NOT MEASUREMENT SENSITIVE

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SUPERSEDING
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PERFORMANCE SPECIFICATION

MANUALS, INTERACTIVE ELECTRONIC TECHNICAL - GENERAL CONTENT, STYLE, FORMAT, AND USER-INTERACTION REQUIREMENTS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification contains common requirements for the general content, style, format, and user interaction features which are required for Interactive Electronic Technical Manuals (IETM). IETMs are digital in form and designed for interactive display to the maintenance technicians or system operator end users by means of a computer controlled an Electronic Display System (EDS). This specification provides requirements governing the creation and development of IETMs and associated presentation software (see 6.1).

1.2 Paragraphs with limited applicability. This specification contains paragraphs and specific requirements which are not applicable to all Services. Such paragraphs or requirements are prefixed to indicate the Services to which they pertain: (A) for Army; (N) for Navy; (M) for Marines; and (F) for Air Force.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this specification should be addressed to: Det 2, HQ ESC/AV-2, 4027 Col Glenn Hwy., Suite 300, Dayton, OH 45431-1672; by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC F6846 AREA TMSS

Distribution Statement A: Approved for public release; distribution is unlimited.

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

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

SPECIFICATIONS

Military

MIL-PRF-87269	Data Base, Revisable - Interactive Electronic Technical Manuals, for the support of

STANDARDS

Military

MIL-STD-12	Abbreviations for Use on Illustrations, Specifications, Standards, and in Technical Documents.
MIL-STD-1840	Automated Interchange of Technical Information
MIL-STD-38784	Standard Practice for Manuals, Technical: General Style and Format Requirements (Appendix A)

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

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

Department of Defense

DOD 5200.1-R	DoD Information Security Program Regulations
DOD 5220.22-M	National Industrial Security Program

(Application for copies should be addressed to the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.)

2.3 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 document cited in the solicitation (see 6.2).

Aerospace Industries Association (AIA)	PUBS-119, Publications:
	DoD Liaison Recommendation for Hazardous Materials Warnings in Technical Data

(Application for copies of AIA PUBS-119 documents should be addressed to the Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.)

American National Standards Institute (ANSI) Publications:

ISO 10744	Information technology - Hypermedia/Time-based Structuring Language (Hytime)

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

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

3. REQUIREMENTS

3.1 General content requirements for the IETM data base. The Interactive Electronic Technical Manual Data Base (IETMDB) shall be constructed of composite nodes. These nodes shall comprise the basic units of information within the IETMDB. These composite nodes shall be composed of primitives, relationships (links) to other pieces of information, and context attributes as defined in MIL-PRF-87269. The primitives of which these composites are constructed shall include text, tables, graphics, and dialogs. A revisable data base developed according to the requirements of this specification shall conform to the general requirements listed herein and the specific requirements of MIL-PRF-87269.

3.1.1 Text. Textual information shall consist of alphanumeric data consisting of letters, words, sentences, paragraphs, numbers, Greek letters, special characters (symbols), etc. Textual information shall follow the guidelines for style detailed in 3.3 of this specification. Textual information shall contain reference links to other information, parts descriptions, or graphics when those links are required to describe the IETM.

3.1.2 Tables. Displayable tables shall be represented as a series of separate entries; each entry being associated with a specific row and column intersection (cell) of a table. When it is necessary to associate a table entry with another information element or attribute, the entry (cell) shall refer (through a relationship) to the appropriate architectural element or primitive element in the IETMDB.

3.1.3 Graphics. Graphic information (e.g., drawings, illustrations) shall be hierarchical and consist of logically related groups of graphic primitives. Graphics data elements shall be composed of a series of these graphic primitives which are capable of being overlaid on each other to build a complete graphic. These graphics shall be the individual objects capable of being referenced in a node. Graphics shall be composed of information represented in accordance with one of the graphic standards included in MIL-STD-1840. Graphics shall include, but not be limited to, the following types: locator diagram, functional block diagram, general support graphic, schematic, wiring diagram, flow diagram, or graph/chart.

3.1.4 Dialogs. Dialogs shall be formulated as prompting questions which are intended to be presented by the EDS to the user. Dialogs shall be developed so that they require a user to respond (i.e., enter data) before any subsequent processing is undertaken. The dialog information in the IETMDB shall be formulated so that once a dialog is presented to the user, and answered, certain assertions about the user's environment are able to be made. The information associated with dialogs shall permit the presentation system to provide actions to follow all completed dialogs. Subsequent procedures available for presentation shall be conditional upon one of the possible answers requested by the prompt.

3.1.5 Element links. Specific information elements in the data base which have relationships to other elements, shall be represented by linking the information together. These links shall be developed to allow the user to branch from the immediate technical information to other related information. The links shall be of two types. The first type shall provide for a one to one direct relationship between two pieces of information. The second type shall provide for relationships to exist between several pieces of information. The links shall not be restricted to any one data type and shall be available for use with all data elements.

3.1.5.1 Links to reduce redundancy. Links shall be used to eliminate redundant information elements whenever practicable.

3.1.5.2 Location elements. The location elements used for internal references and external cross references shall be developed to conform to the location element definitions of ISO 10744 as specified by MIL-PRF-87269.

3.1.6 Context. Context dependent filtering, as defined in MIL-PRF-87269, shall be used to provide the capability to present the user with only the information that applies to a specific configuration or situation. This filtering shall be accomplished through the use of precondition and post-condition elements. The precondition element shall enable the display of appropriate information during presentation. The post-condition element shall enable the recording of

presentation events for later filtering. The IETMDB shall also contain the additional precondition properties which are required to be satisfied for the element to be applicable to the current context at presentation time.

3.2 General content requirements related to IETMs. This 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.

3.2.1 Help related to technical content. The user shall have access to information relating to the technical content of the IETM, such as information on the weapon system itself (e.g., theory of operation or schematics) or assistance in using one of the special features of the authored procedures. The help function shall also 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.

3.2.1.1 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. Address for forwarding deficiency reports or other evaluative comments.

i. Method of obtaining additional copies and the format of those electronic copies.

j. Distribution statement.

k. Export control notice, if applicable.

l. 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.

m. 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.

3.2.1.2 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.

3.2.1.3 Introduction. All IETMs shall contain information which explains the purpose and scope (e.g., organizational level troubleshooting and corrective maintenance for a particular system), content and organization. This section shall present the range of tasks covered by the IETM as it relates to the purpose and scope of the manual.

3.2.1.4 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.

3.2.1.5 How to use "help" information. In addition to the technical information related help described in 3.2.1, 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.

3.2.1.6 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).

3.2.1.7 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.

3.2.2 Warnings, cautions, and notes. Technical information shall be supplemented with warnings, cautions, and notes in such a way so as: to attract the user's attention to practices, procedures, and conditions which could lead to injury or equipment damage; to warn the user against performance of certain hazardous actions; or to require specific steps leading to safe performance of the procedure. Procedures prescribed for the operation and maintenance 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 11807. The information included in warnings and cautions shall conform to the requirements of Appendix A of MIL-STD-38784 to the extent that it is not in conflict with this specification. Appropriate warnings and cautions shall be included when it is impossible to avoid use of or exposure to hazardous chemicals, adverse health factors in the environment, or hazardous equipment. Warnings, cautions, notes, or other information to be highlighted shall:

a. be integrated with the material to which it applies.

b. be apparent to the user as a warning, caution, or note by including an appropriate graphic cue which includes items such as icons, labels (e.g. "WARNING), or other visual cues.

c. contain all necessary information to reduce or alleviate the hazard.

d. be easy to read and understand in the work environment.

