts and identifier numbers shall not be crowded into spaces between graphic elements; callouts shall be clearly distinguishable from the graphic elements and each other.
- c. Labels used for part names or other graphic element identifiers instead of index numbers shall be identical to those used in the associated text.
- d. Leader lines (with arrow heads,) shall be drawn from the index number to the equipment item.
- e. Leader line width shall differentiate from graphic line width.
- f. Leader lines shall not obscure essential graphic detail.
- g. Leader lines shall not cross graphic lines if, an alternative is possible.
- h. Leader lines shall be straight wherever possible.
- i. When straight lines are not possible, leader lines shall have one bend at an angle of 45 degrees, drawn with the angled end pointing to the graphic.
- j. Leader lines shall not cross or come in contact with other leader lines.

3.3.1.2.5 Special Requirements.

The following requirements shall apply, in addition to those previously stated herein, unless otherwise contained in the applicable functional requirements of the conventional TM performance specification corresponding to the type of IETM being developed, (e.g., operation, maintenance) as determined by the procuring activity. Generally, the major types of information covered shall include, but not be limited to procedural (task), fault isolation, parts, and descriptive or narrative text.

3.3.1.2.5.1 Descriptive Information.

Narrative text shall be used to assist in the comprehension of procedural data.

3.3.1.2.5.2 Requirements Peculiar To Procedural Information.

Procedural information shall be used to instruct an end user how to operate, test, or repair a system; or carry out a logistics support procedure. Format for tasks and subtasks shall conform to the requirements contained herein.

3.3.1.2.5.2.1 Title And Label Requirements.

The following title and labeling information shall be associated with procedural tasks and subtasks. It shall be used primarily for window labeling upon presentation.

3.3.1.2.5.2.1.1 Task Title.

Wording of the task title shall be identical with the wording used in the task description in the detailed task analysis summary of the system supportability analysis. If no supportability analysis task title is available, the task title shall conform to the requirements of MIL-STD-38784, or the requirements herein.

3.3.1.2.5.2.1.2 Subtask Title Line.

A subtask title line, if required, shall consist of an uppercase title and may have a subtask number (Arabic). If numbered, subtasks shall be numbered sequentially throughout a task. A subtask title shall be structured in the same manner as a task title and uniquely identify the material which it heads.

3.3.1.2.5.2.2 Supporting Material For Tasks.

Procedural data shall contain the following information, which shall be displayed before the steps are viewed.

3.3.1.2.5.2.2.1 Procedure Applicability Statement.

Any procedure presented shall specify the equipment model, range, or sequence to which the procedural information applies. When a procedure to be presented does not apply to all existing models, the applicable equipment model or model range shall be identified. Such terms as "on later equipment" and "on early serial numbers" are not acceptable. When a procedure does not apply to all models, the IETM system shall require entry of the applicable system or equipment model number, serial number, or other unique system identifier before the task can proceed. If this information has been entered earlier in the use of the IETM (e.g., log-in) and that information is available at the time the procedure is presented, reentry of the information shall not be required. Such a control shall be based on established designations, such as model designation, part number, serial number range, or similar means. Indefinite categories such as "early serial numbers" or "some late models" shall not be used.

3.3.1.2.5.2.2.2 Initial Setup.

The initial setup or input conditions, where required, shall be provided at the beginning of every new task (e.g., consumable materials, support equipment). All lists provided as part of the initial setup shall be headed by individual underlined labels, using upper case initial letters with successive letters in lower case. Information presentation in each window shall avoid crowding; as many frames shall be used for each initial setup as necessary.

3.3.1.2.5.2.2.3 Safety Considerations.

Safety conditions shall be identified as stated herein (see [3.3.1.2.3.2](#)).

3.3.1.2.5.2.2.3 Dynamically Generated Fault Isolation Recommendations.

Dynamically generated fault isolation recommendations shall be computed, as required, with information received from user input and/or automated system recording. The fault isolation system shall provide the option to select a recommended test or repair action to perform that will aid in the fault isolation process. Results from these maintenance actions shall be used to update the status of the current situation producing additional recommendations if necessary. Recommended computations shall be based on a variety of input data including, but not limited to, historical information, heuristics, probability factors, and cost factors such as time or availability. The models for dynamically generated fault isolation recommendations shall be based on a computed process which involve one or more automated approaches including, but not limited to: model based reasoning, dependency models, fault based reasoning, rule based logic, information theory, or advanced artificial intelligence schema.

3.3.1.2.5.2.4 Presentation Requirements.

Presentation of dynamic fault isolation information shall be interactively displayed. Dynamic fault isolation of a system shall be depicted in some representative form (e.g., functional block diagram, connectivity block diagram, or iconic form). Depictions shall convey information about current components under investigation and the detected faults. Interaction with the depictions shall obtain additional information such as, but not limited to, lower levels of system detail, theory of operation, supply status, associated graphics, and part information. Presentation of system

information shall be hierarchical in nature. It shall include automated access to additional system wide information including, but not be limited to, block diagrams of all subsystems and the complete set of test and repair procedures, symptoms, and parts. The information presentation shall not be limited to a single set of troubleshooting recommendations but shall include user options for viewing a variety of troubleshooting information such as a best test or best repair list, previous actions performed during the troubleshooting process, test results, and block diagrams.

3.3.1.2.5.3 Presentation Of Parts Information.

A data base of supporting parts information (similar to a conventional Illustrated Parts Breakdown (IPB) or Repair Parts and Special Tools List (RPSTL)) shall be incorporated. In general, the IETM shall have the capability of accessing parts information to: permit unambiguous identification of all replaceable or repairable parts authorized at the current level of maintenance; show precisely the physical relationship of this part to other parts of the system; and provide all data required to order the part through the use of an automatically prepared parts ordering form. Each part shall be presented using line graphics showing the physical relationship of the part to the adjacent equipment.

3.3.1.2.5.3.1 Availability.

Parts information shall be made available at the point in the presentation in which a specific part is identified including, but not limited to:

- a. a locator diagram;
- b. parts shown on any logic flow diagram or circuit diagram;
- c. parts cited in the text of the technical information;
- d. a dialog prompt for parts related information;
- e. any citation using a part designation in any of its available forms.

3.3.1.2.5.3.2 Direct Access.

Parts data shall be accessible by direct entry of applicable part identification or numbering systems (e.g., stock number, part name, system/subsystem/sub-subsystem (subject) number (SSSN), reference designator).

3.3.2 Content for Electronic and IC Equipment Manuals.

3.3.2.1 Topics.

The contents shall be arranged in accordance with the following:

- a. General Information and Safety Precautions
- b. Operation
- c. Functional Description
- d. Scheduled Maintenance
- e. Troubleshooting
- f. Corrective Maintenance
- g. Parts List

3.3.2.1.1 General Information and Safety Precautions.

All safety precautions necessary for the protection of personnel and the ship shall be included and cross-referenced as the initial paragraphs ahead of the introduction. These precautions shall be prepared in accordance with this document. The content of this chapter shall be so that command level, supervisory personnel, and other users having a general interest in the equipment can easily and rapidly determine the purpose, physical and functional characteristics, and the operational capabilities of the equipment.

3.3.2.1.1.1 Introduction.

The introduction shall provide an explanation of the purpose, scope, supersedure data, and ship or shore applicability of the technical manual, including the models, serial numbers, and configurations covered. The interface relationship of the technical manual to other referenced publications and the relationship of the equipment to

referenced systems or other equipment shall also be included. Warranty and guarantee information shall be included as stated in the contract and will be in accordance with the Federal Acquisition Regulations, including hardware modifications (such as ship alterations, engineering change proposals, machinery alterations, ordnance alterations, field changes, and so forth), as applicable.

3.3.2.1.1.2 Equipment Description.

The equipment description shall describe the intended use (why, where, when, how, and with what), capabilities, and limitations of the equipment. Text covering physical description or structural arrangement shall be brief, with special attention given to avoiding unnecessary or repetitious details that are easily illustrated. The equipment, or all units of the equipment shall be clearly illustrated and identified. If the technical manual covers more than one equipment configuration, a table defining the differences shall be included. Assembly and detail drawings as appropriate may be referenced.

3.3.2.1.1.3 Equipment Illustration.

Equipment illustrations shall be in accordance with paragraph [3.3.2.1.1.4](#).

3.3.2.1.1.4 Equipment Illustration.

For installations consisting of more than one unit or assembly, a pictorial illustration representing the equipment, or all units comprising the equipment shall be included and shall be designated figure 1-1. If two units of the equipment differ between models, the alternate units shall be shown side by side (if clarity is not sacrificed) and designated by applicable model numbers. If more than two units differ, two frontispieces should be furnished and designated as figures 1-1 and 1-1A. The illustration shall show the major units of the equipment, relative size of each unit, basic interconnections between units, and their relationship with other equipment. The illustration shall be a left-hand full page or foldout (never backed up) and shall be assigned the folio (blank/1-0).

