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Computation, Mathematics, and Logistics Department
Test and Evaluation Report

Proposed Draft Military Specification for Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs)

by
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The report summarizes recent activities in the Department of Defense and in the US Navy, Army, and Air Force to establish Service use of Interactive Electronic Technical Manuals (IETMs) as replacements for paper Technical Manuals for logistic support of military equipment.

The IETM concept is described, and an overview is provided of five IETM acquisition Specifications and Military Handbooks developed by the Tri–Service Interactive Electronic Technical Manual Working Group established in 1989 by the Defense Quality and Standardization Office.

One of these five draft documents, MIL–M–IETMQA, Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMS) and Associated Technical Information, 1 Jun 1990, is described and presented. (Four other companion Reports have been prepared to introduce and describe the four related IETM acquisition Specifications and Handbooks.) (see reverse side)

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A copy of MIL–M–IETMQA is included in this report as an Appendix.

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ABSTRACT

This Report summarizes recent activities in the Department of Defense and in the US Navy, Army, and Air Force to establish Service use of Interactive Electronic Technical Manuals (IETMs) as replacements for paper Technical Manuals for logistic support of military equipment.

The IETM concept is described, and an overview is provided of five IETM acquisition Specifications and Military Handbooks developed by the Tri-Service Interactive Electronic Technical Manual Working Group established in 1989 by the Defense Quality and Standardization Office.

One of these five draft documents, MIL-M-IETMQA, *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information*, 1 Jun 1990, is described and presented. (Four other companion Reports have been prepared to introduce and describe the four related IETM acquisition Specifications and Handbooks.)

This Report (1) summarizes the Quality Assurance Program philosophy upon which MIL-M-IETMQA is based; (2) introduces the concept of the Quality Assurance Program Plan (QAPP); (3) summarizes the difference in Quality Assurance procedures required for IETMs and those used in preparing paper TMs; (4) describes and explains the particular QA procedures required for IETM production by MIL-M-IETMQA (particularly in the area of Validation of the IETM System, the IETM Source Data Base, and the View Package production process); and (5) summarizes proposed DOD acceptance tests (in an Appendix) for information and guidance.

A copy of MIL-M-IETMQA is included in this Report as an Appendix.

ADMINISTRATIVE INFORMATION

ACKNOWLEDGEMENTS

1.0 INTRODUCTION

1.1 BACKGROUND

During the 1980s, it became increasingly apparent that the striking increases in the complexity and sophistication of the weapon systems of all three Services were causing a serious lag in the production, distribution, and management of the Technical Information required to maintain, operate, and support these systems. Of particular concern were increasing weight and space requirements resulting from the increasing bulk of the required paper Technical Manuals.

At the same time, a number of significant technological improvements were being made in the field of information handling, particularly the advent of small, inexpensive, fast computers. Such innovations offered the potential of almost complete replacement of paper-based Technical Information through the use of light, easily stored, highly capable electronically processible media, which at the same time were capable of more effective interactive display to the end user.

Research, Development, Test, and Evaluation efforts of the three Services during this past decade have conclusively demonstrated, both through field tests and through in-house analyses and experimentation, the feasibility and intrinsic value of providing integrated Technical Information in paperless form in such a way that it can be displayed to end users by means of an interactive Electronic Display System.

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For example, the Navy Technical Information Presentation System (NTIPS) Program at David Taylor Research Center, the Navy's Lead Laboratory for TI automation, demonstrated under operational conditions the improvements achievable in maintenance-technician performance [Refs (1) and (2)] through the use of electronically displayed TI. Similar results have been achieved by the Air Force under its Computer-based Maintenance Aiding Information System (CMAS) and its Integrated Maintenance Information System (IMIS) programs [Refs (3) and (4)]. The Army has automated Training Information under its Electronic Information Delivery System (EIDS), and has assessed the capability of using field portable maintenance aids under the Militarized Electronic Information Delivery System (MEIDS) program.

In addition, a number of pilot prototype developments and tests involving land, sea, and air vehicles and their weapon systems are being carried out, by individual System Acquisition Managers of all three Services, in an effort to provide interactive and electronically displayed Technical Information.

Ref (1)   Fuller, Joseph J., Theodore J. Post, and Anne S. Mavor, "Test and Evaluation of the Navy Technical Information Presentation System (NTIPS), F-14A Field Test Results," DTRC-88/036 (Sep 1988).

Ref (2)   Fuller, Joseph J., Raymond L. LeBeau, Anne S. Mavor, Theodore J. Post, and Charles S. Sawyer, "Test and Evaluation of The Navy Technical Information Presentation System (NTIPS), AN/SPA-25D Test Results," DTRC-88/035 (Sep 1988).

Ref (3)   Thomas, D.L. and J.D. Clay, "Computer-Based Maintenance Aids for Technicians: Project Final Report," Air Force Human Resources Laboratory, AFHRL-TR-87-44 (Aug 1988).

Ref (4)   Link, W.R., J.C. Von Holle, and D. Mason, "Integrated Maintenance Information System (IMIS): A Maintenance Information Delivery Concept," Air Force Human Resources Laboratory, AFHRL-TP-87-27 (Nov 1987).

1.2 DOD AND TRI-SERVICE PROGRAMS ESTABLISHED IN RESPONSE TO TECHNICAL INFORMATION AUTOMATION POLICY

To coördinate and standardize the increased use of computer-aided logistic support throughout the three Services, the Department of Defense established the Computer-aided Acquisition and Logistics Support (CALS) program [see Ref (5)], which also has had a wide effect in stimulating progress toward the goal of TI automation, and particularly toward standardization of such efforts.

The Department of Defense established [Ref (5)], and later reiterated [Ref (6)], a policy requiring that access to and the delivery of system-related logistic-support information be automated.

For example, Ref (6) provided the following directions:

a. For systems now in full-scale development or production, program managers were required to review specific opportunities for cost savings or quality improvements that could result from changing delivery or access using the Computer-aided Acquisition and Logistics Support standards.

b. For systems entering development after September 1988, acquisition plans, solicitations, and related documents required specific schedule and cost proposals for:

Ref (5)   DEPSECDEF MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS, of 24 Sep 1985. Subj: Computer Aided Logistic Support.

Ref (6)   DEPSECDEF MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS AND DIRECTOR, DEFENSE LOGISTICS AGENCY, of 5 Aug 1988. Subj: Computer-Aided Acquisition and Logistic Support.

(1) integration of Contractor Technical Information systems and processes;

(2) authorized Government access to Contractor data bases; and

(3) delivery of Technical Information in digital form.

c.   DOD components were to program for automated systems to receive, store, distribute, and use digital weapon-system Technical Information, including achieving the earliest possible date for digital input to DOD engineering data repositories.

More recently, the Joint Uniform Service Technical Information System (JUSTIS) concept has been announced, a planned effort which will combine, to as great a degree as possible, Tri-Service procedures and equipment for acquisition and control of system-support Technical Information.

1.3 THE INTERACTIVE ELECTRONIC TECHNICAL MANUAL CONCEPT

The culmination of this effort throughout the 1980s in response to the DOD policy statements cited has been the development of the Interactive Electronic Technical Manual (IETM) Concept. The IETM Concept involves full application of existing technological capabilities to the problems of providing Technical Information which is both more effective for the end user and more efficient in terms of acquisition, control, and update.