3.2.2.1 Safety summary. Every IETM which contains warnings or cautions shall contain at least one safety summary conforming to the requirements of Appendix A of MIL-STD-38784 as cited above. 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.

3.2.2.2 Text of warnings and cautions. The textual information contained in warnings and cautions shall be presented in a simple, straightforward, and non-exaggerated manner. The content shall contain all necessary information needed to reduce or alleviate the hazard without reference to additional information. Warnings and cautions shall not contain procedural steps other than those dealing with hazard avoidance or correction. The text of warnings and cautions shall contain the following information in the order indicated:

a. The specific nature of the hazard.

b. The steps to be taken to avoid or minimize the hazard.

c. The location of the source of the hazard.

d. The consequences of failing to heed the warning or caution.

3.2.2.3 Text of notes. Notes shall be written in accordance with the style requirements defined in this specification. Notes shall be used to supply needed information that is not a step in the procedure. Information presented in notes shall be limited to necessary specifics. Required tolerances and clearances shall not be given as notes, but shall be included in the procedural steps.

3.2.2.4 Placement of warnings, cautions, and notes. Warnings, cautions, and notes shall be logically positioned at the points where they apply in accordance with the following rules:

a. Warnings and cautions shall be directly associated with and precede in logical sequence the text or procedural step to which they apply.

b. Notes shall either directly precede or directly follow the applicable text or step depending on the point to be emphasized. However, in the case of a procedural step, a note shall not follow the procedural step to which it applies.

3.2.3 Danger from multiple sources. When it is possible for one type of danger to come from any of several sources or one type of danger to require more than one remedial action, the danger may be referred to once in a single combined warning.

3.2.4 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.

3.2.5 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 General style requirements. IETMs shall be prepared in accordance with the general style requirements contained in this paragraph. 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 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 applied as specified by the procuring activity (see 6.2). 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. Unless otherwise

specified by the procuring activity (see 6.2), procedures within steps shall be implemented as follows. The user shall be given the option to access or bypass a general purpose procedure referenced by a step (e.g., "Open access panel"), before continuing the task. When a procedure is unique to a task, or involves use of a peculiar piece of equipment, it shall be included in the procedural data and not made optional.

3.3.2 (A, F) Multiple skill level tracks. If specified by the procuring activity (see 6.2), technical information shall be available in each of two separate and complete skill tracks, each representing a differing level of detail: one level for a novice skill level and another for an expert skill level. The novice level shall contain all information necessary for an inexperienced user to perform the task involved or to comprehend a description. The expert level shall function as a checklist, presenting only the steps required to complete a task or providing a description in broader terms, requiring a higher level of theoretical knowledge. Both levels shall contain all pertinent warnings and cautions. The expert user shall be given the ability to access information at the novice level, but, the novice user shall not be given the capability to access information at the expert level unless otherwise specified by the procuring activity (see 6.2).

3.3.3 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.

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

3.3.4.1 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.

3.3.4.2 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 3.2.1).

3.3.4.3 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. If specified by the procuring activity, standard shortened identifiers shall be substituted at all times when no confusion will result (see 6.2).

3.3.4.3.1 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 3.3.4.7).

3.3.4.3.2 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.

3.3.4.4 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.

3.3.4.5 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. If specified by the procuring activity, conversion of U.S. standards of measurement to metric standards of measurement shall follow in parentheses (see 6.2).

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.

3.3.4.6 Numerical expression of tolerances. The optimal value shall be expressed, along with associated tolerances (e.g., 15 ± 1.25 VDC, or 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.

3.3.4.7 Vocabulary (permitted words). If specified by the procuring activity, words used in the text of the IETM shall be limited to those contained in "permitted word lists" (see 6.2). Words initially used by the IETM author, which are not on these lists, shall be eliminated and replaced with permitted words, unless the comprehensibility of a given passage requires the use of a "non-permitted" word. Non-permitted words shall be approved by the Government. Terminology shall be consistent throughout the IETM; i.e., the same word for a given component must be used throughout the IETM.

3.3.5 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 equipments to be supported by the IETM (see 6.2).

3.3.5.1 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.

3.3.5.2 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.

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

3.3.5.4 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.

3.3.5.5 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.

3.3.5.6 Measurements and tolerances. Numerical measurements and tolerances shall be expressed in the same manner as that required for text (see 3.3.4.6).

3.3.5.7 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. Unless otherwise specified by the procuring activity, all nomenclature used in graphics shall be identical to the nomenclature for the corresponding item in the related text (see 3.3.4.3.2 and 6.2).

3.3.5.8 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.

3.3.5.9 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 as specified by the procuring activity (see 6.2).

3.3.5.10 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.

3.3.5.11 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.

3.3.5.12 Schematic and wiring diagrams. Unless otherwise specified by the procuring activity, 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 (see 6.2). The technician shall have access to the entire wire list, schematic, or wiring diagram when that full graphic is available in the IETM.

3.3.5.13 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.

3.3.5.14 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, as specified by the procuring activity (see 6.2).

3.3.5.14.1 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.

3.3.5.14.2 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.

3.3.5.14.3 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.

3.3.5.15 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.

3.3.5.16 Style requirements for animated information The motion of the animated information shall be easily discernable by the user and clearly differentiated from the background and other static information of the overall display.

3.3.6 General style requirements for audio information Audio information shall consist of nonverbal auditory tones, or computer generated or electronically stored speech. Redundant visual information shall be provided to ensure effective information presentation when the audio output device is not available or functioning.

3.3.6.1 Requirements for nonverbal auditory tones Nonverbal auditory tones shall be limited to applications where immediate discrimination is not critical to personnel safety or system performance. Nonverbal auditory tone frequencies shall range between 200 to 5000 Hz, preferably between 500 and 3000 Hz. Nonverbal audio tones shall be of sufficiently low intensity and duration so as not to startle the hearer, add to overall noise levels, or interfere with local speech.

3.3.6.1.1 Nonverbal auditory tones in conjunction with error messages and alerts Nonverbal auditory tones used in conjunction with a visually displayed error message or alert, shall consist of a single frequency and shall precede the presentation of the visually displayed message or alert by no more than 0.5 seconds.

3.3.6.1.2 Compatibility with ambient conditions. Nonverbal auditory tones which might be mistaken for tones commonly found in the work environment shall not be used.

3.3.6.2 Computer-generated or electronically-stored speech. Computer-generated or electronically stored speech shall be limited to procedural information.