3.3.2.1.1.5 Reference Data.

Reference data, equivalent to the following, shall be included in tabular form:

- a. Descriptive (identification plate data) which identifies manufacturer, type, model, part or identifying number (PIN), Joint Electronic Type Designation (when applicable) Repairable Identification Code (RIC) and allowance parts list (APL), as applicable.
- b. Functional characteristics, such as: power requirements, horsepower, pressure, capacity, modes of operation, power output, frequency, pulse characteristics, sensitivity, selectivity, including tolerances, where applicable.
- c. Capabilities and limitations, such as: pounds of thrust, knots, turning radius, minimum and maximum ranges, degree of coverage, resolution, accuracy.
- d. Rated outputs, such as: wattages, voltages, horsepower, gallons per minute.
- e. Environmental characteristics, such as: ambient temperatures, heat dissipation per unit, humidity limits.

3.3.2.1.1.6 Equipment, Accessories, and Document Supplied.

A tabular listing of all equipment and documents supplied shall be included. List the equipment and its units (a major building block for a set or system, consisting of a collection of basic parts, subassemblies, and assemblies packaged together as a physically independent entity, refer to IEEE 200 for a detailed description), and accessories (special tools, test equipment, miscellaneous parts, and Government furnished items) which form a part of, or are supplied with the equipment. The table shall include the following:

- a. Column 1, Quantity. This column shall contain the quantity of each unit and accessories supplied with the equipment.
- b. Column 2, Item Name or Nomenclature. This column shall contain the official name (for example, pump, winch) or nomenclature (name and designation) of each component, unit, or accessory.
- c. Column 3, PIN number, RIC number, or unit number. This column shall contain the PIN, RIC, or unit number of each equipment unit or accessory.

- d. Column 4, Overall Dimensions. This column shall contain the crated (if available) and uncrated height, width, and depth in inches (or inches and centimeters) of each unit or accessory.
- e. Column 5, Weight and Volume. This column shall contain the crated (if available) and uncrated weight and volume in cubic feet of each unit and accessory.

3.3.2.1.1.7 Equipment and Publications Required but not Supplied.

A tabular listing of all test equipment and publications required but not supplied for the equipment or system shall be included. Unless otherwise specified, the latest edition of NAVSEA ST000-AG-IDX-010, or the web site <https://tmde.cdmd.navy.mil> shall be used as a guide for the selection and application of test equipment required for shipboard use. If a measurement requirement is established which cannot be satisfied by the subcategory SCAT codes listed in this guide, or alternate test procedures cannot be developed utilizing the listed SCAT codes, a request for assistance should be directed to:

Commander Naval Sea Systems Command Arlington, VA 22242-5160 ATTN: SEA 0415

The listing shall contain:

- a. Column 1, SCAT Code. When applicable, this column shall contain the four digit group of numbers, which is included in NAVSEA ST000-AG-IDX-010 or the web site <https://tmde.cdmd.navy.mil>, used to identify a measurement requirement.
- b. Column 2, Test Equipment Category. This column shall contain the item name of each item of equipment required.
- c. Column 3, Representative Test Equipment Model Number. This column shall contain the model number of the Standard or Substitute Standard General Purpose Electronic Test Equipment (GPETE), which can be used to satisfy the measurement parameters.
- d. Column 4, Equipment Test Parameters. This column shall specify the range of test parameters which must be satisfied by this test equipment item (it shall not define the range(s) of the test equipment model).
- e. Column 5, Application. This column shall indicate the intended use of the test equipment (for example, scheduled maintenance, troubleshooting, corrective maintenance, or installation).

3.3.2.1.1.8 Field Changes and Factory Changes.

Equipment changes (for example, field changes, factory changes, engineering changes or notices, modifications, and so forth) shall be identified and included in separate tables. A table of field and factory changes shall be contain the following:

- a. Column 1, Change Number. This column shall list the change number for each field and factory change considered and included in the preparation of the manual.
- b. Column 2, Nomenclature. This column shall list the equipment nomenclature and serial numbers of equipments affected by the change.
- c. Column 3, Description. This column shall contain a brief statement identifying the change and its purpose.

3.3.2.1.2 Operation.

Operating instructions shall include all the procedures necessary to enable operating personnel to efficiently and effectively use the equipment in accomplishing its designated task. These operating instructions shall be in sufficient detail to allow operators, having previous experience in the operation of similar or related equipment, to independently and safely operate the equipment without additional training or explanation.

3.3.2.1.2.1 Introduction.

The introduction shall describe each operator's relationship to the equipment and each other, and shall identify those units having controls and indicators which he is expected to use in the performance of his duties. The introduction shall be supported by illustrations which identify and locate all operator controls and indicators. The intended

function and application of the equipment shall be fully explained so that the operators will know exactly what he or they should expect to accomplish with the equipment.

3.3.2.1.2.2 Controls and Indicators.

A description of all operator controls, indicators, protective devices and jacks shall include the following:

- a. Names of panel designations as marked on the equipment.
- b. Positions and operating functions for each control, and the normal operating condition of each indicator in each of the operating functions in tabular format.
- c. The text shall be supported by detailed illustrations (see figure [1122](#)).
- d. When more than one operator is required to operate the equipment, his designated position and function, and the relationship to his controls and indicators shall be specified.

3.3.2.1.2.3 Operating Procedures.

Operating procedures shall include the following:

- a. Operator Turn-on. All steps necessary to bring the equipment from OFF through STANDBY condition to full operation.
- b. Modes of Operation. Procedures for each mode of operation, for example, manual, automatic, local, remote, and so forth. The use and relative advantage of each mode shall also be described.
- c. Operation under interfering conditions. Describe the equipment antijamming and interference reduction features, the advantages of each feature, and the operating procedures to be followed in all possible situations. Supporting illustrations (such as indicator displays, waveforms and so forth) shall be included which provide typical observations of jamming and interference for evaluation by the operator.
- d. Operator turn-off. This procedure shall include all steps necessary to bring the equipment from full operation through STANDBY to OFF condition.
- e. Battle-short or Emergency Operation. This procedure shall cover operating the equipment during emergency conditions (control failure, air failure, lube oil failure, loss of cooling water, and so forth). Emergency operator instructions shall be included. Provide a WARNING or CAUTION to return the equipment to proper operation when the emergency is over.
- f. Emergency turn-off. This procedure shall cover turning the equipment off during an emergency (fire, water, smoke, hazard to personnel, loss of coolant, normal power, and so forth).
- g. Electromagnetic Interference (EMI). This procedure shall include information pertaining to the recognition of EMI (such as sights, sounds, lack of response, or other irregularities) and operating procedures to cope with them during operations.

3.3.2.1.2.3.1 Method of Presentation.

Operating procedures shall be presented in tabular form and shall be in concise, simply-worded, step-by-step procedures shall be in accordance with this document and shall include the following:

- a. A short explanation of the operation to be performed.
- b. Initial safety requirements (actions, inspections, and references to emergency turn-off procedures).
- c. Connection of any accessory equipment not permanently connected.
- d. Instructions for obtaining or confirming the presence of all critical inputs such as power, coolant, air, signal, air conditioning, and so forth.
- e. Procedures for setting controls and making adjustments which must be accomplished by the operator prior to equipment turn-on.
- f. Procedures for determining operational readiness and the acceptable indications expected from built-in indicators such as meters, lamps, gauges cathode ray tubes, and recorder readouts.
- g. Milestones in the operational status of the equipment shall be

identified and included by brief statements such as "the generator is now in STANDBY."

- h. Visual or aural observations which occur as a result of an operator action, such as boom lowering, sweep rotation, blower motor running, and so forth.
- i. Procedures that can be hazardous to personnel or equipment shall be emphasized by DANGERS, WARNINGS or CAUTIONS, as applicable. "Notes" shall not be used in lieu of DANGERS, WARNINGS or CAUTIONS.
- j. Illustrative material supporting the procedures shall identify and locate all operating controls and indicating devices as well as normal in-use positions or indications.
- k. Operator's checks and adjustments in proper sequence.
- l. Operator's maintenance actions and schedules.

3.3.2.1.2.4 Operator's Maintenance Instructions and Schedules.

These instructions shall define maintenance tasks and schedules to be performed by the operator. The maintenance tasks shall be limited in scope such that they will not be in conflict with his operational commitment; will not be beyond his technical training; will not be dangerous; will not be the responsibility of the maintenance technician; and will not potentially comprise the operation of the equipment. Normally these tasks will be restricted to minor adjustments, cleaning, and fuse or lamp replacement.