The IETM Concept involves a system approach, which includes basically all of the following components:

a.   A standardized, automated, revisable source Data Base.

b.   Use of a computer-controlled authoring system.

c.   The generation of digital Technical Information (containing text and graphics), either directly by an Author, or automatically by computer. This Technical Information is recorded on an electronically processible medium (optical or magnetic), rather than on paper.

d.   Technical Information (consisting of task-related increments) which is optimally arranged and formatted for interactive screen presentation.

e.   Presentation (display to the end user) by means of a computer-controlled Electronic Display System (EDS) possessing an extensive user-interaction capability. The EDS is capable of displaying the IETM, performing related logistic-support functions, and interfacing with other Service logistic-support Information Systems.

An IETM permits a user to locate required information more easily, and to present it faster, more comprehensibly, more specifically matched to the configuration, and in a form that requires much less storage than paper. Powerful troubleshooting procedures not possible with paper Technical Manuals are possible using the computational capability of the IETM Display Device.

IETMs will be used by maintenance technicians, afloat and ashore; to maintain and operate weapon systems by Intermediate and Depot maintenance activities; and by training personnel.

The IETM Concept has been described in detail in Ref (7).

1.4 PREPARATION OF SPECIFICATIONS AND HANDBOOKS FOR SERVICE-
    WIDE COORDINATION OF ACQUISITION OF AUTOMATED TECHNICAL
    INFORMATION

To coordinate this wide-spread effort, the Defense Quality
and Standardization Office established in 1989, under the DOD
Technical Manual Technology Exchange Subcommittee, chartered by
DOD INST 4151.9 [Ref (8)], an Interactive Electronic Technical
Manual Working Group, chaired by the Navy, whose primary
functions were to:

a. Foster the exchange of ideas and the agreement on a
    single approach regarding:

    (1) the acquisition of IETMs which use computer
        technology for innovative electronic display;
        and

    (2) presentation of Technical Manual Information
        among all Department of Defense Agencies.

b. Develop a set of DOD Specifications for:

    (1) The acquisition of IETM data; and

Ref (7)   Rainey, Samuel C., Joseph J. Fuller, and Eric L. Jorgensen,
          "The Electronic Delivery of Automated Technical Information for
          Logistics Support of Navy Weapons Systems: Potential, System
          Description, and Status," DTRC-89/007 (Feb 1989).

Ref (8)   DoD Instruction 4151.9 of 3 Jan 1989, "DoD Technical Manual
          Program Management."

> (2) The Electronic Display Systems needed for the presentation of IETMs for the maintenance of DOD weapons, systems, and equipment.

The Working Group was also charged with the responsibility of providing a recommendation to the DOD CALS Policy Office concerning inclusion of IETM interchange Specifications into the set of CALS standards; e.g., in connection with MIL-STD-1840.

The Tri-Service Working Group consists of representatives of (a) the David Taylor Research Center (DTRC) of the Navy, (b) the Air Force Logistics Command (AFLC-MMDE), and (c) the US Army Communications-Electronics Command (AMCPM-TMDE).

With DTRC and the Air Force Human Resources Laboratory (as an advisor to AFLC) contributing the primary effort, a series of five Specifications (see Section 2.3) and Handbooks for IETM acquisition has been drafted. This series consists of:

- A Specification governing the nature of the Revisable IETM Data Base;

- A Specification providing general Content, Style, Format, and User-Interaction requirements for all IETMs;

- A Handbook describing for a System Acquisition Manager the best approach to writing acquisition Specifications for individual View Packages (to be used for IETM procurement);

- A Handbook presenting requirements for the Electronic Display System;

■ A Specification presenting requirements for an IETM Quality Assurance Program.

These documents have been widely circulated for comment within both the DOD and Industry.

These drafts were also developed to accomplish as near-term objectives the provision of a suite of IETM prototype acquisition documents for use by major DOD programs in establishing initial IETM capabilities. These programs include the Navy's A-12 Attack Aircraft Program, the Advanced Tactical Fighter Program of the Air Force, and the M-1 Main Battle Tank Program of the Army.

1.5 PURPOSE OF PRESENT REPORT

The purpose of the present Report is to present and to describe in detail one of these draft Specifications, specifically: MIL-M-IETMQA. *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information.* June 1990.

A series of four other Reports has been prepared, each Report describing one member of the set of five acquisition

documents prepared by this Working Group [Ref (9) through Ref (12)].

Section 2 of this Report provides an overall description of this suite of Acquisition Specifications and Handbooks. Section 3 summarizes the Approach and Requirements of one of the five documents; in this case, MIL-M-IETMQA.

The 1-June-1990 draft version of MIL-M-IETMQA is included in this Report as Appendix A.

Ref (9)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Specification for Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/027 (Jul 1990).

Ref (10)   Jorgensen, Eric L., Samuel C. Rainey, and Joseph J. Fuller, "Proposed Draft Military Specification for General Content, Style, Format, and User-Interaction Requirements for Interactive Electronic Technical Manuals," DTRC Report 90/028 (Jul 1990).

Ref (11)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Handbook for Preparation of View Packages in Support of Interactive Electronic Technical Manuals. DTRC Report 90/026 (Jul 1990).

Ref (12)   Jorgensen, Eric L., Samuel C. Rainey, and Joseph J. Fuller, "Proposed Draft Military Handbook Presenting Requirements for an Electronic Display System for Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/025 (Jul 1990).

2.0 ACQUISITION DOCUMENTATION FOR INTERACTIVE ELECTRONIC TECHNICAL MANUALS AND ASSOCIATED TECHNICAL INFORMATION

2.1 DEFINITIONS

2.1.1 <u>The Interactive Electronic Technical Manual (IETM)</u>.

As defined by the Working Group, an *IETM* is a Technical Manual, prepared (authored) by a Contractor and delivered to the Government, or prepared by a Government activity, in digital form on a suitable medium, by means of an automated authoring system; designed for electronic-screen display to an end user; and possessing the following three characteristics:

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

b. The elements of Technical Information constituting the TM are so interrelated that a user's access to the information he requires is facilitated to the greatest extent possible, and is achievable by a variety of paths.

c. The computer-controlled TM-Display Device can function interactively (as a result of user requests and information input) in providing procedural guidance, navigational directions, and supplemental information; and also in providing assistance in carrying out logistic-support functions supplemental to maintenance.

This terminology is consistent with the standard DOD definition of *Technical Manual*. Ref (8), states:

> Technical Manuals are publications that contain instructions for the installation, operation, maintenance, training, and support of weapon systems, weapon-system components, and support equipment. TM information may be presented in any form or characteristic, including but not limited to hard printed copy, audio and visual displays, magnetic tape, discs, and other electronic devices. They normally include operational and maintenance instructions, parts lists or parts breakdowns, and related technical information or procedures exclusive of administrative procedures. Technical Orders (TOs) that meet the criteria of this definition may also be classified as TMs.

2.1.2 The View Package.

IETM information, as provided to the end user for viewing on an Electronic Display Device, will be constructed in individual task-oriented increments called View Packages.