3.3.6.2.1 Abbreviations. Computer generated or electronically stored speech shall be encoded to pronounce the entire word an abbreviation represents (e.g., for the abbreviation "sec." the word "second" shall be pronounced). Computer generated or electronically stored speech shall be encoded to pronounce the individual letters of abbreviations of multi word phrases, without regard to case or punctuation, when that pronunciation is in common usage (e.g., for the abbreviation "A.D." (Anno Domino), the individual letters "a" and "d" shall be pronounced). When pronunciation of the individual letters of abbreviations of multi word phrases is not in common usage, computer generated or electronically stored speech shall be encoded to pronounce each word the abbreviation represents (e.g., for the abbreviation "SSE", shall be pronounced "south south east").

3.3.6.2.2 Acronyms. Any acronym used in the context of procedural information that either cannot be or typically is not pronounced as a whole recognizable word, shall be encoded by the computer speech system as single letters (e.g., the acronym "APU" shall be pronounced: "A P U").

3.3.6.2.3 Alphanumeric strings. Any string of digits or alphanumeric characters used in the context of procedural information that typically are not pronounced as an intact unit shall be encoded as single spoken letters or combinations of numbers and letters (e.g., the reference designator A1A12A9 shall be pronounced: "A one A twelve A nine;" while the part number 78349015 shall be pronounced: "seven eight three four nine zero one five").

3.4 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 specification, 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 specification 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. Table I 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.

3.4.1 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

TABLE I. *List of minimum user interface virtual functions.*

Virtual Function	Description
SELECT	Make a choice at the current cursor position
POINTER SELECT	Move cursor and make a choice at the current pointer position
OK	End input; process data or indicated action
DELETE	Remove items indicated by the cursor
CANCEL	Terminate current action without entering data
MENU	Activate Menu and toggle menu bar on if applicable
UP	Move cursor up
DOWN	Move cursor down
LEFT	Move cursor left
RIGHT	Move cursor right
TAB	Move cursor to next field
BACK TAB	Move cursor to previous field
SCROLL-UP	Move scroll bar slider box up (image down)
SCROLL-DOWN	Move scroll bar slider box down (image up)
SCROLL-LEFT	Move scroll bar slider box left (image right)
SCROLL-RIGHT	Move scroll bar slider box right (image left)
CENTER	Relocate center of graphic to position of cursor after ZOOM-IN
ZOOM-IN	Enlarge the displayed image
ZOOM-OUT	Reduce the displayed image
SYSTEM HELP	Access application help
CONTEXT HELP	Access situation-specific help
FULL SCREEN	Enlarge graphic to size of client area
QUIT	End current application; close windows associated with application

Common user interface components described in this specification shall be implemented on all types of presentation systems used unless otherwise specified. (see 6.2) The components cursor, windows, menus, controls, dialogs, and optional pointer shall be implemented as follows.

3.4.1.1 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).

3.4.1.1.1 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.

3.4.1.1.2 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.

3.4.1.1.3 Shapes. Each cursor mode shall use clearly discernable shapes or icons.

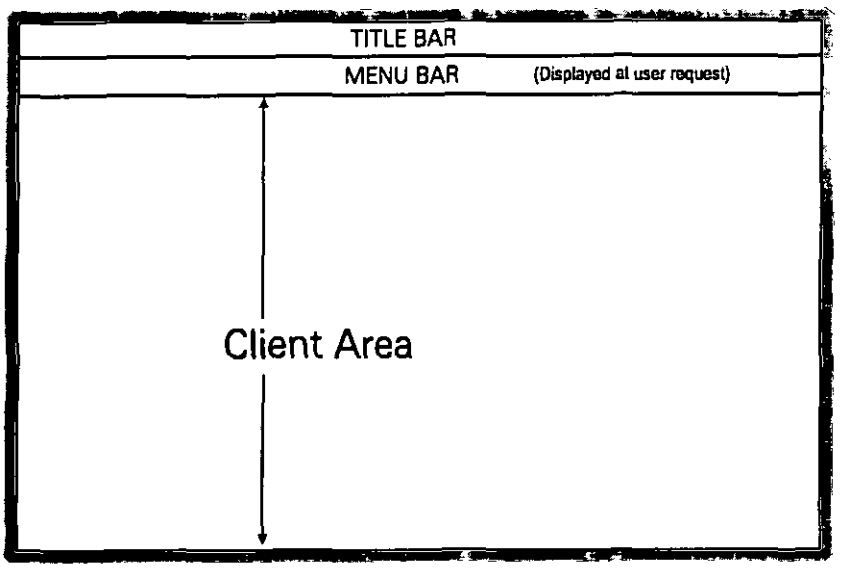
3.4.1.1.4 Tab groups. When several sets of selectable objects are displayed, they shall be formed into fields called "tab groups". Cursor movement (and associated focus for any input) shall be constrained within a single tab group. The TAB function shall allow a forward sequential movement of the cursor 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.

3.4.1.1.5 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.

3.4.1.2 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 bars showing). If a single window device is specified by the procuring activity, the IETM shall restrict the use of multiple windows (see 6.2).

3.4.1.2.1 Presentation. The minimum window shall be composed of client area, title bar, menu bar, and window controls (see figures 1 and 2). Window controls are not applicable to single window systems (see 3.4.1.2).

3.4.1.2.2 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 3.5.1.).



Note: Display format is for example only.

FIGURE 1. *Components of the display window*

3.4.1.2.3 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 3.4.1.3) 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 (see 6.2), the title bar shall be capable of being toggled on and off with a menu bar (see 3.4.1.3.5.1). 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.

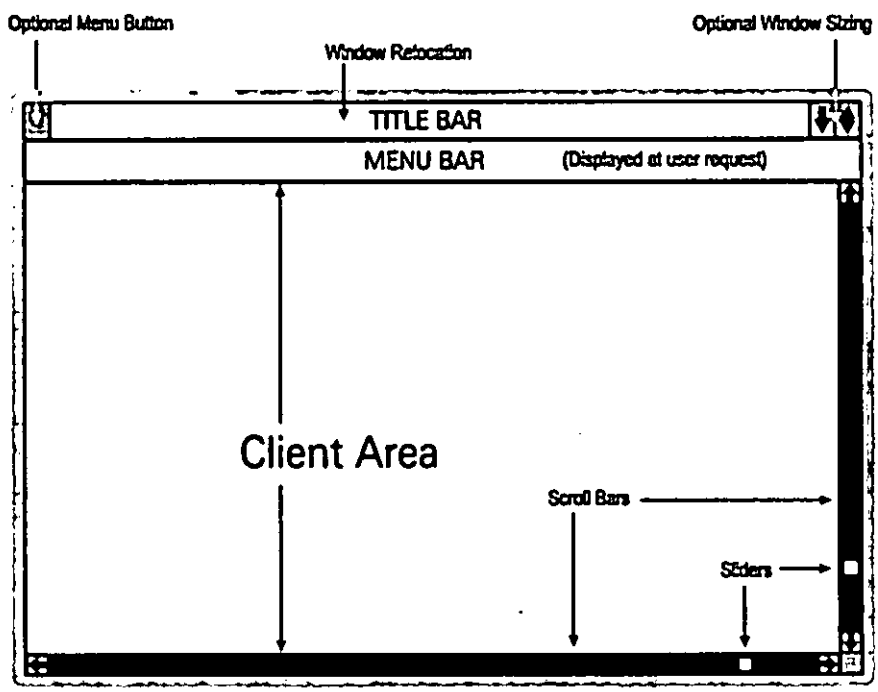
3.4.1.2.4 Window controls. Whenever the information to be displayed requires a space larger than the available window area, the user shall be given the capability to manipulate the displayed information or window using the following window controls. The need for this capability shall be minimized.