3.3.2.1.2.4.1 Method of Presentation.

Maintenance procedures shall be in concise, simply-worded, step-by-step procedures and shall include the following:

- a. A short explanation of the task to be performed.
- b. Initial safety requirements (actions, inspections, and reference to emergency turn-off procedures).
- c. Separately identified and defined steps for each task and major subroutine.
- d. Where possible, a limit of 10 steps to each identified task or subtask.
- e. Procedure that can be hazardous to personnel or equipment shall be emphasized by DANGERS, WARNINGS and CAUTIONS, as applicable. "Notes" shall not be used in lieu of DANGERS, WARNINGS or CAUTIONS.
- f. Illustrative material supporting the procedures shall identify and locate all maintenance points with clear pictorials showing essential details.

3.3.2.1.3 Functional Description.

This topic shall include a detailed analysis of the principles of operations of the overall equipment and its functions. The development of the equipment function in every mode of operation shall be described. The structure and organization of this chapter shall parallel the organization of the topic, Troubleshooting. The text shall refer to and support the functional troubleshooting diagrams. The descriptions shall be presented in successive levels of increasing detail as follows:

- a. Overall Level (Level 1). The text shall support and refer to the overall functional block diagram (see paragraph [3.3.2.1.3.1](#)). All major functions (an essential functional operation which is fundamental to operation (as opposed to a circuit) of the equipment, such as transmit, receive, control, display, power distribution, cooling, and so forth, shall be described at this level.
- b. Major Function Level (Level 2). Describe the development of each major function at the level of detail shown on its related signal flow diagram, or logic diagram, The text shall support and refer directly to the diagrams.
- c. Circuit Level (Level 3). Describe alternating current (ac) and direct current (dc) power distribution in detail; support the descriptions by reference to the power distribution diagrams. Describe mechanical devices, cooling systems, and so forth; support the descriptions by reference to mechanical schematic, overall and functional block diagrams.

3.3.2.1.3.1 Overall Functional Block Diagram.

The overall functional block diagram shall show the major functions of the equipment correlated in a logical manner to show outputs, inputs, cooling, built-in-test-equipment, air pressurization, power distribution, and so forth. Hardware packaging shall be subordinated to the functional arrangement. The following shall apply:

- a. For multifunction equipments, whether single or multiunit, each major function shall be represented by a block and shall show the functional generation of outputs, cooling, air pressurization, power distribution, and so forth. All functions covered in the Troubleshooting topic shall be shown on this diagram.
- b. The blocks shall be connected by lines and arrowheads showing the direction of the flow.
- c. Each block shall be identified by the functional name only.
- d. Each equipment input and output shall be identified by title. Waveforms shall be included as applicable.
- e. Modes of operation shall be identified by title or symbols, as applicable.
- f. Ancillary equipment shall be shown by blocks when the ancillary equipment is associated with major functions. Ancillary blocks shall be identified by nomenclature and shall be identified as "(Ancillary)."

3.3.2.1.3.2 Simplified Electrical and Electronic Schematic Diagrams.

These diagrams shall show, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. These diagrams shall be arranged functionally to show the operation of the circuits in the same manner as illustrated in SE000-01-IMB-010.

3.3.2.1.3.2.1 Integrated Circuits and Micro-miniature Capsules.

Simplified schematics in accordance with SE000-01-IMB-010 or logic diagrams showing input and output connections, truth tables, and waveforms as applicable, supported by a brief description of overall functional operation, shall be included for circuits within different types of nonrepairable integrated circuits and micro-miniature capsules. Nonrepairable circuits are not required for functional understandings of theory of operation. Manufacturer's data sheet information may also be included if it contains the technical contents of this requirement and meets the format and legibility requirements of this document.

3.3.2.1.3.3 Simplified Piping Diagrams.

These diagrams (hydraulic, pneumatic, or fluid) shall show the interconnection of components by piping, tubing, or hose, and sequential flow in the system. Pumps, heat exchangers, valves, gages, and so forth, shall be clearly identified.

3.3.2.1.3.4 Mechanical Schematic Diagrams.

These diagrams shall show sufficient detail to explain the operational sequence and arrangements of a mechanical device including the electrical control circuits. Nomenclature, symbols, PIN, and necessary descriptive data shall be shown as required. Gears, shafts, clutches, levers, mechanically-driven switches, motors, synchros, and so forth, shall be shown in functional arrangement. Gear ratios or number of teeth and direction of rotations, and so forth, shall be given. Symbols used on these diagrams shall conform to any symbology requirements provided by the Government.

3.3.2.1.3.5 Digital Equipment.

The functional description of digital equipment shall be similar to that for conventional equipment. However, the functional and hardware makeup of digital equipment requires a variation in the method of presentation and descriptive requirements. Special considerations relative to the functional description of digital equipment are specified herein.

3.3.2.1.3.6 Method of Presentation.

An overall description of the functional relationship of the logic sections, units, and assemblies comprising the equipment shall be provided. The following shall be included:

- a. An introduction to and description of the signal characteristics:
 1. Signal levels or bi-stable states utilized by the equipment; i.e., true (1) and false (0), and their relative voltage levels.
 2. Interpretation of the word-code bit structure; i.e., address, instruction, or data bit codes.

3. Signals, identified by their operational accomplishment.
- b. Overall and functional block diagrams and descriptions.
- c. Logic principles shall be described beginning with an introduction to the basic digital logic symbology used in the manual. Each logic function shall be described and supported by Boolean equations, truth tables, simplified logic diagrams, and timing diagrams.
- d. Functional description of power distribution, power supplies, and regulators shall conform to [3.3.2.1.3](#).

3.3.2.1.4 Scheduled Maintenance.

It is intended that the engineering effort required to develop preventive maintenance data be expended only once and that the data, where applicable be used both in Scheduled Maintenance, Logistic Support Analysis (LSA) and/or maintenance requirements cards (MRC) where one or more of the latter three data items are required by the contract or SEATASK. When the approved LSA or MRC data is available, it shall be included in the manual in the identical technical content and, wherever practicable, in the identical format. When included in the manual, such LSA or MRC data shall be integrated with other technical data required by this document. The manual, as delivered, shall reflect the detailed maintenance requirements of the completed MRCs. This shall contain preventive maintenance procedures and performance test instructions to be accomplished on a scheduled or condition monitoring basis. When an MRC or a reference standards book is available or prepared under the same contract, this information may be duplicated in the technical manual without change in format.

3.3.2.1.4.1 Introduction.

The introduction shall be an explanation of the purpose, scope, and arrangement of the scheduled maintenance data. When a preventive maintenance procedure is critical to the operation of the equipment and the schedule for servicing is absolute (not just recommended), this information shall be conspicuously written as a caution. The following applicability statement shall be included:

"The scheduled maintenance instructions in this manual are intended to duplicate those furnished in the Planned Maintenance System (PMS). In case of conflicts, the PMS documentation takes precedence. Such conflicts should be reported immediately on the user comment sheet in accordance with the TMDER procedures for this manual."

3.3.2.1.4.2 Scheduled Maintenance Action Index.

This index shall include all scheduled procedures. The index shall be performance tests and preventive maintenance actions tabulated as follows:

- a. Column 1, Periodicity. This column shall contain an alphanumeric list of all maintenance actions contained in this division of the manual. The following periodicity symbols, as appropriate, shall be used in the order of increasing periodicity as listed below:

Interval	Symbols
Daily	D
Weekly	W
Monthly	M
Quarterly (3 months)	Q
Semiannually (6 months)	S
Annually	A
Overhaul cycle	C
As specified (explain circumstances)	R*

*An R periodicity will be preceded by a recommended calendar periodicity (for example, DR, WR, MR, and so forth).

- b. Column 2, Maintenance Action. This column shall list the maintenance action which corresponds to the periodicity number in column 1.
- c. Column 3, Reference. This column shall state the paragraph number that contains the procedure listed in column 2.

3.3.2.1.4.3 Preventive Maintenance Procedures.

These procedures shall include information required to examine, clean, and lubricate the equipment, and shall contain:

- a. Safety precautions.
- b. Tools, parts, materials, and test equipment required.
- c. Cleaning solvents. Solvents shall be identified by Government specification numbers and National stock numbers.
- d. Instructions for properly maintaining all safety devices and interlocks, with warnings and cautions.
- e. Instructions for lubrication at shipboard operating temperatures; also types and quantities of lubricants to be applied. Lubricants shall be identified by Government specification numbers and National Stock Numbers (NSN). Specific lubricants for arctic or tropic environments shall be included. When a proprietary lubricant is approved, a Government specification lubricant shall be listed as an emergency substitute.
- f. The minimum rating of the technician who can be expected to perform the task.
- g. Procedures of obtaining access to subassemblies of subcomponents.
- h. Instructions for in-place balancing and noise reduction.
- i. Inspection procedures for parts which deteriorate due to cycles of use, age, or climatic conditions.
- j. Illustrations to identify lubrication points and other pertinent data.
- k. Other information pertinent to these procedures.