A *View Package (VP)* is a fully organized and formatted item of computer-processible Technical Information derived from an IETM Data Base and capable of interactive electronic display to an end user by means of an Electronic Display System (EDS). In function and design, a View Package is completely equivalent to an individual Interactive Electronic Technical Manual. A View Package may be constructed:

a.   entirely by an Author using an automated authoring system;

b. completely automatically using a series of automated processes (software) which perform the data-selection, structuring, and formatting processes; or

c. by a combination of the above two approaches.

A View Package is designed to support a specific function in the operation or logistics-support of a weapon system or other military equipment.

2.1.3 <u>Nature and Purpose of the Revisable IETM Data Base</u>

As noted above, a View Package is created entirely from data contained in a *Revisable IETM Data Base* (IETMDB), which is a complete collection of Data Elements relating to a weapon *system or* other equipment acquired by the Government and constructed in a standardized procedure in order to provide the following capabilities:

a. Government activities or DOD Contractors concerned with logistic support for the weapon system involved can access the Data Base directly to obtain needed logistic-support information for specific purposes.

b. The IETMDB can serve as the basis for construction and update of the entire suite of electronically displayed interactive weapon-system Technical Manuals through the use of automated authoring systems.

c. The IETMDB can serve as the basis for fully automated construction, by either a Contractor or a Government Activity, of View Packages, which are increments of

interactive electronically presented logistic-support Technical Information.

d. Required portions of the IETMDB can be interchanged by means of standardized procedures throughout the DOD and its supporting Contractors on a real-time basis when needed.

2.1.4 The Electronic Display System (EDS)

The EDS is a computer-based Technical Information system designed to accept, process and integrate Technical Information for prime-equipment logistics support, and display that information to users. The EDS is also intended to support inquiries by users (in addition to Operations and Maintenance users) who have such responsibilities as supply, training, field-data collection, readiness measurement, operations scheduling, maintenance planning, maintenance quality control, and hardware configuration control. The software supporting the EDS will also be required to support additional (as yet unspecified) functions in the future, which will emerge as technologies and standards evolve. Specifically, the EDS is intended for use:

a. In maintenance Work Centers and shops to support Troubleshooting and Planned and Corrective Maintenance;

b. In portable form at remotely located maintenance sites;

c. Embedded in a weapon-system control panel as support both for System operation and System maintenance;

d. In presenting operating and maintenance information during personnel training courses;

e. In a variety of centers and offices in support of System-related, logistics-supported functions which require Technical Information.

The Electronic Display System will consist of one or more computer-controlled Devices which display the required Technical Information by means of a screen (such as a cathode-ray-tube or a plasma display) either in a pre-ordered sequence or in random-access increments, as called for by the user; e.g., a maintenance technician. To accomplish this display, the IETM, consisting of the Technical Information recorded on a suitable medium (e.g., on an optical disc), is designed to be loaded into the EDS, "read" by this Device, and displayed in a sequence as directed by the user.

The IETMs to be used by this Display System must accordingly be so constructed as to assure full compatibility with the operating software of the Display Device, and must be tested by the preparing Contractor on such a Display Device prior to delivery.

2.1.5 <u>Summary</u>

As noted, all IETMs:

a. Will be constructed through the use of an automated authoring system, and will consist of task-related increments referred to as View Packages;

b.   Will be based on an automated system Data Base, the IETMDB, prepared by the System Prime Contractor for delivery as such to the Government, retention for his own use, or both;

c.   Will consist of a digital data stream recorded on an optical or magnetic medium, but not paper, electronically displayed by the Electronic Display System in terms of text and graphics;

d.   Will be optimally formatted and styled for screen presentation (i.e., "frame oriented" rather than "paper oriented").

e.   Will be constructed for electronic display on a highly interactive Electronic Display System, which will support related logistic-support functions and which may be networked for interface with other Service Information Management Systems.

2.2 IETM PROCUREMENT OPTIONS

Logistic-support procedures for weapon systems and related equipment differ to some extent among the Services. A certain amount of necessary variation in the acquisition procedures involving the VPs, the IETMDB, and the EDS has been provided in the system of Specifications and Acquisition Handbooks developed by the IETM Working Group.

Thus, these Specifications and Handbooks detail several optional approaches in the acquisition of IETMs. These are as follows:

a.	Using appropriate IETM Specifications, the Service may buy whatever directly-authored Interactive Electronic Technical Manuals are required. Although the Author (equipment Prime Contractor) will need to establish an automated equipment or weapon-system (source) Data Base, this Data Base will not be acquired by the Government, but will be maintained and used by the Contractor, both for the preparation of IETMs and for other purposes.

(1) As an option, the Government might contract for on-line access to technical portions of this Contractor-owned Data Base. In such a case, both content and accessibility aspects of the IETM Data Base would have to be constructed to standard requirements.

b.	Acquisition by the Government of directly authored IETMs (fully prepared and validated by the Contractor) as well as the IETM Data Base upon which they are based. Government acquisition of the IETM Data Base may involve either of the following options:

(1) Delivery to the Government in standardized form and subsequent maintenance by the Government (with or without update information supplied on a continuing basis by the Contractor);

(2) Title acquired to the IETM Data Base by the Government, but with the Data Base retained and maintained in the Contractor's plant. The Government to be provided with on-line access to the Data Base.

c.   Based on acquisition of the IETM Data Base, using
either option b.(1) or b.(2), preparation of View
Packages using either a fully automated process or one
which is essentially fully automated. View Packages
could be prepared either:

(1) By the Contractor [based on Data-Base acquisition
    option b.(1)], and delivered as such to the
    Government, or

(2) By the Government [based on Data-Base acquisition
    option b.(2)].

2.3 SUMMARY AND PURPOSE OF THE DRAFT ACQUISITION
SPECIFICATIONS AND HANDBOOKS PREPARED BY THE TRI-SERVICE
IETM WORKING GROUP

As noted, five draft Specifications and Handbooks have
been prepared, and circulated widely for DOD and Industry
comment, to provide System Acquisition Managers with the
necessary contractual documentation for acquisition of
Interactive Electronic Technical Manuals, the associated source
Data Base, and the necessary Electronic Display Systems. These
statements of requirements are preliminary and will certainly
be modified as experience is gained with the acquisition,
management, and use of this type of Technical Information, as
the technology advances, and as the Department of Defense
improves its in-house logistic-support infrastructure for
support of IETMs.

The five draft Specifications and Handbooks prepared by
the Inter-Service IETM Working Group (of which Appendix A of

this Report is one), together with individual statements of the purpose of each document, are as follows:

2.3.1 The Revisable IETM Data Base Specification

2.3.1.1 Title

Draft MIL-D-IETMDB. *Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs)*. 1 June 1990.

2.3.1.2 Purpose

This Specification contains the requirements for a Revisable Interactive Electronic Technical Manual Data Base (IETMDB) to be constructed by a weapon-system Contractor. This non-redundant and neutrally formatted Data Base is intended to be the single source of data for all Technical Manuals to be used in support of a given weapon system, or other equipment being acquired by the Government. This Specification may be used in two primary modes:

    a. as a set of standard requirements to which the Contractor must adhere in the development and maintenance of his internal Data Base for subsequent conversion to Government-deliverable form; and

    b. as a set of requirements for a Data Base that is physically delivered to the Government, or is maintained by the Contractor on behalf of the Government.

2.3.2 The IETM General Content, Style, Format, and User-Interaction Requirements Specification

2.3.2.1 Title

Draft MIL-M-GCSFUI. *Manuals, Interactive Electronic Technical: General Content, Style, Format, and User-Interaction Requirements for.* 1 June 1990.