3.4.1.2.4.1 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.

3.4.1.2.4.2 Window control options. If specified by the procuring activity, additional window controls shall be included as described below (see 6.2).

3.4.1.2.4.2.1 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.



Note: Display format is for example only.

FIGURE 2. *Basic display window with optional controls*

3.4.1.2.4.2.2 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.

3.4.1.3 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.

3.4.1.3.1 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.

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

3.4.1.3.3 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.

3.4.1.3.4 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 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.

3.4.1.3.4.1 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.

3.4.1.3.4.2 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 3.4.2).

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

3.4.1.3.4.4 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.

3.4.1.3.4.5 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.

3.4.1.3.4.6 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.

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

3.4.1.3.5 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.

3.4.1.3.5.1 Menu bar on single window screen device. When a single window device is specified by the procuring activity (see 6.2), 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 3.4.1.3). 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.

3.4.1.3.6 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 (see 6.2), the command interface shall be available only when the menu bar is displayed and active (see 3.4.1.2). 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.

3.4.1.3.6.1 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.

3.4.1.3.6.2 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.

3.4.1.4 Dialogs and dialog controls. A dialog box shall be used as the principal means to communicate with the IETM application software. Seefigure 3 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 3) 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.

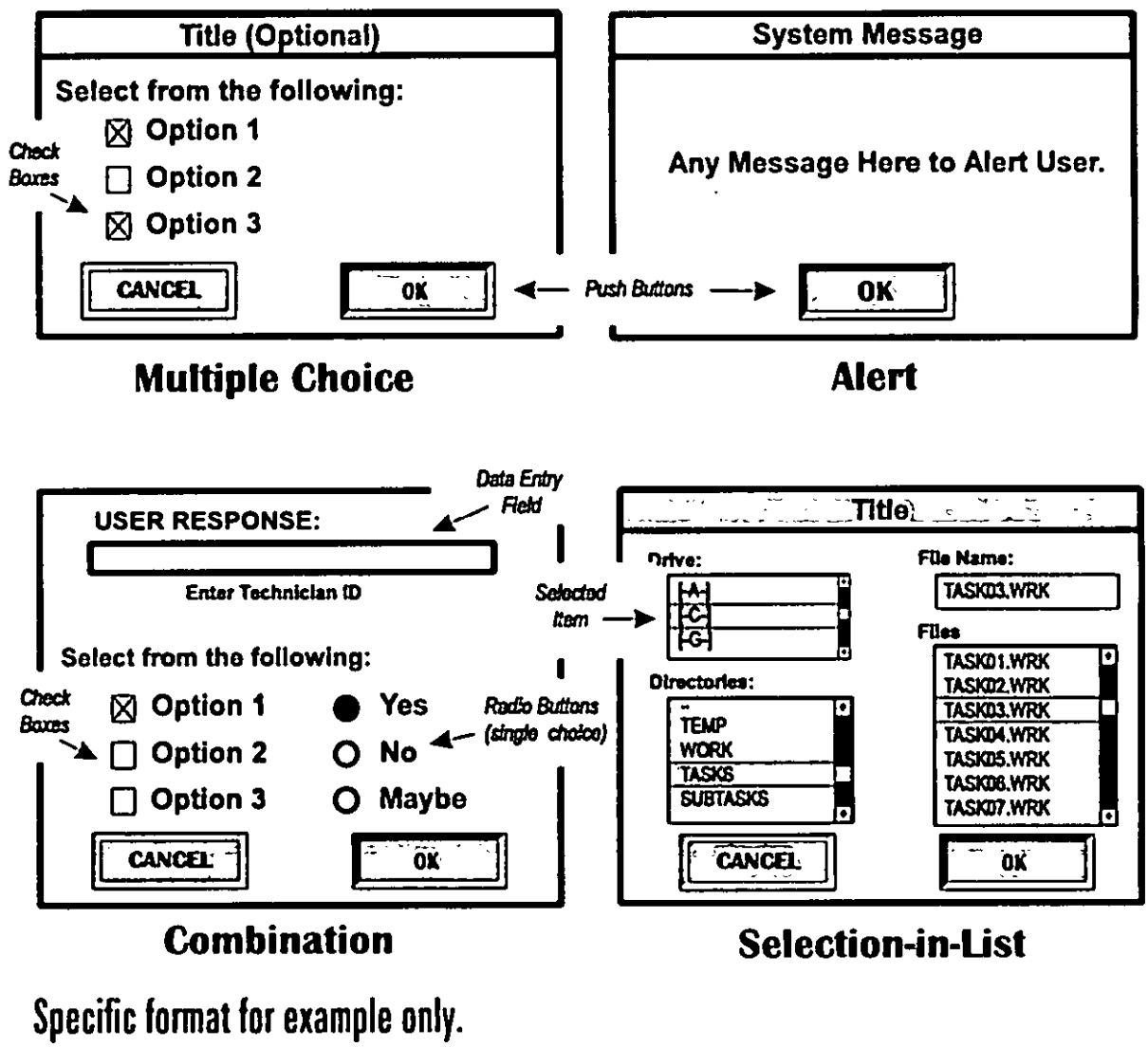


FIGURE 3. Dialog Box Types

3.4.1.4.1 Dialog cursor movement. The cursor shall move only to items which require input from the user.

3.4.1.4.2 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.

3.4.1.4.3 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 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.

3.4.1.4.3.1 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.

3.4.1.4.4 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).

3.4.1.4.4.1 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.

3.4.1.4.5 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.

3.4.1.4.5.1 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.

3.4.1.4.5.2 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.

3.4.1.4.6 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.

3.4.1.4.7 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.

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

3.4.2 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.

3.4.2.1 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 specification.

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

TABLE II Minimum and optimal character heights for various viewing distances at viewing angles of 16 and 20 minutes of arc.

Viewing Distance (Inches)	Minimum Character Height 16 Minutes of Arc (Inches)	Optimal Character Height 20 Minutes of Arc (Inches)
18	0.08	0.11
24	0.11	0.14
30	0.14	0.17
36	0.17	0.21
42	0.20	0.24
48	0.22	0.28
54	0.25	0.31
60	0.28	0.35
66	0.31	0.38
72	0.34	0.42

Note: The formula used for the above calculations is: Character Height = [(Min of Arc x Viewing Distance)/(57.3 x 60)]

3.4.2.1.1.1 Character font. All titles, headings, callouts and special characters shall be sans-serif font. Narrative text shall be serif font. Table II lists the minimum recommended character heights for various reference viewing distances and shall be used to determine the appropriate character font size. Unless otherwise specified by the procuring activity, the minimum reference viewing distance shall be 36 inches (see 6.2).

3.4.2.1.1.2 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).

3.4.2.1.1.3 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.

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

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

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

3.4.2.1.1.6 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 3.4.2.1.2.1).

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

3.4.2.1.2 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.