3.3.2.1.4.4 Scheduled Performance Tests.

These tests shall contain step-by-step procedures necessary to verify that the equipment is operating within standards in all modes of operation and shall contain the following:

- a. Safety precautions.
- b. A list of tools and test equipment identified by type, manufacturer, and model number.
- c. The title of the test to be performed.
- d. The minimum technician rate required for performance of the test.
- e. Preliminary setup data required to perform the test.
- f. Detailed procedures for accomplishing the test. Procedures requiring lengthy and identical setup data may be presented in detail in one procedure and referenced in succeeding procedures.
- g. Values or conditions, with tolerances, indicative of normal operation.
- h. References to troubleshooting or corrective actions to be used if the test values are not within tolerances.
- i. Illustrations to support the test.

3.3.2.1.5 Troubleshooting.

Troubleshooting Procedures and data shall contain all information necessary for a technician to locate a malfunction in the equipment. Troubleshooting shall be presented based on locating potential faults in a unit, assembly, subassembly module, or piece part, depending on the maintenance concept (the planned concept by which the equipment, assemblies, units, components, modules, or piece parts are to be repaired or replaced by designated maintenance level activities (organizational, intermediate or depot), for the level of maintenance being performed. When the troubleshooting concept limits the location of a fault to a repairable item (such as the unit, assembly, subassembly, or module) for organizational level maintenance, troubleshooting procedures and data shall also be presented that will permit a repair of the item at the intermediate- or depot-level maintenance facility, except when this information is included in another technical manual and the procedures can be directly referenced. When more than one level of maintenance must be provided for, organizational- and intermediate-level troubleshooting

procedures shall be separated so that the organizational-level troubleshooting procedures are identified as "Organizational-Level Troubleshooting", and are presented first. Intermediate-level troubleshooting procedures shall follow organizational-level procedures and shall be identified "Intermediate-level Procedures." Immediately following this title the following statement shall be included: "These procedures are authorized for accomplishment by Depot-level activities only." When a separate depot-level manual is specified in this document, it shall include the information required by the Technical Repair Standards.

3.3.2.1.5.1 Troubleshooting Instructions.

This shall contain all instructions and information necessary to locate troubles and conduct tests on each component, assembly, or subassembly of the equipment as follows:

- a. Troubleshooting guides providing step-by-step procedures for logical isolation of faults. This information shall direct the technician to observe meters, fuses, circuit breakers, valves, and other available indicators which would indicate the presence of trouble.
- b. Complete instructions on signal tracing for electric circuits including the use of special test instruments and unusual servicing techniques.
- c. Where appropriate because of equipment complexity, troubleshooting diagrams including schematics giving details of mechanical and electrical assemblies and relationships as follows.
 - (1) Mechanical Schematic Diagrams
 - (2) Piping Diagrams
 - (3) Control Diagrams
 - (4) Power Distribution Diagrams

3.3.2.1.5.2 Troubleshooting Data.

This topic shall contain all the information required to enable the technician to locate malfunctions in the equipment.

3.3.2.1.5.2.1 Introduction.

The introduction shall explain the approach and logic of the troubleshooting principles presented in the manual. Describe the troubleshooting data and show how they relate to one another.

3.3.2.1.5.2.1.1 Troubleshooting Index.

The troubleshooting index shall be presented in tabular form. The index shall list all equipment, list all major and supporting functions (in alphabetical order), provide references to the technician (to the appropriate procedures), and list diagrams that are to be used to troubleshoot a specific function (see figure [156](#)).

3.3.2.1.5.2.1.2 Relay, Coil, Switch, and Lamp Indexes.

These indexes shall be prepared in tabular form for all relay coils, switches and indicator lamps. The first column of each index shall list each relay coil, switch, or lamp alphanumerically by reference designation. Subsequent columns of the relay index shall give the name of the functional bus and shall identify the coil supply voltage, including polarity and frequency, as appropriate. Subsequent columns in the lamp index shall identify the lamp name and the energizing bus voltage. Subsequent columns in the switch index shall identify the switch bus and the switched voltage. In all of the indexes, columnar references shall be made by figure number, sheet, and zone to a troubleshooting diagram where the item is active.

3.3.2.1.5.2.1.3 Protective Device Index.

The protective device index shall list all protective devices, such as fuses, circuit breakers, and so forth. This index shall be in tabular form and include the reference designation, front panel marking of the device, trip-out value of the circuit breaker, and rating of fuses, name of the circuit protected, and a reference to troubleshooting diagrams.

3.3.2.1.5.2.1.4 Maintenance Turn-on Procedure.

Include a maintenance turn-on procedure to energize the equipment from the fully de-energized condition to full operation (see figure [120](#)). This procedure shall enable the technician to determine which major function or supporting function is malfunctioning. Each step of the procedure shall include the action to be taken (STEP), the observation to be made (OBSERVE), and shall presume that normal conditions have been observed in previous steps. Reference shall be made to the procedure for troubleshooting or corrective action to be used (REFERENCE) if

the observation is out of tolerance. Built-in monitors, such as meters, dials, lamps, and so forth, shall be used when possible for making observations, as opposed to the use of external test equipment. The procedure is complete when the equipment is fully energized and all switches and controls are positioned for proper operation. The maintenance turn-on procedure may be presented in a troubleshooting dependency diagram (see [3.3.2.1.5.2.13](#)).

3.3.2.1.5.2.2 Troubleshooting Procedures.

Troubleshooting procedures shall be directly related to, and support the troubleshooting diagrams. Troubleshooting information shall be developed to guide a technician in the logical order of isolating a fault. This information shall direct the technician to observe meters, fuses, circuit breakers, valves, built-in test equipment, and other available indications showing the presence of trouble. The analysis of normal indications in relation to faulty indications shall be stressed. This information may be in tabular, illustrative, or narrative format, whichever lends to faster troubleshooting. Test programs shall be developed for digital devices when the method is the most practical method of troubleshooting logic.

3.3.2.1.5.2.3 Troubleshooting Diagrams.

Troubleshooting diagrams shall consist of signal flow diagrams, piping diagrams, control diagrams, power distribution diagrams, logic diagrams, maintenance schematic diagrams, and dependency diagrams.

3.3.2.1.5.2.3.1 Signal Flow Diagrams.

Signal flow diagrams shall consist of detailed block diagrams illustrating the functional development of each major function from its origin to its measurable output. The flow path shall begin with one or more initial inputs (or appropriate interface conditions) and proceed through each unit, assembly, and subassembly influencing the signal flow. Each hardware-level block shall reference a schematic diagram to isolate the faulty part. All items shown on the signal flow diagram shall be identified by their reference designations. The following shall apply:

- a. Titles of diagrams shall correspond to the signal flow described.
- b. Diagrams shall depict such signal flow as receive, transmit, RHI display, PPI display, bearing data, antenna rotation, elevation data, and so forth
- c. All test points necessary to isolate the trouble to the lowest level of hardware block (for example, subassembly). Include test parameters required to define satisfactory operation. Where signal flow diagrams depict signal flow in more than one mode of operation, that data shall be presented on the apron for all modes. Apron notes shall also include test data for test equipment setup. All inputs and outputs shall have signal description information.
- d. References shall be made to the functional description, troubleshooting procedures, corrective actions, and so forth, as appropriate, by paragraph number. Normally these references shall be included with the notes.
- e. The display of more than one function or mode of operation on one diagram shall be allowed only when clarity is not sacrificed and the functions are relatively simple.
- f. Screwdriver adjustments, dial adjustments, and adjustable controls shall be shown.
- g. The reference designations (for example, 1A1A2) shall be placed in each hardware block. Reference to the figure number of the schematic diagram shall be placed adjacent to the reference designation.
- h. All input and output signals and connectors and terminals in the signal path shall be shown. Identify the signal, and show all lead numbers, connector numbers, and terminal identifiers.
- i. All built-in controls and monitoring devices shall be shown. Do not show external test equipment, unless it is a permanent part of the equipment.
- j. Hull grounds, chassis grounds, signal grounds, and power grounds shall be shown.
- k. All leads of components such as motors, generators, synchros, and so forth, shall be identified.
- l. All relay coils that are energized by the signal shall be shown.
- m. All relay contacts and relay terminals in the flow path shall be shown and identified. All relay contacts shall be depicted in operational mode. References to control diagrams on which the relay coils appear shall be shown adjacent to the relay contacts.
- n. All switches which affect signal flow shall be shown and identified. Switch terminals and panel markings corresponding to the switch

- positions shall also be shown.
- o. Mechanical couplings of all controls, switches, potentiometers, synchros, and so forth, shall be shown.
 - p. Signal paths shall be identified by weighted lines and arrowheads.
 - q. Test instruction procedures and test data shall be shown.