2.3.2.2 Purpose

This Specification contains common requirements for the Content, Style, Format, and User-Interaction features required for Interactive Electronic Technical Manuals and the operating software of the devices upon which they are viewed. These IETMs are to be delivered to the Government in digital form and must be designed for interactive display to the maintenance-technician end-user by means of a computer-controlled Electronic Display System. The range of IETMs for which general requirements are described in this Specification will cover the maintenance, diagnostic, training, system-operation, parts-information, and installation functions which are required to achieve and maintain full operational capability of a specific weapon system or other military equipment.

2.3.3 The IETM View Package Handbook

2.3.3.1 Title

Draft MIL-HDBK-IETMVP. *Guidelines for Developing Specifications for Interactive Electronic Technical Manual (IETM) View Packages.* 1 June 1990.

2.3.3.2 Purpose

The purpose of this Handbook is to provide guidance for the preparation of individual View-Package Specifications, so that System Acquisition Managers may define View Package Requirements quickly and effectively for the numerous different specialized increments of Technical Information which will be required. A Handbook of this type has been referred to as a meta-specification: a Specification describing how to write a View Package Specification which is the end-item Specification for procurement of an actual IETM.

2.3.4 The IETM QA Program Requirements Specification

2.3.4.1 Title

Draft MIL-M-IETMQA. *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information.* 1 June 1990.

2.3.4.2 Purpose

This Specification prescribes the requirements for a Contractor's QA program for Interactive Electronic Technical Manuals (IETMs) and, where procured, the associated IETM Data

Bases and supporting View Packages. The requirements herein cover the QA process and present the plan for implementing it, from planning through final submission of the delivered product for acceptance; they apply as well to changes and revisions thereto.

2.3.5 The Electronic Display System Handbook

2.3.5.1 Title

Draft MIL-HDBK-EDS (Navy). *Electronic Display System (EDS) for Interactive Electronic Technical Manuals (IETMs).* 1 June 1990.

2.3.5.2 Purpose

This Handbook describes the basic functional requirements for an Electronic Display System (EDS) designed to display Interactive Electronic Technical Manuals (IETMs). It establishes the minimum system requirements to be used in a detailed Specification for competitive procurement, either for portions of the full requirements or tailored to suit the application, user environment, device compatibility, and interfaces to existing computer systems.

The requirements described in this Handbook are of three types:

a. Those which describe the Electronic Display System hardware;

b. Those which describe the EDS software of the display System for system operation, IETM applications, and utility functions.

c. Those which specify the minimum performance of the several individual Display Devices which constitute the EDS.

To achieve full compatibility of the EDS with the IETMs and View Packages, the Display System Software (as well as the View Package) must also be constructed in compliance with MIL-M-GCSFUI.

Each of the three Services has its own strategies for developing Specifications and Standards for an Electronic Display System. This Handbook presents the existing Navy concepts, and is accordingly identified as a Navy-only document. Proposed concepts of the other Services which do not differ extensively from requirements described in this Handbook will be included in succeeding versions of the Handbook.

2.4 RELATIONSHIP OF MIL-M-IETMQA TO OVERALL SET OF IETM ACQUISITION SPECIFICATIONS AND HANDBOOKS

Each of the other four Acquisition Specifications or Handbooks in the IETM series provides requirements for a specific software product or software/hardware product (the EDS Handbook). It is the function of MIL-M-IETMQA to provide a contractual document to assure that the IETM products (IETMDB and VPs) are of high quality and in accordance with contractual requirements. QA procedures described by MIL-M-IETMQA do not apply to the Electronic Display System.

3.0 SUMMARY OF MIL-M-IETMQA,
QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR IETMs
AND ASSOCIATED TECHNICAL INFORMATION

3.1 QUALITY ASSURANCE PRINCIPLES FOR IETMS

As defined in connection with the preparation and delivery of Technical Information, Quality Assurance is a Contractor function. In general, whether the TI is intended for use on a paper medium, or constructed for interactive display as in the present case, the Contractor's QA program must monitor certain consignment and consecutive processes and assure that they are being carried out in a professional manner so as to provide a comprehensible quality product which is free from error. These processes are, in general:

a. Assembly of the required Technical Source Data required for system support;

b. Establishment of the necessary staff, automated authoring system, and clearly outlined procedures for generating and testing the TI;

c. Composing and reviewing the Technical Information;

d. Validation of the Technical Information;

e. Correction of errors found, and final inspection;

f. Support of the Government's Verification Process.

3.2 PHILOSOPHY OF QUALITY ASSURANCE PROCEDURES AS DESCRIBED BY MIL-M-IETMQA

The approach used by MIL-M-IETMQA in establishing requirements for IETM Quality Assurance procedures follows closely that of the existing Quality Assurance Specifications MIL-Q-9858, Quality Program Requirements (which applies to hardware equipment) and MIL-M-85357, Manuals, Technical: Quality Assurance Program, Requirements for (which applies to paper Technical Manuals).

In both of these Specifications, emphasis is given to establishment of a program of QA surveillance from the initiation of the equipment-manufacturing or TM-generation process rather than establishment of inspection procedures late in the fabrication sequence, where much time and effort may have been uselessly applied to the production or TM-generation process.

3.3 DIFFERENCES BETWEEN QA FOR IETMS AND QA FOR PAPER TECHNICAL MANUALS

Although the philosophy of Quality Assurance for Automated Technical Information is identical to that for paper Technical Information, QA procedures for IETMs differ from those for paper Technical Manuals in several important aspects:

a. Procedures must be established by the Contractor for assurance that the Source Data File, the IETMDB itself, conforms to Government Specifications (particularly as regards standardized access and interchange qualities); that it is complete; and that it is free from error.

b. Because of the possible use of highly automated procedures which may be used for generating View Packages, similarly automated QA methods must be developed and applied to assure that such View Packages are complete, comprehensible, and accurate.

c. QA must be performed using a specific Electronic Display System approved by the Government to assure that the Technical Information (and its interactive features) looks and responds to the Author and the QA organization in the same way as it will to the end user.

d. The entire IETM package generated, along with its auxiliary and interactive features, must be Validated as a system to assure proper display, support of related functions (e.g., maintenance and action reporting), and interfacing with other networked EDS units and Service Information Management Systems.

e. IETM QA involves control and Validation of certain software processes (e.g., a View Package Compilation algorithm or applications routines incorporated into the IETM package). Approved, computer programs to accomplish this software testing will be required.

f. The Contractor will be required to generate the IETMs by means of an automated authoring system, with sufficient capability to carry out the complex interactive functions required by the IETM suite of Specifications and Handbooks.

At the same time, the computer-controlled nature of IETMs offers the possibility, far more than in the case of paper TI,

of developing computer software to carry out extensive QA tests of all aspects of the TI.

3.4 THE APPROACH TO QA ADOPTED BY MIL-M-IETMQA

The Contractor's QA procedure is controlled by MIL-M-IETMQA through the requirement that the Contractor prepare, as part of his Prime Equipment Bid Package, a Quality Assurance Program Plan (QAPP). Once approved (accepted) by the Government, this QAPP will be made part of the Contract (part of the Contractual Statement of Work), and will be used as the basis for continued QA inspections by the Contractor's QA organization, which must be separate from the Contractor's TI-generation staff.