3.4.2.1.2.1 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.

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

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

3.4.2.2.2 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.

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

3.4.2.2.4 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 specification (e.g., scrolling, zooming).

3.4.2.2.5 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.

3.4.2.2.6 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.

3.4.2.2.6.1 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).

3.4.2.2.6.2 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.

3.4.2.2.6.3 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.

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

3.4.2.3 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.

3.4.2.3.1 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.

3.4.2.3.1.1 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.

3.4.2.3.1.2 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.

3.4.2.3.1.3 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.

3.4.2.3.2 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.

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

3.4.2.3.4 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).

3.4.2.4 User prompts/questions. User prompts shall be displayed as dialogs (see 3.4.1.4.5). Prompts shall be used to obtain any information required by the IETM. Prompts shall be presented as questions.

3.4.2.4.1 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.

3.4.2.4.2 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.

3.4.2.5 Audio controls. When either verbal or nonverbal audio signals are presented, the capability to repeat the audio signal shall exist. Audio on-off and volume shall be provided.

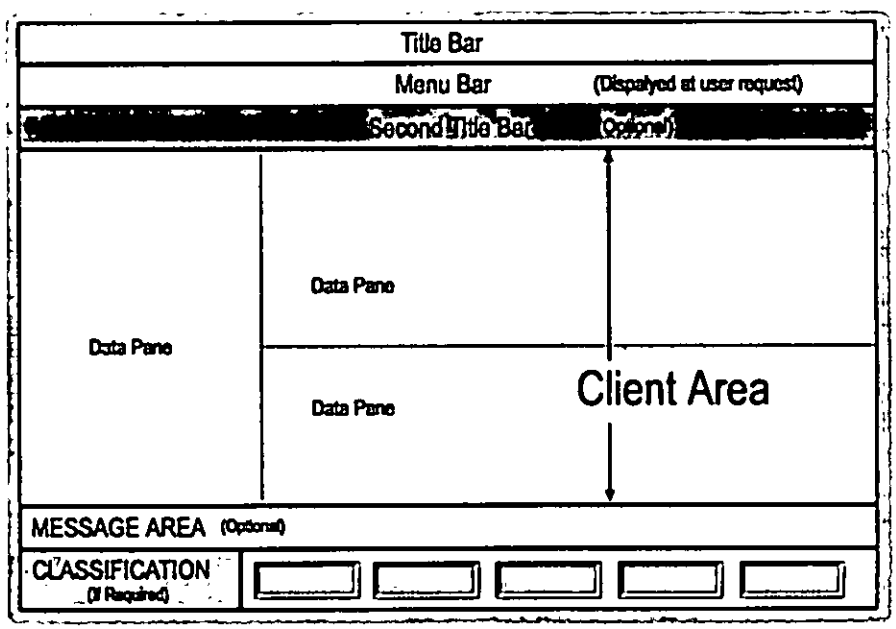
3.4.2.6 Video controls. When displaying a motion video sequence, the video sequence shall automatically begin after the entire screen has been displayed. The capability shall exist to allow pausing, repeating and exiting the video sequence.

3.4.2.7 Motion/animation controls. If displaying an animated graphic, the animation sequence shall automatically begin after the entire screen has been presented. The capability shall exist to allow pausing, repeating, and exiting the animation sequence.

3.5 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 3.4. In addition the final IETM shall conform to the applicable special requirements specified in 3.6. The general formatting and user interaction requirements of the following paragraph shall apply to all IETMs.

3.5.1 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 4).

3.5.1.1 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 3.5.1.2. 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.



Note: Display format is for example only.

FIGURE 4. *Client area components.*

3.5.1.2 Arrangement of data panes. Windows shall be composed of one or more separate data panes (see figure 5) 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 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.

3.5.1.3 Footer bar (function designation area). Unless another location within the window is specified by the procuring activity (see 6.2), 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.

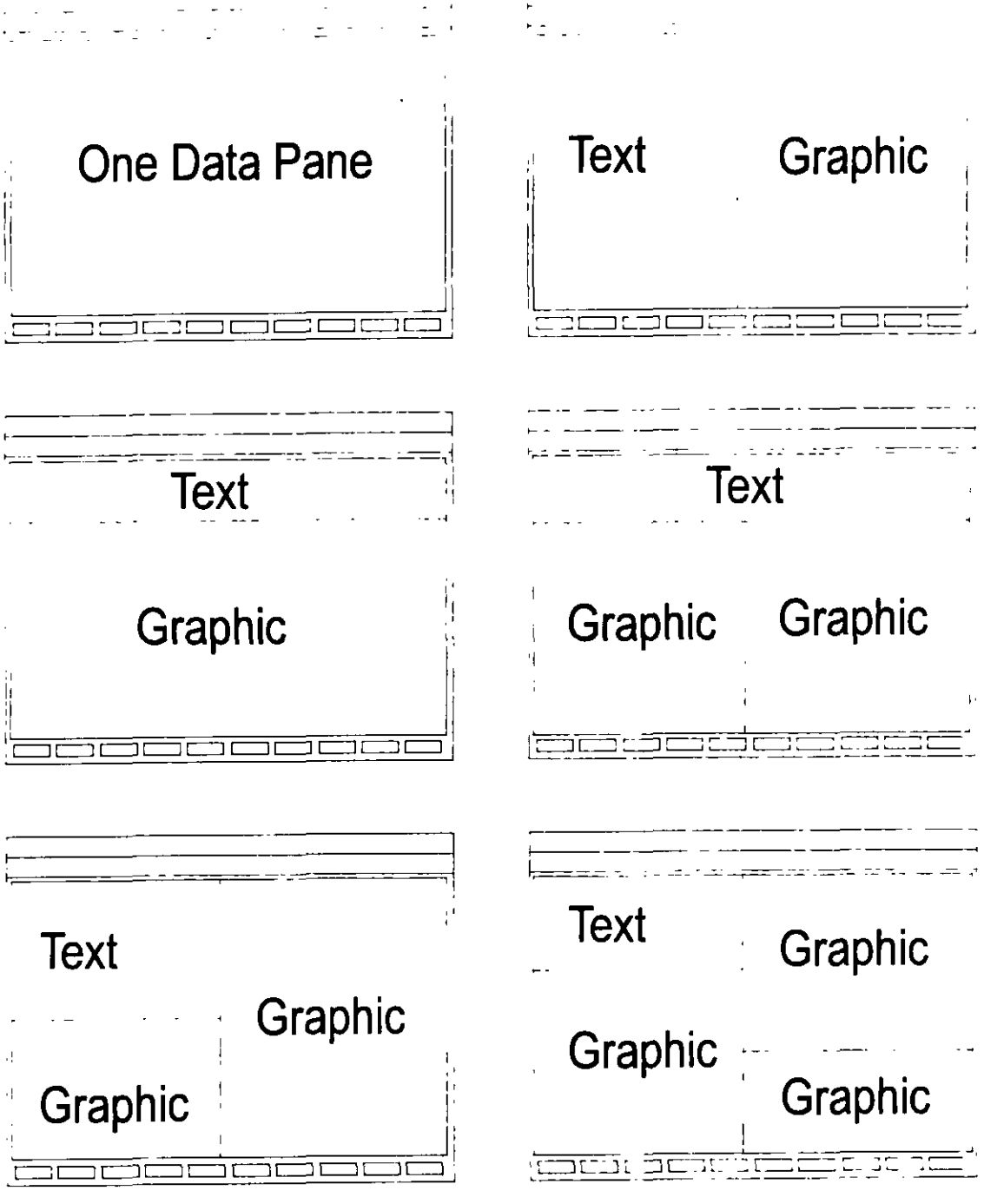


FIGURE 5. *Examples of window data pane templates.*

3.5.1.3.1 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.