3.3.2.1.5.2.3.2 Piping Diagrams.

Piping diagrams shall be developed for fluid cooling, air, gas, steam, oil and hydraulic systems. Fluid symbols shall be in accordance with ASME Y32.10, with hydraulic systems supplemented by SAE AS 1290. These diagrams shall show, when significant, flow rate, temperature, pressure, and all devices which measure, control, or modify the flow. Also, a test data table shall be included on the piping diagram and reference shall be made to appropriate corrective actions and functional descriptions.

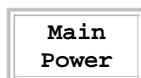
3.3.2.1.5.2.3.3 Control Diagrams.

Control diagrams shall be included for all control circuits. Control circuits shall be grouped according to energizing voltage, control function, mode of operation, or physical limits of cabinet or assembly, as applicable. Supporting information required to clarify the use of the diagram shall be provided in the general notes. The functional name and reference designation for each relay, switch, lamp, and so forth, shown shall be included. All relay energizing circuits shall be shown with all tie points and terminals and with switches and relay contacts in their operating positions. All terminal connections, switches, interlocks, contacts, or other relays in series with the energizing path, plus lamps or indicators (electrically connected in the energizing or indicating status of contact closures), shall be shown. The following note shall appear on all control diagrams: "All switches and relay circuits are shown in operating positions." In cases of multiple operating positions, switch and relay positions shall be explained by a specific note on the diagram apron.

3.3.2.1.5.2.3.4 Power Distribution Diagrams.

Power distribution diagrams shall depict the distribution of primary ac power, secondary ac power, and dc power from the terminal board, breaker, or fuse box to the various assemblies, subassemblies, or modules of the equipment. Normally, a separate diagram shall be developed for each voltage level used within the equipment. The following rules apply in the preparation of power distribution diagrams:

- a. Show and identify motors, transformers, regulators, power supplies, assemblies, subassemblies, and modules.
- b. Show and identify all power-line devices such as fuses, circuit breakers, switches, and relay contacts.
- c. Show and identify all connections including plugs, jacks, and terminal boards in the distribution path.
- d. Use dot-and-dash lines to set off hardware boundaries such as units, assemblies, and subassemblies. Identify each unit, assembly, and subassembly by reference designation. Include a figure reference to the schematic diagram covering the unit, assembly, and subassembly.
- e. Reference all relay contacts to the appropriate control diagrams. All relay contacts shall be shown in the operating condition.
- f. Include voltages and tolerances, as required.
- g. Show and identify all metering circuits and indicators.
- h. Show all grounds, commons, neutrals, and return lines.
- i. Display the power path from left to right and from top to bottom whenever practicable.
- j. Conspicuously mark on the diagram the functional names of all "main line" switches and circuit breakers. In addition, set off any power control markings engraved or stenciled on the equipment in a rectangular box, for example:



- k. Show all relay coils in series with the main power distribution path. Relay control circuits shown on control diagrams need not be repeated on distribution diagrams.
- l. Add the following note on all control diagrams: "All switches and relay circuits are shown in operating positions."

3.3.2.1.5.2.4 Maintenance Schematic Diagrams.

Maintenance schematic diagrams shall include unit-to-unit interconnection diagrams, intra-unit interconnection diagrams, and unit, assembly, and subassembly schematic diagrams. Complete coverage of the equipment shall be provided by these diagrams. Maintenance schematic diagrams shall be prepared in accordance with the following:

- a. The schematic diagram for each unit shall be drawn so that, together with the interconnecting diagrams, all circuit elements are included and all circuits can be traced from unit to unit.
- b. Schematic diagrams shall be zoned by alphanumeric coordinates. The location of all circuit elements by zones shall be included in a table located on the apron of diagrams containing more than 100 parts. When a part such as a relay or a twin tube is drawn in sections at different locations, list as many coordinates as necessary to locate all sections.
- c. Major and minor signal paths shall be represented by different line weights. The heavier line weight shall show the major signal path. Whenever possible, signal flow shall be from left to right and from top to bottom. Arrowheads denoting the direction of signal flow shall be placed on the signal flow lines.
- d. The use of ground and voltage buses is discouraged except in the power supply. However, voltage bus connections can be shown by broken lines directly beneath the connection. As a substitute for ground buses, individual grounds should be used and appropriate notes shall be included to indicate sources. If separate ac, dc, and signal grounds are actually used in the equipment, they shall be shown by keyed symbols.
- e. All significant voltages at buses, tube pins, transistor elements, and so forth, shall be shown except when this data can be presented best in a voltage chart (see j). Indicate whether the voltage is ac or dc; dc voltages shall be shown by polarity. Where critical voltages occur within the equipment, tolerances for those voltages shall be shown in the illustrations.
- f. The functional names of all operating controls and adjustments shall be conspicuously marked on the schematic. In addition any operating front panel markings on the equipment shall be set off in a rectangular box. The functional name of all stages (tubes, transistors, and so forth) also shall be included.
- g. The function, source, and destination of all input and output circuits shall be identified and indicated by figure number.
- h. Power and signal frequencies shall be designated in hertz (Hz). Resistance values, if more than 1 ohm, shall be noted for all wire-wound devices such as motors, relay coils, and transformers.
- i. Rated current and voltage values of primary and secondary windings of power transformers shall be indicated.
- j. A resistance and voltage chart for a schematic diagram shall be provided on the apron or on preceding page size pages. This chart shall give the normal resistance and voltage to ground (or other points of significance) for each tube socket pin. In addition, list all conditions which effect the resistance or voltage values given, such as control settings, equipment connections, tubes removed from sockets, and so forth. If semiconductors (transistors, diodes, and so forth) are employed in circuits, adequate caution notices must be included to prevent damage to these devices when making resistance measurements in the circuit. No intra-element resistance measurements (that is, between emitter, base, and collector) are required to be made on transistors. Also, resistance of power supply buses and other points of significance shall be indicated.
- k. Each schematic diagram shall be identified by the reference designation number, located in the lower right-hand corner of the image area.
- l. Schematic diagrams shall be presented in alphanumeric order corresponding to the referenced designation of units, assemblies, subassemblies, and so forth. When two or more identical assemblies, or modules are used, redundant schematic diagrams need not be repeated. However, a table which cross references the reference designation to the figure number of the common schematic diagram shall be provided immediately preceding the schematic diagram. Schematic diagrams covering more than one unit, assembly, or module shall include on the apron or convenient location of the illustration for identification purposes, all the reference designations of the unit, assemblies, and modules to which they refer.
- m. Circuit elements shall be grouped functionally and arranged to make signal flow obvious from left to right and top to bottom. Circuit elements shall not be arranged to fill up white space or to maintain

tube or transistor alignment. Circuit elements shall be arranged in textbook form for the convenience of the user. Layout shall not be distorted to achieve fit.

- n. Breaks in lines shall be used as frequently as possible to avoid cluttered diagrams. Add necessary notes or text to explain how to use break symbols, where to find mating ends of broken lines on drawing, and so forth.

3.3.2.1.5.2.5 Logic Diagrams.

Logic diagrams shall be provided for digital devices and digital circuitry of conventional analog equipment in accordance with IEEE 991. Distinctive shapes shall be utilized. Internal and external data shall be included. Logic diagrams shall cover digital functions, such as, Input-Output Control, Memory Control, Data Transfer, Clock-pulse generation and distribution, and so forth. Emphasis shall be placed on functional development and presentation rather than on hardware groupings.

3.3.2.1.5.2.6 Integrated Circuitry Packages and Nonrepairable Assemblies.

When integrated circuit packaging techniques, such as Dual In-Line packages, are utilized, the level of detail on the logic diagrams may be restricted to that necessary to isolate problems to either a specific integrated circuit package or if the maintenance concept so dictates, to a specific nonrepairable assembly, providing there is sufficient detail to understand the process of troubleshooting.

3.3.2.1.5.2.7 Timing Circuit Diagrams.

Timing circuit diagrams shall be provided for all significant timing relationships. These diagrams shall show the exact timing relationships and the origins of all timing signals (conventional and digital).

3.3.2.1.5.2.8 Single-Function Diagrams.

Single-function diagrams for nonprogrammable devices which result in a unique output function may be prepared to the requirements of signal flow diagrams.

3.3.2.1.5.2.9 System Control Function Diagrams.

System control function diagrams shall be provided for all system control circuits. The control function diagrams shall be at the system level but shall be constructed in accordance with [3.3.2.1.5.2.3.3](#). The diagrams shall show essential fault isolation test points or comparable indicators, and shall include appropriate references to equipment manuals.

3.3.2.1.5.2.10 Assemblies and Subassemblies, Modules, Standard Electronic Modules, Designated Nonrepairable.

Logic diagrams, functional information, hardware and test data shall be supplied to the extent that it is required to understand the operation of the equipment, concept of troubleshooting, and to serve as the basis for affecting a critical repair.

3.3.2.1.5.2.11 Flow Charts.

Flow charts for digital devices shall be provided to support the explanation of machine instructions and test programs, and shall be in accordance with ISO 6829.