Requirements for inspections and procedures to be included by the Contractor are provided in detail (in 14 areas) by MIL-M-IETMQA (Section 3.1.1 of the Specification).

3.5 VALIDATION

Central to the entire QA process is the emphasis of MIL-M-IETMQA on a careful Validation process. It requires preparation of a Validation Plan, a Prevalidation Certification, and Validation of the IETM (and the IETMDB) using individuals similar in training and experience to intended end users of the IETM. Of particular importance are the requirements for Validation of the automated View Package Compilation Process, when such a process is used (Section 3.5.2), and for Validation of the entire IETM System (Section 3.5.3). Validation is to be followed by correction of

errors found, and a thorough post-Validation review (Section 3.5 of the Specification) of the IETM.

The Validation is to be performed using an EDS identical to the equipment which will ultimately be used to display the IETM.

3.5.1 Validation of IETM.

Validation of IETM, which is to be undertaken only after Contractor certification that the IETM is ready for Validation, is to be performed by individuals who are of approximately the same education, experience, and skill level as the actual target audience for the IETM. The Validator must use a Government-specified Electronic Display Device to establish a display mode identical to that involved in Fleet use. An operational environment must be used, if possible, or simulated, if practicable.

3.5.2 Validation of View-Package Compilation Process

One of the options in acquiring Interactive Electronic Technical Manuals involves use of the IETM Data Base as the source of Technical Information which will be assembled automatically (i.e., by use of a pre-prepared computer program), or nearly automatically, into individual View Packages, as described in MIL-HDBK-IETMVP. Contractor-generated algorithms, and software developed for preparation of individual View Package configurations must be Validated.

In carrying out this Validation, the Contractor must demonstrate the capability of the Contractor-generated programs to extract appropriate (defined) information entities from the IETMDB, to structure them into coherent procedural or descriptive Technical Information, and to format this TI for display to the end user using a Government-specified or Government-furnished Electronic Display Device.

The Validation must include a complete exercise of all TI sequences (procedural, descriptive, or fault-isolation) contained in the View Package; i.e., the Contractor must Validate the compilation process by Validating the functionality of the compiled product.

3.5.3 IETM System Validation

In addition to Validating the individual tasks and non-procedural data of the entire IETM, the Contractor must also Validate the entire IETM system, with its various utilities and special functions. This IETM system Validation will consist of two parts: (1) A demonstration of the system, and (2) System software tests.

3.5.3.1 IETM System Demonstration

The Contractor must demonstrate the hardware and software accuracy, capabilities, and compatibility of the field version of the IETM system with Government systems and contractual requirements. Specifically, the IETM system demonstration must:

a. Be performed entirely on an EDS which is approved by the Government;

b. Demonstrate the system's compliance with applicable Specifications and compatibility with Government systems;

c. Demonstrate maintenance tasks, displayed for a selected sampling of the various subsystems of the equipment involved, in various levels of complexity;

d. Introduce a selected sampling of simulated faults to exercise the retrieval capabilities (linking) of the system;

e. Demonstrate all system utilities and special functions, including ad hoc user access to data; and

f. Demonstrate the general visibility and readability of the IETM data as displayed on the Government-furnished EDS.

3.5.3.2 System Software Tests

The Contractor must develop a software routine capable of exhaustively testing the IETM system. This program, to be in accordance with MIL-STD-2167 and MIL-STD-2168, must, as a minimum:

a. Check that all data access links and branches are valid and operable;

b. Verify that there are no "open loops" in the fault isolation tasks (i.e., that each task ends in a single

resolution, and each retrieval string ends in isolation and repair of a discrete fault);

c. Verify that there are no unreferenced or inaccessible data in the system; and

d. Check that all special functions are fully operable.

3.5.4 <u>Validation of the IETM Data Base</u>.

When required by the Contract, the Contractor must deliver, as an adjunct to the IETM, an IETM Data Base, as described in MIL-M-IETMDB. This extensive automated Data Base consists of (1) a wide variety of information entities related to the weapon system (or other equipment); (2) a series of assigned information-entity attributes; and (3) a series of defined relationships linking the information entities. Validation of this Data Base will normally represent the final action in the QA chain, which has been exercised during the assembly of the Data Base from source data, and its organization into a form which conforms to the requirements of MIL-M-IETMDB.

3.6 REQUIREMENT FOR DESCRIPTION OF AUTOMATED AUTHORING SYSTEMS

The Specification does not designate use of any specific type of IETM authoring system. However, it requires that the Contractor's Quality Assurance Program Plan provide a description of the automated IETM authoring system intended for Contractor use, sufficient to demonstrate to the Government the capability of the authoring system to:

a. Support Technical Manual Planning and Control.

b. Automatically capture data from a wide variety of computerized Data Bases, including text, graphics, and tables.

c. Create and change Technical Information, including text, graphics (both vector and bit-map), and tabular data; and the ability to merge these information elements into a single composite element.

d. Provide flexible access by the Author to files in the Data Base he has assembled for preparing the IETM and any associated TI.

e. Provide prompts to the Author; e.g., to propose proper sequences of writing, to identify omissions in pre-established plans, and to identify faulty authoring logic.

f. Provide the Author with a view of his finished product in a form identical to that in which it will be viewed by the end user; (i.e., a full WYSIWYG "What You See Is What You Get" capability).

To accomplish these functions, the Contractor's authoring system will be required to contain the software necessary to provide the internal linking (providing the information-access sequences) of the IETM and associated IETM Data Base.

3.7 REQUIRED COMPATIBILITY BETWEEN THE IETM AND THE ELECTRONIC DISPLAY SYSTEM (EDS)

The Specification includes the requirements that essentially the entire Quality Assurance process be designed to demonstrate the compatibility of the IETMs to be generated with the EDS upon which the end user will display the Technical Information. The Contractor's plan for obtaining the required Government-furnished EDS for this purpose must be described in the QAPP (Section 3.1.7 of the Specification). The appropriate EDS is thus to be used to carry out Contractor Quality Reviews at In Process Reviews, and, of particular importance, during Validation.

3.8 ADDITIONAL CHARACTERISTICS OF MIL-M-IETMQA

Through enforcement of the QAPP, MIL-M-IETMQA requires also the following:

a. Monitoring to assure that all system support data sources are fully utilized, particularly the LSAR;

b. The performance of Contractor Quality Reviews supplemented by Government-chaired In-Process Audits (IPAs);

c. Control of Subcontractors and Vendors;

d. Preparation of a Verification support plan.

In an Appendix, the Specification MIL-M-IETMQA summarizes the Government's proposed IETM Acceptance Tests for information purposes, to acquaint an IETM Contractor with the nature of the

inspection which his IETM (and VPs and IETMBD) must pass once
it is delivered to the Government.

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APPENDIX A

Copy of Draft Military Specification MIL-M-IETMQA. *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs) and Associated Technical Information.* 1 June 1990.

Prior to the publication of this report the document included as Appendix A has been officially submitted to the DOD Defense Quality Standardization Office and the DOD CALS Policy Office by the Office of the Chief of Naval Operations, Code 403 - Logistics Policy (OPNAV LTR 4160 Ser 403T/OU593187 dtd 4 Jun 1990). It has also been submitted to the Pageless Technical Manual Working Group of the Aerospace Industry Association for Review and Comment. This document was distributed as a review draft and is largely a DTRC product with assistance from the Air Force as noted. This Appendix is in the exact form that was submitted to these organizations.