3.5.1.3.2 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.

3.5.1.3.3 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.

3.5.1.3.4 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 3.4.1.3.

3.5.1.4 Optional second header line. If specified by the procuring activity (see 6.2), 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.

3.5.1.5 Optional message area. If specified by the procuring activity (see 6.2), 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.

3.5.1.6 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.

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

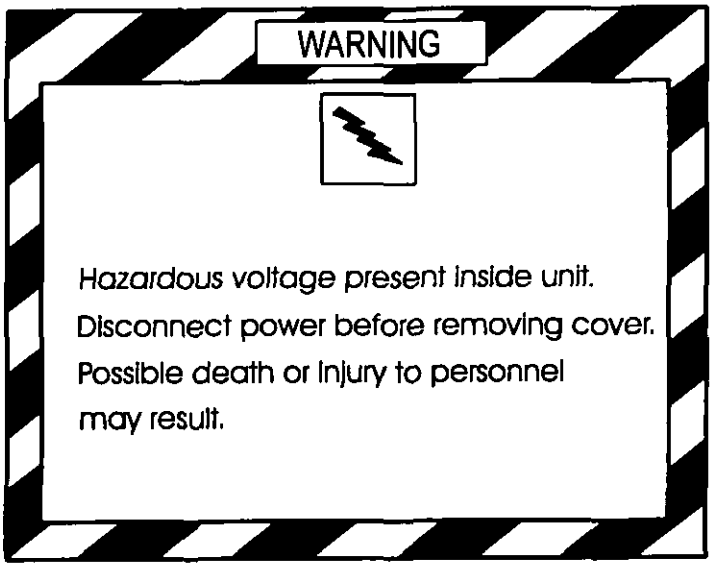


FIGURE 6. *Warning, Caution, and Note display example*

3.5.1.6.2 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 6).

3.5.1.6.3 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 and MIL-STD-38784, Appendix A.

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.

3.5.1.6.4 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.

3.5.1.6.5 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.

3.5.1.7 Indication of classified information. Whenever classified information is displayed, an indication of the classification level shall be indicated in the footer area (see 3.5.1.3 and figure 4). The indication shall be the upper case spelling of the words corresponding to the classification level (e.g., CONFIDENTIAL). When color is available, these indications shall be displayed with a red background. Classification indications shall be clearly distinguishable from the function indicators in the same area. Technical data developed using this specification shall have security classification markings in accordance with DOD 5220.22-M and 5200.1-R.

3.5.2 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.

3.5.2.1 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 Table III.

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

3.5.2.1.2 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.

3.5.2.1.3 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

TABLE III. *User Navigation Functions*

Function	Description
NEXT	Action to move forward to the succeeding window
BACK	Action to move to the previous window or to review all windows which led to the current state
BROWSE NEXT	Action to move to the succeeding window without permanently setting system variables; however, system variables will be set to a temporary state table
BROWSE BACK	Action to move to the previous window without permanently resetting system variables; however, system variables in the temporary state table will be reset
BROWSE EXIT	Action to leave browse mode
RETURN	Action to return to window before last branching
CREATE BOOKMARK	Action to create a bookmark for the purpose of saving data for reference
REMOVE BOOKMARK	Action to erase a specific bookmark
MODIFY BOOKMARK	Action to change the name of a specific bookmark
GO TO BOOKMARK	Action to go directly to a specific bookmark
SEARCH	Action to find additional data with limited information available
DIRECT ACCESS	Action to access information by hierarchy, bookmarks, glossary or index
MORE-DETAIL	Action to switch to novice track of information, if available
LESS-DETAIL	Action to switch to expert track of information, if available
CROSS REF	Action to access related information attached to a selectable item
HELP	Action to access help functions

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.

3.5.2.1.4 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.

3.5.2.2 Required data access functions. There shall be multiple data access paths provided to the user including, as a minimum, the following access methods:

3.5.2.2.1 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.

3.5.2.2.2 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.

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

3.5.2.2.2.2 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.

3.5.2.2.3 MORE DETAIL, LESS DETAIL. If a separately authored track of more or less detailed technical information is available (see 3.3.2), the capability to activate the level of detail functions within the parameters allowed by the technician's skill level shall exist.

3.5.2.2.4 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.

3.5.2.2.5 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.

3.5.2.3 Other functions. *If specified by the procuring activity, other system functions shall be made available (see 6.2).*

3.6 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 (see 6.2). Generally, the major types of information covered shall include, but not limited to: procedural (task), fault isolation, parts, and descriptive or narrative text. *See definitions in Section 6.*

3.6.1 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.*

3.6.1.1 Tasks and subtasks. Each new task or subtask shall begin on a new display. In terms of content, each task shall involve closely related activities. Each subtask shall include all steps required to achieve a specific objective.

3.6.1.2 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.

3.6.1.2.1 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.

3.6.1.2.2 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.

3.6.1.2.3 Step number. Each step shall be presented as consecutive Arabic numerals. The approval of the procuring activity shall be required to use any alternate numbering system (see 6.2).

3.6.1.3 Supporting material for tasks. Procedural data shall contain the following information, which shall be displayed before the steps are viewed.

3.6.1.3.1 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.

3.6.1.3.2 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.

3.6.1.3.3 Safety considerations. Safety conditions shall be identified as specified in MIL-STD-38784 and as stated herein (see 3.2.2).

3.6.1.4 Style requirements. Language (verb tense, person and number) shall comply with the requirements of MIL-STD-38784 and as stated herein (see 3.6). All essential information shall be available and readily accessible.

3.6.2 Fault Isolation information. The fundamental logic for interactive fault isolation shall not be dictated by the IETM presentation system but shall be based on a specifically designed troubleshooting logic which shall include, but not be limited to, predefined fault isolation sequences and dynamically generated fault isolation recommendations based on system or user inputs and as specified herein (see 3.6).

3.6.2.1 General Requirements. Fault isolation information shall be designed to permit direct access to the relevant corrective maintenance procedures after a fault has been isolated, unless otherwise specified by the procuring activity (see 6.2). The capability shall exist to:

a. enter symptoms manually by means of symptom codes or human readable text, or by initiation of automatic retrieval from the system or equipment under observation;

b. enter and change test results when such information is required by the troubleshooting procedure;

c. confirm conditions required before continuing a maintenance action;

d. review and browse through previous actions and test results;

e. access all troubleshooting information needed to troubleshoot the system in an efficient and clearly defined manner.