3.3.2.1.5.2.12 Coding Instruction Sheets.

Coding instruction sheets shall be provided for all programs. The listing shall contain all coding and address data as well as an adequate notes section to ensure understanding (see figure [128](#)).

3.3.2.1.5.2.12.1 Test Programs.

Test programs with coding instruction sheets shall be developed and included to support troubleshooting procedures.

3.3.2.1.5.2.13 Troubleshooting Dependency Diagrams.

One of the following types of troubleshooting diagrams shall be provided to augment the troubleshooting procedures. Supporting information required to explain the use of the diagrams shall be provided in the text or

general notes.

3.3.2.1.5.2.13.1 Fault Logic Diagrams.

Fault logic diagrams shall be based on a fault indication observed during troubleshooting. The diagrams shall comprise a branching series of questions pertaining to fault isolation. Each question shall pertain to a further observation or measurement, and shall result in a "yes" or "no" answer, thereby progressively narrowing the possible functional area of the fault. Tolerance values shall be presented in those instances where a definitive "yes" or "no" is not obtained. This progression and elimination shall isolate the functional area of the equipment containing the fault and then refer the user to the portion of the manual containing that information needed to complete the fault isolation and repair. Each diagram shall include or make reference to information necessary to establish the test or operating conditions required for starting the fault isolation procedure. Only three types of blocks shall be used. Shaded blocks (right and bottom border lines weighted) shall contain questions which may be answered from observation, without changing test setup and without special equipment. Single-line blocks shall contain questions requiring measurement by special setup of external test equipment. Double-line boxes (conclusion boxes) shall list the functional area within an equipment that is the probable source of malfunction and shall reference a procedure or another diagram for further isolation or correction of a fault.

3.3.2.1.6 Corrective Maintenance.

This chapter shall contain instructions required to adjust and align the equipment, remove, clean, inspect, repair, reinstall, and align all repairable parts, modules, subassemblies, and assemblies. The instructions shall identify the action to be accomplished; safety precautions to be observed; tools, parts, materials, and test equipment required; preliminary control settings; test equipment setup instructions; and step-by-step instructions, with supporting illustrations, to accomplish the maintenance task. Corrective maintenance instructions shall be provided for all items designated repairable irrespective of the maintenance concept unless this information is included in another technical manual and can be referenced.

3.3.2.1.6.1 Introduction.

The introduction shall contain an explanation of the purpose, scope, and arrangement of the corrective maintenance data.

3.3.2.1.6.2 Adjustments and Alignment.

This shall contain all information and procedures required to perform all necessary adjustments and alignments as follows:

- a. Nonoperator type adjustments.
- b. Alignments requiring external jigs, test equipment, or bench setups.
- c. Alignments that are accomplished after a repair or replacement of a part or module.
- d. Test equipment setup and other illustrations necessary to support the procedures.

3.3.2.1.6.3 Repair.

This shall contain all procedures required in the repair of assemblies and repairable parts. Repair procedures shall include but not be limited to the following:

- a. Removal, disassembly, and inspection.
- b. Repair or replacement of piece parts.
- c. Cleaning and inspection.
- d. Reassembly, adjustment, installation, calibration, and checkout.
- e. Exploded views, sectional views, and wiring diagrams necessary to support the procedures.
- f. Obvious repair actions such as soldering, use of multimeters, hand tools, and so forth, shall not be included except where these actions involve hazards to personnel or equipment.
- g. Repair procedures shall be arranged in numeric-alpha unit designation order of the equipment.

3.3.2.1.6.4 Supporting Illustrations and Data.

The use of clear, sharp illustrations to supplement description and maintenance coverage is required. Exploded views are required for parts location illustration. As a minimum, illustrations or sketches of the following shall, when applicable, be included:

- a. Typical bearings for rotating or moving equipment.
- b. Method of taking clearance measurements where required.
- c. Typical mechanism for absorbing thrust where applicable.
- d. Locking devices when applicable.
- e. Typical seal assembly (pressure or vacuum seals or controlled leakage between rotor and casing).
- f. Typical assembly of blading to rotor, with lock devices, where applicable.
- g. Typical assembly of field poles, laminated core iron, electrical windings, commutator, slip rings, and brush rigging where applicable.
- h. Equipment assembly with upper casing partially removed.
- i. Series of illustrations showing installation of supervisory instruments (such as resistance temperature detectors in bearings).

3.3.2.1.7 Parts List.

The parts list shall list and identify and shall reference or include an illustration that will show the location of all repair parts, (see [3.3.2.1.7.7](#)). All mechanical parts subject to replacement, although not provisioned as a spare part, such as handles, slides, plates, covers, and so forth included in the provisioning documentation shall be included in the parts list and identified in the respective parts-location diagram. This topic shall include the following:

- a. Introduction.
- b. List of major components or list of major units.
- c. Parts list for Electronic Equipment.
- d. List of common item descriptions.
- e. List of attaching hardware.
- f. List of manufacturers.
- g. Parts location illustrations.

3.3.2.1.7.1 Introduction.

The introduction shall contain an explanation of the scope and arrangement of the parts list. The following type of information shall be included:

- a. Models of equipments and, where all equipment of a specific model do not have interchangeable parts, serial numbers of equipments covered.
- b. Explanation of any special notes.
- c. Explanation and instructions for using the list of common item descriptions.
- d. Explanation and instructions for using the list of attaching hardware.
- e. Explanation and instructions for using the parts list.
- f. Explanation and use of the list of manufacturers.

3.3.2.1.7.2 List of Major Components or Major Units.

A list of major components or a list of major units in tabular form shall be included as follows:

- a. Column 1, PIN, RIC, or unit number. This column shall list the PIN (an alphanumeric designator which identifies parts, items, or bulk materials, that are covered by a specification or standard, the number derived from a military specification such as type RWR74549R9FM; or a military standard such as MS 18272) or unit number and APL for each major component, if available.
- b. Column 2, Quantity. This column shall list the quantity of components.
- c. Column 3, Name or Nomenclature. This column shall contain the approved nomenclature of the major components and shall be subdivided as follows:
 1. Name of unit. This column shall list the approved name of the unit.
 2. Designation. This column shall list the type designation of the unit.
- d. Column 4, Page number. This column shall list the number of first page of the parts listing for major unit.

3.3.2.1.7.2.1 Parts List.

The parts list shall be in tabular form in accordance with this document. The parts list shall be divided and arranged by major units in numerical sequence (for example, unit 1 with its parts, and so forth, will precede unit 2 with its parts). All parts attached to the unit shall be listed first in alphanumerical order, followed by unit assemblies with parts and subassemblies with parts, also listed in alphanumerical order. The shall be arranged as follows:

Unit	1
(Cabinet parts)	1A1T1 1B1 1C1 1CR1 1R1 and so forth
Assembly	1A1
(Assembly parts)	1A1A1T1 1A1A1B1 1A1A1C1 1A1A1CR1 1A1A1R1 and so forth
Subassembly	1A1A1
(Subassembly parts)	1A1A1A1T1 1A1A1A1B1 1A1A1A1C1 1A1A1A1CR1 1A1A1A1R1 and so forth
Unit	2
	and so forth

3.3.2.1.7.3 Parts List for Electronic Equipment.

Parts lists for electronic equipment shall be in tabular form and include the following (see figure [131](#)).

- a. Column 1, Reference designation. This column shall contain the reference designations of all parts listed in sequential order. The unit numbering method of assigning reference designations, as specified in IEEE 200, shall be used to identify units, assemblies, subassemblies and parts. Mechanical part (MP) numbers shall be assigned to mechanical parts subject to replacement, such as handles, slides, and so forth, that are included in the APL but not assigned MP numbers in the engineering drawings. With the exceptions of screws, nuts, bolts, and other attaching hardware, every functioning part in the equipment shall have a reference designator. The parts list shall be divided and arranged by major units in numerical sequence (for example, unit 1 with its parts will precede unit 2 with its reference designations parts, and so forth). When reference designations have been cancelled for more than two consecutive items, only the first and last of the designations are to be listed, separated by the word "through". For example: 3A1R69 through 3A1R100 not used.
- b. Column 2, Notes. This column shall contain equipment reference information such as serial number, model number, configuration data, and so forth.
- c. Column 3, Name and description. This column shall include descriptive data to identify the parts of the equipment and aid in determining substitutes. Such information shall consist of the name, electrical or mechanical characteristics, and PIN of the item, and when applicable, attaching hardware. Common parts (for example, washers, springs, nuts, bolts, and so forth) shall be identified only by the PINs. Those parts not having a PIN shall also include physical characteristics (material and sufficient dimensions) to identify the parts within the set the manufacturer's part number and CAGE or the equipment contractor's part number and CAGE, federal supply code (FSC) number. FSC code 31349 shall be used for military parts and code 80058 for JETDS items, and drawing

number. Replaceable mechanical parts that are assigned as "MP" numbers in accordance with (a) preceding, shall include the manufacturer's part number or engineering drawing number along with the name and description of the item. The statement "Same as . . .," or equivalent, shall not be used for describing identical parts. For identical parts that are used more than five times in the equipment, key number the complete list of common item descriptions and reference made there to by the item number. Attaching hardware, with quantity required, shall be identified by the assigned letter code. For example, C(4) would be the third listed piece of attaching hardware in which four pieces are used. When nonstandard parts have been approved and there are multiple sources, each source shall be cited in the description. If selected values for critical parts are required, sufficient information, such as criteria for selection and range of values, shall be provided to permit the repair activity to make selection. For each part, the part number of the actual item manufacturer shall be used, unless the part is physically modified by the equipment contractor.