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NOTE: This draft, dated 30 May 1990, prepared by DTRC/AFHRL/AFLC, has not been approved and is subject to change. DO NOT USE FOR ACQUISITION PURPOSES.

MILITARY SPECIFICATION

QUALITY ASSURANCE (QA) PROGRAM REQUIREMENTS FOR INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs) AND ASSOCIATED TECHNICAL INFORMATION

Table of Contents

MILITARY SPECIFICATION

QUALITY ASSURANCE (QA) PROGRAM REQUIREMENTS FOR INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs) AND ASSOCIATED TECHNICAL INFORMATION

1. SCOPE

1.1 <u>Overview</u>. This Specification prescribes the requirements for a Contractor's QA program for Interactive Electronic Technical Manuals (IETMs) and, where procured, the associated IETM Data Bases and supporting View Packages. The requirements herein cover the QA process from planning through final submission of the delivered product for acceptance; and apply as well to changes and revisions thereto. This Specification provides detailed requirements for:

    a.   Preparation of a Quality Assurance Program Plan (QAPP);

    b.   Participation in a Guidance and Quality Planning Conference;

    c.   In-Process Audits (IPA's) of products and processes including compatibility of IETM's with a Government-specified Electronic Display Device (EDD); this compatibility to be demonstrated during IPAs and during Validation;

    d.   Participation in Government-conducted In-Process Audits (IPAs);

    e.   Validation of the IETMs and related Technical Information;

    f.   Preparation of a Verification Support Plan; and

    g.   Retention and analysis of QA records.

1.2 <u>Applicability</u>. This Specification, when invoked in the Contract or other contractual document, applies to a given IETM procurement. It is not intended to apply to procurement of commercial and off-the-shelf Technical Manuals.

1.3 <u>Contractual Intent</u>.

1.3.1 <u>Contractor Surveillance</u>. The Contractor shall carry out his QA Program in accordance with his QAPP as submitted to, and approved by, the Government, and incorporated into the procurement contract. The Contractor's QA organization shall perform surveillance activities to ensure compliance with the approved QAPP, applicable IETM specifications, and other contractual documents. These activities shall commence early in

the IETM-generation process and continue throughout the procurement. (See 3.3.3.)

1.3.2 <u>Government Surveillance</u>. The Contractor shall participate in a Guidance and Quality Planning Conference to be conducted by the Government (See 3.2), and in a series of Government-conducted In-Process Audits (IPAs) at scheduled intervals throughout the term of the Contract. (See 3.3.2.) The purpose of these IPAs is to ensure that the Contractor is complying with the approved QAPP, and that contractually required deliverables meet applicable IETM specifications and other contract requirements.

1.3.3 <u>Responsibility for Inspection</u>. Unless otherwise specified in the Contract or order, the Contractor is responsible for the performance of all inspections as specified herein. The Contractor shall use his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform also at its discretion any of the inspections set forth in the approved QAPP, applicable IETM specifications, and other contract documents where such inspections are deemed desirable to assure that supplies and services conform to contract requirements.

1.4 <u>Records of Information</u>. Records of QA inspections shall be kept and made available to the Government (See 3.2, 3.3, 3.4, 3.5).

2. <u>APPLICABLE DOCUMENTS</u>

2.1 <u>Government Documents</u>. The following documents of issue in effect on the date of invitation for bid or request for proposal form part of this Specification to the extent specified herein. Specification and Standard issues shall be those listed in that issue of the Department of Defense Index of Specifications and Standards (DODISS) specified in the applicable contract.

2.1.1 <u>Specifications, Standards and Handbooks</u>.

2.1.1.1 <u>Specifications</u>.

MIL-Q-9858   Quality Program Requirements

MIL-M-GCSFUI Manuals, Interactive Electronic Technical: General Content, Style, Format, and User Interaction, Requirements for

MIL-M-IETMDB Manuals, Interactive Electronic Technical, Revisable Data Base for Support of

2.1.1.2 <u>Standards</u>.

    MIL-STD-109   Quality Assurance Terms and Definitions.

    MIL-STD-1388-?A   Logistic Support Analysis Record, DoD Requirements for

    MIL-STD-1840 Automated Interchange of Technical Information

    DOD-STD-2167 Defense System Software Development

    DOD-STD-2168 Defense System Software Quality Program

2.1.1.3 <u>Other Government Documents</u>.

    MIL-HDBK-EDS (NAVY) Electronic Display System for (Navy) Interactive Electronic Technical Manuals.

    MIL-HDBK-IETMVP   Preparation of View Packages in Support of Interactive Electronic Technical Manuals

2.2 <u>Other Documents</u>.

2.3 <u>Order of Precedence</u>. In the event of a conflict between the text of this Specification and the references cited herein, the text of this Specification shall take precedence.

3. <u>REQUIREMENTS</u>

3.1 <u>IETM Quality Assurance Program</u>. The Contractor shall establish a QA program in accordance with the requirements of this specification, which supplements and details the requirements of MIL-Q-9858, to ensure the development of technically accurate and complete IETMs. Terminology shall follow MIL-STD-109, except where superseded by the terminology of this Specification. Quality Assurance procedures for software, developed in accordance with DOD-STD-2167 and delivered as part of the IETM and associated Technical Information (for example, the IETM Data Base and supporting View Packages where ordered) shall conform to the requirements of DOD-STD-2168. The Contractor's QA program shall encompass the accountability for, and development of, QA functions required for the management of the following IETM program elements:

    a.   Source data;

    b.   Intermediate products, including IPAs;

c.   Graphics;

d.   System software;

e.   Database integrity;

f.   Authoring system;

g.   Validation;

h.   Records;

i.   Contractor operating procedures;

j.   Verification support; and

k.   Final product.

3.1.1 IETM Quality Assurance Program Plan (QAPP). The Contractor shall prepare a Quality Assurance Program Plan (QAPP) in accordance with the requirements of this Specification. The QAPP shall describe the scope and approach of the Contractor's IETM QA Program. The QAPP shall include:

a.   A list of all contractually deliverable IETM items.

b.   QA Structure and Organization and its functional relationship to the IETM-Generation Organization.

c.   Description of the Authoring system.

d.   Word Lists

e.   Describe a plan for obtaining and using a Government-specified or Government-furnished Electronic Display Device and associated View Package if required for Quality Reviews, prevalidation, and Validation.

f.   A listing of the Contractor's written operating procedures

g.   A listing of audit procedures for quality reviews

h.   A listing of critical operations involved in IETM generation.

i.   Audit procedures for each IETM deliverable

j.   Subcontractor and Vendor control Plan

k.   Sampling inspection plan

l.   Description of computer-supported inspection and validation procedures using the Government-approved Electronic Delivery/Display Device (EDD)

m.   Validation Plan

n.   Verification Support Plan

3.1.2 Implementation of QAPP. The Contractor shall submit the QAPP to the Government for approval. The Government will furnish written notice of the acceptability of the Contractor's QAPP. The QA Program, as approved by the Government through review of the QAPP, shall be fully implemented by the Contractor. This implementation shall be evidenced by establishment of the following:

a.   Comprehensive Contractor operating instructions for all procedures related to development of IETMs;

b.   In-Process Audit (IPA) procedures and records;

c.   Data and system software validation procedures;

d.   Corrective and preventive action procedures; and

e.   Management support of the QA program.