3.6.2.2 Predefined fault isolation sequences. Predefined fault isolation sequences shall consist of a specified sequence of fixed procedures and tests that will isolate the detected fault. These predefined fault isolation sequences are representative of the fixed fault trees in fault isolation manuals and shall be based on the reporting of an observed symptom, alert, or as a result of a previous test. The input of the result (or outcome) of a test or an observation shall be required before displaying information on the next procedure, test, or corrective maintenance action.

3.6.2.2.1 Presentation requirements. Presentation of predefined fault isolation information shall consist of and be presented as procedural data (see 3.6.1). Procedural steps shall contain test instructions, observation requirements, and corrective repair actions. Prompts via dialogs shall be used to initiate actions requiring input.

3.6.2.3 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.

3.6.2.3.1 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.

3.6.3 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 reparable 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.

3.6.3.1 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.

3.6.3.2 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).

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

4. VERIFICATION

4.1 Verification. Unless otherwise specified in the contract or purchase order:

a. Validity of the accuracy and scope of the IETM technical content, user interface functionality and EDS-IETM interface shall be the responsibility of the contractor (see 6.6.16).

b. The contractor shall provide suitable facilities to perform the validation functions specified herein.

c. The contractor's existing quality assurance (QA) procedures shall be used.

d. The government reserves the right to review any of the verifications when such reviews are deemed necessary to ensure supplies and services conform to the prescribed contractual requirements.

4.1.1 Minimum Verification Requirements. As a minimum, verification shall ensure the following:

a. Suitability of the IETM for the intended user environment.

b. Usability by the intended user.

c. IETM to EDS compatibility.

d. Compatibility with other Government systems.

4.1.2 Compliance. All IETMs shall meet all requirements of Sections 3 and 5 of this specification. The requirements set forth in this specification shall become a part of the contractor's overall inspection or quality program. The absence of any requirement in this specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Use of sampling inspections shall be in accordance with commercially acceptable quality assurance procedures; however, Government approval for use of sampling in QA procedures does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

5. PACKAGING

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

5.1.1 Encoded computer products. Packaging of encoded computer products, in preparation for delivery, shall be in accordance with the requirements of MIL-STD-1840.

5.1.2 Classified material. Classified material shall be packaged and identified in accordance with DOD 5200.1-R, DOD 5220.22-M, and the implementing Service regulations.

6. NOTES

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

6.1 Intended use. This specification is intended to be cited in a procurement in which the Government acquires IETMs. This specification describes the general requirements the author must follow concerning the creation and selection of general content, style, format and user interaction features of the IETM. However, this specification is intended to be implemented in combination with the specific style guides and detailed requirements specifications of individual end item IETMs (e.g., an IETM for a specific functional area or a specific weapon system). These documents in turn reference this specification for the general IETM requirements which are common to the differing functional end item IETMs. This specification is not a complete end item specification in itself. Specific requirements for the type of IETM under development are found in the associated performance specification identified in the contract Statement of Work (SOW) for the corresponding conventional technical manual (TM) functionality. This specification applies to all levels of maintenance.

6.1.1 Interaction of the IETM and the EDS. An IETM must be constructed to be fully compatible with the operating and presentation software of an EDS, and must be presented on such a display device before any actual use, testing, or evaluation of operational suitability can take place (i.e., using the Government specified end user IETM display device). In this sense an IETM does not exist without its corresponding EDS, and, each formatting and user interaction requirement cited in this specification should have a corresponding software section in the associated EDS design specification.

6.2 Acquisition requirements. Acquisition documents must specify:

a. Title, number, and date of the specification.

b. Issue of the DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1, 2.3).

c. End user skill level to which the IETM is to be developed (see 3.3.1).

d. If procedures within steps will be other than as specified herein (see 3.3.1).

e. If a separately developed higher skill level track will be used, and, if the novice user will be prohibited from accessing the higher skill level track (see 3.3.2).

f. Approved shortened identifiers for nomenclatures (i.e., acronyms) used for equipment item assemblies, parts, etc. (see 3.3.4.3).

g. If conversion of U.S. standards of measurement to metric standards of measurement is to be included (see 3.3.4.5b.).

h. A "permitted word" list(s), when required (see 3.3.4.7).

i. The least capable device to be supported by the IETM (see 3.3.5).

j. If nomenclature used in graphics is to be other than as specified herein (see 3.3.5.7).

k. How the human figures used in graphics are to be clothed (e.g., Enlisted working uniform for a particular Service) (see 3.3.5.9).

l. If wire lists, schematics, and wiring diagrams referenced by an associated text pane will be other than as specified herein (see 3.3.5.12).

m. If locator graphics will be optional or part of the procedural or descriptive information (see 3.3.5.14).

n. If additional user interface components other than described in this specification is to be implemented (see 3.4.1).

o. If a single window device will be used (see 3.4.1.2).

p. If the additional window controls (i.e., window resize, relocation, and menu button) are required (see 3.4.1.2.4.2).

q. The reference viewing distance, if other than as specified herein (see 3.4.2.1.1.1).

r. If the footer bar location is to be other than as specified herein (see 3.5.1.3)

s. If the top line in the client area is to be reserved for additional header information and any requirements for information displayed on that line (see 3.5.1.4).

t. If an area is to be reserved on the display window for the message area and any particular requirements for that message area (see 3.5.1.5).

u. If other system functions are required. (see 3.5.2.3).

v. What special requirements for procedural data, fault isolation, and parts information are required according to the applicable functional requirements of the conventional TM performance specification corresponding to the type of IETM being developed (see 3.6).

w. If step numbering is to be other than as specified herein (see 3.6.1.2.3).

x. If content requirements for troubleshooting information are other than as specified herein (see 3.6.2.1).

y. If packaging other than as specified herein is required (see 5.1).

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

6.4 Requirements covered by this specification. This specification covers general requirements for IETMs as outlined below and presented in Section 3.

6.4.1 General content. General content requirements common to IETMs are covered in 3.1, 3.2, and portions of 3.6. Specifically, 3.1 applies to the standard revisable data base items specified in MIL-PRF-87269 which, in turn, are used to create the IETM; 3.2 applies to all IETMs whether or not they used MIL-PRF-87269 to specify the source data base; and, 3.6 includes content requirements which are peculiar to certain subsets of IETMs such as troubleshooting IETMs or proceduralized maintenance instructions. Content statements applying to the IETM are classified into two types:

a. Those applicable to construction of the IETM such as those dealing with the IETM technical structure and those required to support the use of a particular IETM (e.g., Help information).

b. Those applicable to specific technical processes to assure effective use of the IETM for the logistic support purpose intended.

6.4.1.1 Content structure and supporting information. Common content requirements for IETM structure require the incorporation of features such as front (introductory) matter, list of contents, glossary, list of acronyms, statement of applicability, IETM number, IETM date, IETM edition, and many others.

6.4.1.2 Content related to technical functions. Standardized increments of technical content are needed to ensure that the information presented in support of a given process is complete, comprehensible, and effective, e.g., the requirement that location drawings be incorporated to assist the user in remove and replace procedures, or the requirement that setup information be incorporated for all system related procedural information. Similarly, content requirements such as standardized requirements for parts information will be detailed under this category. Most of the requirements in this category are included in 3.6. The applicable functional requirements of the conventional TM performance specification corresponding to the type of IETM being developed must be used to determine the look and feel of the IETM within the

context of the EDS and end user requirements, (e.g., Work Package TMs (MIL-PRF-87929) have specific work package and subwork package requirements for task preparation, accomplishment and completion).