- d. Column 4, Figure and item number. This column shall reference the parts location illustration by figure number and item number enclosed in parenthesis [for example, 6-119(17)].

3.3.2.1.7.4 List of Common Item Descriptions.

This list shall include the description of all identical parts that are used more than five times in the equipment. The description of each common item shall totally identify the item including manufacturing CAGE code and part number or military standard number. Like parts should be grouped and arranged in alphanumerical order. Item numbers shall be assigned consecutively, for example:

Item Number	Description
1	CAPACITOR, FIXED, CERAMIC, DIELECTRIC 3PF, 500 VDCW; MIL type CCZ1UJO30C.
2	CAPACITOR, FIXED, GLASS, DIELECTRIC 5100 PF, + 1% 300 VDCW, mfr 86969, dwg 231B743H15
3	RESISTOR, FIXED, COMPOSITION, 3000 ohms + 5% 1/2w; mfr 42384 dwg 4469D69
4	RESISTOR, FIXED, COMPOSITION, 4000 ohms + 5% 1/2w; MIL type RC20GF402J

3.3.2.1.7.5 List of Attaching Hardware.

A list shall be included that shows items of attaching hardware. Attaching hardware shall be listed alphabetically and identified by an assigned letter. For example:

Letter code	Name and Description
A	CAPSCREW, 1/4-28, UNF-2A, 1 in. lg, HEX HEAD, DRILLED HEAD, CRES MS51100-8.
B	WASHER, FLAT, 0.750 in. ID, 0.312 in. OD, 0.066 in. thickness, ROUND STEEL.

Items used fewer than five times need not be included in the List of Attaching Hardware providing the item is completely identified in the parts list, following the part identification that is being attached.

3.3.2.1.7.6 List of Manufacturers.

The list of manufacturers shall contain the names, addresses, and CAGE number of all manufacturers supplying items for the equipment as referenced in the parts list. The list shall be presented in numerical sequence by CAGE number. CAGE numbers shall be in accordance with Cataloging Handbook H4/H8.

3.3.2.1.7.7 Parts Location Illustrations.

Illustrations shall be included to provide positive and rapid location of parts. Types of parts location illustrations include exploded views, when approved by the Government, engineering drawings and sectional views, printed-circuit boards, as applicable. Suitable parts location illustrations located elsewhere in the manual may be referenced.

3.3.2.1.7.7.1 Printed-Circuit Board.

Printed-circuit boards shall be illustrated foil side up. When printed wirings appears on both sides of the board, both sides shall be illustrated. All parts mounted on the board shall be outlined in black solid (front) or dashed lines (rear) (even though mounted on the reverse side of the board) and their connections to the printed wiring clearly illustrated. If insufficient room exists, separate illustrations, top and bottom views, shall be provided. Each part shall be labeled with the applicable reference designation. To facilitate parts location, a locating grid and corresponding guide chart shall be provided when more than 30 items are mounted on a board.

3.3.2.1.7.7.2 Criteria for Illustrations.

Items shall be called out on illustrations by call-out leader, index number, or grid coordinates. Standard attaching hardware items (such as nuts, bolts, washers, screws) need not be called out or illustrated, except when they are on exploded views or are referenced in a procedure. Multiple items of attaching hardware connecting parts together need not show every item; for example, if four screws and washers attach one part to another, only one screw and washer need be shown, but all four screw holes on the part must be shown. Exploded views shall be supplied for units, subassemblies, and components designated Navy repairable but may be included in the Corrective Maintenance Topic, "Repair", for parts-location purposes.

4.0 QUALITY ASSURANCE PROVISIONS.

4.1 Responsibility For Inspection.

The contractor is responsible for the performance of all inspection requirements (examinations a

4.1.1 Responsibility For Compliance.

All items shall meet all requirements of this document. The inspections set forth in this docun

4.1.2 Government Inspection.

Material furnished in accordance with this document shall be subject to inspection, verificatio

4.1.2.1 Government Inspection At Subcontractor Facilities.

Government inspection, verification and acceptance of a preliminary material at a subcontractor

"Government inspection and verification is required prior to shipment from your plant. Upon receipt of this order, promptly notify and provide a copy of this order to the Government representative servicing your plant so that Government inspection and verification may be planned. If the Government representative cannot be identified, the prime contractor shall be notified immediately."

The prime contractor shall report to his Government representative any nonconformance of subcontractor's manuals

and shall require the subcontractor to coordinate corrective action with the appropriate Government representative.

4.2 TMQA Program And Responsibilities.

The contractor shall establish a TMQA program to ensure the development of technically accurate required for the management of the following IETM program elements:

- a. Source data collection.
- b. Intermediate product.
- c. Participation in quality reviews and IPRs.
- d. Graphics and illustrations.
- e. Authoring system software documentation and control.
- f. Authoring system capability.
- g. Validation.
- h. Internal coordination (documentation of contractor operating procedures).
- i. Record keeping.
- j. Verification support.
- k. Final product.

4.2.1 Written Operating Procedures.

Contractor personnel, subcontractors, and vendors involved in IETM generation shall operate in accordance with written operating procedures. Portions of these procedures that relate directly to product quality shall be identified by name, number, and date. Such procedures shall be originated, revised, and controlled within the framework of the overall TMQA program, and shall periodically be reviewed, evaluated, and updated as required. Current operating procedures shall be made available for Government inspection (see [4.2.3.2](#)).

4.2.2 TMQA Program Organization.

The contractor's TMQA program organization shall have well defined responsibility, authority, ar

4.2.3 TMQA Program Functions.

All IETM program elements and processes shall be evaluated by contractor and Government quality

- a. Guidance and quality planning conferences.
- b. Quality program reviews.
- c. Quality reviews.
- d. IPRs.
- e. Validation.
- f. Verification.

4.2.3.1 Guidance And Quality Planning Conference.

The guidance and quality planning conference (also referred to as the TMQA guidance conference c

4.2.3.2 Quality Program Reviews.

The contractor shall support quality program reviews as requested by the Government and provide

4.2.3.3 Quality Reviews.

The contractor's QA organization shall conduct quality reviews to ascertain compliance with the

4.2.3.3.1 Corrective Action.

The contractor shall initiate a process of corrective action for all recorded and detected deficiencies.

4.2.3.3.2 Source Data Control.

The contractor shall ensure that the most current source data is available and utilized for IETM development.

4.2.3.3.2.1 Task Identification Matrix Or Equivalent.

The contractor shall ensure the IETM content and organization is consistent with a task identification matrix.

4.2.3.3.2.2 Control of Subcontractors And Vendors.

The contractor shall ensure the quality of IETMs developed by subcontractors and suppliers. The contractor shall ensure that all subcontractors and suppliers are qualified.

4.2.3.3.2.3 Sampling.

All IETM products, regardless of percentage of completion, shall be sampled and evaluated as a minimum.

4.2.3.3.2.4 Classification Of Defects (CD).

The CD table associated with the contractor's sampling procedures shall be made available during development.

- a. Major defects (incorrect, incomplete, missing):
 1. Maintenance procedures.
 2. Hotspots and links.
 3. Values and tolerances.
 4. Illustrations, schematics, wiring diagrams.
 5. Part numbers.
 6. References and indices.
 7. Safety - notes, cautions, warnings, dangers.
 8. Alert acknowledgement.
 9. Technical content (source data and hardware comparison).
 10. Classified matter (incorrect identification and handling).
 11. Charts and tables.
- b. An excess of any one or combination of the following:
 1. Unfamiliar words, inconsistent vocabulary, long sentences, long paragraphs, non-informative headings, organization not based on immediate needs of the user, and complex or unclear illustrations.
- c. Minor defects (incorrect, incomplete, missing):
 1. Typographical errors.
 2. Collated pages.
 3. SM&R codes.
 4. Style and format.