3.1.3 Identification of Contractually Deliverable Items. The first part of the QAPP identifies the scope of the QA effort by identifying all contractually deliverable items, the Contract Specifications with which they must comply, and the schedule for their inspection and delivery. The QAPP shall list:

a.   All interim and final deliverables in complete correspondence with the Contract Data Requirements list (CDRL) of the Contract.

b.   Specifications with which each deliverable item listed in 3.1.1 a. must comply in order to be in complete correspondence with the Contract.

c.   A preliminary schedule for each deliverable item listed in complete correspondence with the Contract; any schedule changes (early or late accomplishment) anticipated by the Contractor shall be indicated. The schedule for each IETM deliverable item shall include the following:

(1) Conduct of Government IPAs (including review of interim deliverables).
(2) Inspection(s).
(3) Validation.
(4) TM Readiness for Verification (proposed start of Verification).
(5) Estimated Date of Readiness for Delivery.
(6) Any other Contractually Required Milestone.

3.1.4 **QA Structure and Organization**. The Contractor's QA organization shall have the responsibility for implementation, administration, and conduct of the QA program. It shall function as the point of contact between the Contractor and the Government in all matters related to QA.

3.1.4.1 **Functional Relationships**. The Contractor shall describe the structure and functional relationships of the QA organization.

3.1.4.2 **Personnel**. The Contractor's organization shall be staffed by an adequate number of QA personnel qualified to implement their responsibilities. The Quality Assurance personnel shall be independent from the IETM-generation personnel. (This requirement does not intend to suggest, however, that fulfillment of the requirements of this Specification is the responsibility of any specific Contractor organization, function, or person.) The Contractor's IETM Quality Assurance personnel shall have well-defined responsibilities; authority to identify and evaluate Quality Assurance problems; and methods to initiate, recommend, or provide solutions and corrective actions as indicated. The QAPP shall:

    a.   Contain a schedule which shows the estimated number of personnel per month that the Contractor will use to accomplish the Quality Assurance tasks under the Contract;

    b.   Explain how the Contractor's QA personnel are organized to retain their independence from personnel responsible for IETM generation, so as to be able to carry out their QA responsibilities in an objective manner.

3.1.5 **Description of the Authoring System**. The QAPP shall state that the Authoring System contains, as a minimum, the following features:

    a.   Capability to support Technical Manual Planning and Control.

    b.   Automated capturing of data from a wide variety of computerized data bases, including text, graphics, and tables.

    c.   Ability to create and change Technical Information, including text, graphics (both vector and bit map), and tabular data; and the ability to merge these information elements into a single composite element.

    d.   Highly flexible access by the Author to files in the data base he has assembled for preparing the IETM and any associated TI.

    e.   Software necessary to provide the internal linking (providing the information-access sequences) of the IETM and associated IETM Data Base.

f.   Ability to provide prompts to the Author; e.g., to propose proper sequences of writing, to identify omissions in pre-established plans, and to identify faulty authoring logic.

g.   Capability to provide the Author with a view of his finished product in a form identical to that in which it will be viewed by the end user; (i.e., a full WYSIWYG "What You See Is What You Get" capability).

3.1.6   <u>Word List</u>.   The contractor shall describe in the QAPP the Contractor's approach to, and identify software for comparison of, authored text with a Government-approved word list (See 3.1.8.6); and describe the Contractor's plan for identifying and obtaining Government approval for use of words considered necessary but which are not on the Government-approved word list.   The QAPP shall also include the Contractor's recommendations for the "system-specific" word list, which will supplement the "Common" and "Technical Area" word lists.

3.1.7   <u>Display Device</u>.   The Contractor shall describe a plan for obtaining and using a Government-specified or Government-furnished Electronic Display Device and associated View Package, if required, for Quality Reviews, Prevalidation, and Validation.   Government specifications for the display device include both hardware and software.

3.1.8   <u>Written Operating Procedures</u>.   Writers, editors, illustrators, typists, vendors, and others at all stages of IETM generation shall operate in accordance with written procedures. These procedures shall be approved by the QA organization prior to their implementation.   Portions of these procedures which relate directly to product quality shall be cited in the QAPP.   Such procedures shall be originated, revised, and controlled within the framework of the overall Quality Assurance Program, and shall be reviewed, evaluated, and up-dated as required to assure that they reflect current practices and that compliance with these procedures results in production of a quality product.

3.1.8.1   <u>Style Guides</u>.   In-house style guides provide written standards for Technical Manual·personnel and are required for the generation of well-written TMs.   If these guides already exist in a form adaptable to contract needs (i.e., in a form which supports Technical Manual creation for interactive electronic display, not paper pages), they may be used either as-is or with only minor modifications, provided also that they are consistent with the Format and Style Requirements expressed in MIL-M-GCSFUI, which may be used in place of existing company style guides. In-house or other style guides the Contractor proposes to use shall be cited in the QAPP.

3.1.8.2   <u>Procedures List</u>.   The QAPP shall list (by name, number, and date) the Contractor's written procedures for the generation of IETM information; at a minimum, the Contractor shall have written procedures in the following areas:

    (1)   Source-data control
    (2)   Inspection of deliverables
    (3)   Validation of procedural and non-procedural Technical
          Information (TI)
    (4)   Critical-operation inspections
    (5)   Contract changes
    (6)   Evaluation, review, and update of organizational operating
          procedures
    (7)   Maintenance of Quality Assurance records
    (8)   Government correspondence control

3.1.8.3   <u>Source Data</u>. The QAPP shall describe plans to ensure that the most current source data are available and utilized for IETM generation (See 3.1.8.2). The following are examples of the types of items and control documents that are considered appropriate Technical Information (TI) source data:

<u>Description of Source Data</u>

    (1) Logistics Support Analysis Record (LSAR)
    (2) Procurement and test specifications
    (3) Technical descriptions contained in project proposal
    (4) Photos of mockups or equipment
    (5) Support-equipment description data
    (6) Task-analysis data
    (7) Maintenance concepts
    (8) Special user-personnel qualifications
    (9) Notes and materials from vendors
  (10) Failure Modes and Effects Analysis (FMEA) data
  (11) Engineering reports
  (12) Blueprints/drawings/sketches
  (13) Vendor brochures and commercial manuals
  (14) Engineering Change Proposals (ECPs)
  (15) Maintenance Engineering Analysis Records (MEARs)
  (16) System and Subsystem
  (17) Support Equipment Requirement Sheets (SERS)
  (18) Provisioning Parts Breakdowns (PPBs)
  (19) Development hardware location and availability
  (20) Classification data (DD254)
  (21) Local Engineering Specifications (LES)
  (22) Manual Change Releases (MCR)
  (23) Technical Information Deficiency and Evaluation Reports
        (TIDERs)
  (24) Validation results
  (25) Verification results
  (26) Design Changes Notices (DCN)
  (27) Supply Item Change Requests (SICR)
  (28) Advance Change Notices (ACNs)

3.1.8.4 <u>LSA/LSAR</u>. The QAPP shall specifically include a plan to assure that direct (on-line) communication exists between the LSAR and the IETM authoring system, and that the LSAR is carefully followed in constructing the IETM.