6.4.2 General style. Style requirements are presented in 3.3. The term "style" refers to:

a. The nature of the language structure (grammar and syntax) used; the vocabulary; and criteria governing technical terminology, numbers, and abbreviations.

b. The presentation related aspects of text, graphics, and audio information (e.g., graphics design, callout construction, and use restrictions on audio tones).

6.4.3 General format. Format requirements deal with all aspects of the arrangement (organization) of text and graphics information for screen presentation, and with the sequencing (ordering) of frames for interactive presentation within an increment of technical information. General format requirements of the IETM user interface are contained in 3.5 of this specification.

6.4.4 General user interaction. User interaction capabilities required for interactive presentation of IETMs (requirements which, as noted, must be reflected in the EDS) are contained in 3.4 and 3.5. The specific functions defined in these paragraphs are:

a. Those user-interaction functions needed to control a screen display (e.g., windowing controls, cursor control, scrolling). (see 3.4, and Table I)

b. Those functions necessary for user-interaction and information display with the IETM. (e.g., HELP, NEXT, BACK). (see 3.5 and 3.5.2.1, Table III)

6.5 Acquisition of IETMs. To acquire the IETMs described herein, this specification must be listed in the appropriate Service's Technical Manual Contact Requirement (TMCR). The TMCR must also include or list any other detailed IETM requirements needed to supplement this general specification (applicable tailored performance specification functional requirements). The TMCR should be listed in the Contract Data Requirements List (DD Form 1423).

6.6 Definitions of acronyms and terms. Acronyms and IETM terms are included below.

6.6.1 Acronyms.

a. AIA - Aerospace Industries Association
b. American National Standards Institute (ANSI)
c. AMSC - Acquisition Management System Control (number)
d. AMSDL - Acquisition Management Systems and Data Requirements List
e. ANSI - American National Standards Institute
f. CDRL - Contract Data Requirements List
g. DODISS - Department of Defense Index of Specifications and Standards
h. EDS - Electronic Display System

i. Hz - Hertz
j. IETM - Interactive Electronic Technical Manual
k. IETMDB - IETM Data Base
l. IPB - Illustrated Parts Breakdown
m .ISO - International Organization of Standards
n. OSHA - Occupational Safety and Health Act
o. RPSTL - Repair Parts and Special Tools List
p. QA - Quality Assurance
q. SSSN - System/Subsystem/Sub-subsystem (Subject) Number
r. TMCR - Technical Manual Contract Requirements
s. VDC - Volts Direct Current

6.6.2 Alert. An Alert is any message, communication, notice, or output which requires manual acknowledgment.

6.6.3 Caution. A Caution is a short message which calls attention to an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to, or destruction of equipment or loss of mission effectiveness. (See MIL-STD-38784)

6.6.4 Confirming events. Confirming events are indications that are not necessarily steps of the task or subtask itself, but are necessary to provide assurance that the task has been performed correctly. They confirm the correctness of the technician's actions and confirm that the equipment is operating properly.

6.6.5 Corresponding functionality. IETMs performing the same functional requirements as conventional (paper) TM should provide the same functionality designed into or specified in the applicable performance specification for the corresponding type of conventional TM being developed, (e.g., an IETM in lieu of MIL-PRF-87929 Work Packages).

6.6.6 Data pane. A data pane is a rectangular region within the client area containing the displayable image of a single data type.

6.6.7 Descriptive information. Descriptive Information is technical information typically contained in a technical manual that provides an end user with the background, theory of operation, and other supporting information necessary for the performance of maintenance, operation of the system or equipment, and the training and logistic support for that system or equipment. Descriptive information is non-procedural and generally supplemental, to assist the user in the comprehension of procedural data. Examples of descriptive information include theory of operation, diagrams, and general knowledge.

6.6.8 Dynamically generated fault isolation recommendations. Dynamically generated fault isolation recommendations are computed, as required, with information gained from user and/or system outputs.

6.6.9 Element Links. Element links are explicit associations between two bodies of information that allow a user to branch from the immediate technical information to other related information. The first of two types provide for a one-to-one direct relationship between two pieces of information. The second type allows relationships to exist between several pieces of information. The links are not restricted to any one data type. They are available for use with all data elements.

6.6.10 Fault isolation technical data. Fault isolation technical data designed to permit troubleshooting in corrective maintenance. Troubleshooting or fault isolation technical data is a special type of procedural technical data (differing primarily in the interactivity involved between display device and technician, and in the presence of extensive branching in the logic). The conventional TM performance specification corresponding to the type of IETM being developed should be consulted for the applicable functional requirements.

6.6.11 Graphic overlays. Graphic overlays are hierarchical and logically grouped graphics specifically designated to visually overlay a master graphic and one another. On a display system they are combined and displayed as one picture.

6.6.12 Interactive Electronic Technical Manual (IETM). A technical manual, prepared (authored) in digital form on a suitable medium, by means of an automated authoring system; designed for electronic window display to an end user, and possessing the following three characteristics:

a. The format and style of the presented information are optimized for window presentation to assure maximum comprehension; that is, the presentation format is "frame oriented", not "page oriented".

b. The elements of technical data constituting the IETM are so interrelated that a user's access to the required information is facilitated to the greatest extent possible, and is achievable by a variety of paths.

c. The computer controlled IETM display device can function interactively (as a result of user requests and information input) in providing procedural guidance, navigational directions, supplemental information, and in providing assistance in carrying out logistic support functions supplemental to maintenance.

6.6.13 Locator Graphic. Locator graphics enable the user to find the specific hardware items (e.g., part, switch, control, indicator, assembly, etc.) referred to in the text. A locator graphic illustrates a particular item and its relationship to the immediate surroundings.

6.6.14 Note. A note is a short message which describes an unusual procedure or condition to which special attention must be paid for any reason (but it may not replace a caution or warning).

6.6.15 Predefined fault isolation sequences. Predefined fault isolation sequences are representative of the fixed fault trees in fault isolation manuals. Based on an observed symptom, the user will proceed through a specified sequence of procedures and tests that will eventually lead to the suspected fault.

6.6.16 Verification. Verification (Section 4), in the context of this specification equates to the contractor's quality assurance program for validating the content of the IETM. Suggested validation methods include:

a. Actual performance. Using production configured equipment, hands-on performance of the procedure using the technical instructions displayed as written.

b. Simulation. Using production configured equipment and the technical manual procedure, simulate the actions required by comparing the task steps to the hardware, while not actually removing any equipment.

c. Table top analysis. Primarily for non-procedural data, compare the technical content to source data to ensure the technical accuracy and depth of coverage.

6.6.17 Warning. A warning is a short message which calls attention to an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in injury to, or death of personnel or long term health hazards.

6.7 Subject term (key word) listing

Data Base
Dialog
Electronic Display System
IETM
Technical Manual, Interactive Electronic
User Interface
Window

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

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

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