4.2.3.4 In-Process Reviews (IPRs).

IPRs will be authorized and convened by the Government to ensure that IETMs are adequate, accurate, and complete.

artwork, and technical content). As applicable, IPRs are convened to monitor the preparation of IPBs to ensure coverage is in accordance with the approved SM&R codes. IPRs will also be conducted during the preliminary development stages of the IETM to ensure adequacy and accuracy of IETM functionality, usability, and presentation (see [4.2.3.4.3](#) through [4.2.3.4.7](#)). Safety and nuclear weapon procedures identified by the Government shall require a 100% IPR. The Government and the contractor will jointly establish the frequency and timing of IPRs, and the Government shall have final approval authority for the schedule. Additional IPRs may be required based on the contractor's or Government's evaluation of the IETM development process or criticality/complexity of the material covered. The IPR schedule will be agreed upon at the guidance and quality planning conference, and the Government approved IPR schedule shall be contained in the guidance and quality planning conference minutes.

4.2.3.4.1 IPR Review Location.

IPRs intended for locations other than the contractor's facility will be approved by the Governm

4.2.3.4.2 Evaluation Of The IETM Authoring System.

The use of the authoring system to be employed in generating the IETM, including a demonstrator

4.2.3.4.3 Evaluation Of The IETM And The Display Device.

An IPR will be authorized to monitor the compatibility of the IETM with the operating and preser

4.2.3.4.4 Evaluation Of IETM Navigation Functions.

An IPR will be authorized to determine if a comprehensive set of commands to navigate and sequer

4.2.3.4.5 Evaluation Of IETM Functionality.

An IPR will be authorized to evaluate IETM functionality as specified by the Government.

4.2.3.4.6 Evaluation Of IETM Presentation Techniques.

An IPR will be authorized to monitor the placement of the IETM technical information within the

- a. Location and use of standard navigation buttons.
- b. Placement and use of the table of contents.
- c. Placement of the technical content such as narrative text, procedural data, and parts information.
- d. Display and placement of graphics and tables.
- e. Hotspot and linking capability.

4.2.3.4.7 Evaluation Of World Wide Web Applicability.

When specified by the Government, the contractor shall demonstrate that the IETM can be accessed and displayed over the World Wide Web.

4.2.3.4.8 Evaluation Of Source Files.

When IETM source files are to be delivered to the Government, the contractor shall validate that the source files have been tagged to the level and depth required by the applicable DTD and the content requirements contained in this document.

4.2.3.4.9 IPR Records.

The Government will act as recorder and record decisions, results, and findings during the IPR. The Government will provide a copy of all recorded IPRs to the contractor.

4.2.3.4.9.1 Disposition Of IPR Findings.

The Government and the contractor shall resolve IPR findings that involve problem areas or findings that require further evaluation before final disposition. Any discrepancy or deficiency found as the result of the IPR shall be corrected prior to certification and acceptance of the IETM.

4.2.3.5 Validation.

Validation is a contractor's quality assurance responsibility that shall be accomplished for all IETMs, changes, and revisions thereto. Validation shall provide a measure of the overall quality of the IETM. The validation shall be performed by individuals who are of approximately the same education, experience, and skill level as the actual target audience for the IETM. Where it is not possible to obtain such personnel for validation, validation personnel shall at least exclude those who cannot be expected to provide a realistic test of the validity of the IETM (e.g., graduate engineers or those involved in authoring the IETM). The Government reserves the right to witness validation. The contractor shall notify the Government of the validation schedule prior to commencement. An IETM shall not be considered validated until the following conditions have been fulfilled:

- a. Contractor's engineering technical review has been completed (see [4.2.3.5.1](#)).
- b. Information reflects configuration of the systems and equipment.
- c. Procedural instructions are readily understandable by the intended user and adequate to perform all intended functions.
- d. Adequacy of data is checked to ensure that it supports the approved maintenance and support plan.
- e. Hardware of the proper configuration is available for the validation effort. An operational environment shall be used, if possible, or simulated, if practicable.
- f. Functionality is in accordance with the specified requirements.
- g. Required information can be easily accessed from the List of Contents and that the navigation and logical sequencing through the information is manageable and user friendly.
- h. All technical information, including text, tables, graphics appear in the appropriate data panes.
- i. Source files are tagged to the level and depth required by the applicable DTD and the technical content requirements contained in this document.

4.2.3.5.1 Engineering Reviews.

The contractor shall conduct appropriate engineering reviews of the technical information to ensure that it is safe, complete, logical, technically accurate, and comprehensible. Based on this review, the contractor shall certify prior to validation that the technical information permits efficient performance of the intended equipment-support functions and that the technical information is ready for validation. All errors noted during this engineering review shall be corrected prior to validation. The contractor shall maintain engineering review records.

4.2.3.5.1.1 Validation Performance.

Theory and principles of operation, system and component description, SM&R codes (when applicable), schematic, and wiring data shall be validated against engineering source data in accordance with the validation plan. Operating and maintenance procedures including checkout, alignment, scheduled removal and replacement instructions, and associated checklists shall be validated against the system and equipment by actual demonstration. Malfunctions shall not be introduced into the system or equipment for the purpose of validation unless specifically required for certification of procedural tasks or system tests. Destructive malfunctions shall not be introduced into the system or equipment for any purpose.

4.2.3.5.1.2 Support Equipment.

Government approved support equipment shall be utilized in the performance of validation. Simulation or substitution of support equipment shall be approved by the Government. It is the responsibility of the contractor to request Government furnished equipment in order to support the validation effort. The contractor shall provide all

consumable and expendable items required to support validation.

4.2.3.5.1.3 Validation Of Readability.

Narrative text shall be validated for conformance to readability standards specified in [3.3.1.2.4.3](#). If the overall grade level (OGL) (including tolerance) is exceeded, the IETM shall be rewritten as required to meet the specified reading grade level (RGL). If a sample grade level (GL) is exceeded, the entire text surrounding each sample shall be rewritten as required.

4.2.3.5.1.4 IETM System Validation.

An IETM system consists of the EDS hardware, the IETM, and the EDS presentation software interoperability. Unless otherwise specified, validation of the IETM system shall be performed by demonstration. The extent of the demonstration shall be in accordance with the contractor's validation plan. Unless otherwise specified by the Government, the field version of the IETM system hardware and software shall be demonstrated to the extent required to establish its accuracy, capabilities, and compatibility with Government systems and contractual requirements. The IETM system validation shall:

- a. Demonstrate the general visibility and readability of the IETM as displayed on the EDS.
- b. Check that all data access links and branches are valid and operable.
- c. As applicable, ensure that there are no "open loops" in the fault isolation tasks (i.e., that each task ends in a single resolution, and each retrieval string ends in successful isolation and repair of a discrete fault).
- d. Ensure that there are no un-referenced or inaccessible data in the system.
- e. Demonstrate all required functionalities are fully operable.

4.2.3.5.1.5 Disposition Of Validated Data.

Corrections and significant comments resulting from validation shall be incorporated prior to issue of the validation certification.

4.2.3.5.2 Verification.

Verification shall be accomplished under the jurisdiction of the Government and may include contractor support. Verification is a responsibility of the approval authority or authorized representative. The purpose of verification shall be to ensure that the contractor's products and services are in conformity with the requirements of this document.

4.2.3.5.2.1 Verification Support Requirements.

Contractor support of verification shall consist of the following:

- a. Serve as verification recorder, if required. Record and maintain records of changes associated with performance of verification.
- b. Provide assistance in performing verification tasks, if required.
- c. Certification that all discrepancies and defects noted during verification have been corrected or resolved.

4.2.3.5.3 Combined Validation And Verification.

When authorized by the Government, verification shall be performed concurrently with validation. Final acceptance of the IETM will be made upon receipt of the validation and verification incorporation certifications.

5.0 PACKAGING.

5.1 TECHNICAL MANUAL SCHEDULE, STATUS AND COSTS REPORTS.

Suggested packaging is commercial in accordance with ASTM D3951. Delivery shall be in accordance with the Contract Data Requirements List.

5.2 QUALITY ASSURANCE PROVISIONS.

5.2.1 Validation Plan.

Suggested packaging is commercial in accordance with ASTM D3951. Delivery shall be in accordance with the Contract Data Requirements List.

5.2.2 Validation Certification.

Suggested packaging is commercial in accordance with ASTM D3951. Delivery shall be in accordance with the Contract Data Requirements List.

5.3 MANUAL, TECHNICAL, STANDARD.

5.3.1 Interactive Electronic Technical Manual (IETM).

Unless otherwise specified by the procuring activity, items shall be packaged in the most economical manner that will provide adequate protection during shipment in accordance with accepted industrial packaging procedures. Packaging of encoded computer products, in preparation for delivery, shall be in accordance with the requirements in MIL-STD-1840.

6.0 GOVERNMENT FURNISHED PROPERTY.

7.0 COST AND PRICING.

Not applicable.

8.0 PRINTING.

8.1 Not Applicable.

9.0 NOTES.

The [Figure List](#) referenced in this document is by ascending order which is not necessarily the order of appearance. Only those figures referenced by the requirements of this document are included which accounts for the non-sequential listing. The figures are samples only. Size and legibility do not necessarily conform to the requirements set forth herein.