3.1.8.5 <u>Drawings</u>. The QAPP shall include measures proposed by the Contractor to assure the effective use of design and manufacturing drawings (e.g., level III drawings) for the IETM generation without the necessity to completely redraft the drawings.

3.1.8.6 <u>Word Lists</u>. The QAPP shall incorporate a listing of the approved Government Word Lists to be used by the Contractor in generation of the IETM.

3.1.9 <u>Contractor Quality Reviews</u>. Many operations in the IETM-production process require inspection so as to discover and correct any TI defects. In these critical operations, it is least expensive to correct defects at an early phase, rather than later in the IETM-generation process. For example, proofreading and typographical-error correction are most cost-effectively accomplished immediately upon completion of text authoring. (These processes may be simplified by incorporation of automated spell-checkers, permissible word lists, and automated syntax-control routines into the automated authoring process.) Similarly, early examination of pencil sketches or proposed layouts, and early correction of identified errors, is cost effective than making corrections to the final ink drawing. Accordingly:

    a.   The QAPP shall list the Contractor's written quality review procedures by name, number, and date. At a minimum, the list shall contain written, critical-operation inspection procedures in the following areas:

        (1) Proofreading
        (2) Check of prepared graphics versus the writer's input
        (3) Editorial review of author's text-graphics module layouts.

    b.   The Contractor's quality review procedures shall contain records which include the name of the review, review date, name and number of the item prepared, method used the correct the material, the name of the inspector (proofreader, editor, etc.), and certification that all errors found were corrected.

    c.   The QAPP shall contain procedures which will define how the contractor assures:

        (1) Maintenance procedures shall have all input conditions explicitly identified. The steps contained in the maintenance procedures shall use concise text and simple graphics to instruct the user. Tasks shall be cross-referenced with appropriate descriptive, troubleshooting, parts, and operational information.

        (2) Steps within a maintenance procedure shall be presented sequentially and in their entirety. Information that is not applicable because of information track or weapon system configuration shall not be displayed. All warnings, notes and

cautions associated with a maintenance action shall be presented so that the user is aware of all potentially dangerous actions. Maintenance procedures shall be presented as the technical writer originally intended them to be presented.

3.1.10 <u>Critical Operation Inspection</u>. Critical operation inspections are IPAs conducted early in the development process when QA processes are most beneficial and cost-effective. For example, a prevalidation inspection of IETM data could allow detection and relatively easy correction of problems which might otherwise cause the termination of a validation procedure. The QAPP shall incorporate a provision for a final (pre-delivery) review, as described in Section 3.5. The QAPP shall identify the Contractor's critical operation inspections, including the phase to which they will be applied, and the intent and scope of the inspections.

3.1.11 <u>Audits for IETM deliverables</u>. The contractor shall describe the audit procedures for each IETM deliverable to ensure compliance with its contractual specifications. The contractor shall also explain procedures for maintaining records of defects found and corrective actions taken.

3.1.12 <u>Control of Subcontractors and Vendors</u>. The Contractor shall describe the approach by which he will ensure that IETM products prepared by subcontractors and vendors satisfy all the contractual quality requirements. The Contractor may: (1) require that the subcontractor or vendor prepare and follow a QAPP using this Specification; (2) perform a receiving inspection to ensure that work accomplished under the subcontractor's own QA plan meets the requirements of this Specification; or (3) establish a procedure to transform vendor input into a form which meets Contract requirements. The Contractor's QAPP shall describe the approach by which he will ensure compliance of subcontractor or vendor products with contractual quality requirements.

3.1.13 <u>Sampling Inspection Plan</u>. The contractor shall describe the overall sampling inspection plan.

3.1.14 <u>Electronic Delivery/Display Device (EDD) Validation Procedures</u>. The contractor shall describe the computer-supported inspection and validation procedures using the Government-approved Electronic Delivery/Display Device.

3.1.15 <u>Validation Plan</u>. The Contractor shall prepare a Validation Plan which covers each IETM item and details the anticipated schedule, requirements, and procedures for performing this Quality Assurance function. This Validation Plan is an interim deliverable, part of the QAPP, and forms part of the contract requirements.

3.1.16   <u>Verification Support Plan</u>.   The Contractor shall develop a verification support plan, describing the Contractor's general approach to supporting a Government-conducted verification. The plan shall be reviewed and approved by the Government. The Contractor shall prepare a supplement to the verification plan, detailing the plan for providing contractor support of the verification effort.

3.2   <u>Guidance and Quality Planning Conference</u>.   A Guidance and Quality Planning Conference, convened by the Contractor, will be conducted by the Government TM Logistics Element Manager at the start of work to review the Contractor's understanding of applicable specifications, formal instructions, established policies, and program requirements.

3.2.1   <u>Schedule</u>.   The Conference shall be held within 45 days of contract award. Attendance should include all Government and Contractor personnel who will be involved in the specific QA program. Anticipated Quality Assurance problems will be identified and resolved at this Conference, by either the Contractor or Government.

3.2.2   <u>QAPP</u>.   The Contractor shall explain his QAPP at the Quality Assurance Planning Conference, showing:

   (1)   how the QAPP meets all of the requirements of this Specification (Section 3.1); and

   (2)   how the Quality Assurance Plan will function to assure a quality product in accordance with Contract Specifications.

3.3   <u>In-Process Audits (IPAs)</u>.   Audits shall be conducted to enable the Contractor's Quality Assurance personnel or the Government to verify that the QAPP is being properly followed, product quality reviews are being correctly implemented, defects are being identified, and appropriate corrective actions are being taken.

3.3.1   <u>Initial Government IPA</u>.   During the initial (Government) IPA, the Contractor shall provide specific demonstrations of the following:

   a.   The use of the authoring system to be employed in generating the IETM, including a demonstration that the authoring-system functions described in the QAPP are in working order and are being used in the IETM-generation process. Relationship of the IETM-authoring process to acquisition and use of relevant source data (particularly the LSAR) shall be specifically addressed.

   b.   Use of the approved Government-specified or Government-furnished Electronic Display System which the Contractor intends to use for Quality Assurance Checks, for Validation, and for Final-Draft Inspection.

c. The approved-word-list comparison routines which the Contractor intends to use during the IETM-generation process. The three Word Lists themselves ("Common", "Technological Area", and "System Specific") shall also be demonstrated.

3.3.2 <u>Government Audits</u>. The Contractor shall make available to the Government its Quality Assurance records for interim and final deliverables, at scheduled In-Process Audits (IPAs) to enable the Government to ensure that the QAPP is both implemented and effective. The Contractor shall also support the Government-conducted IPAs by providing access to finished deliverables, validated Technical Information, and other quality-assurance records as specified in the QAPP. Access to Contractor-generated TI material shall be provided for Government audit by means of the approved Government-specified Electronic Display Device cited in Section 1.1 and described in the QAPP.

3.3.2.1 <u>Location</u>. Unless otherwise specified, Government IPAs will be conducted at the Contractor's facility. The IPAs will be chaired by the Government IETM QA representative. At the IPA, the Contractor shall present the Contractor's Quality Assurance records for Government audit to ensure: (1) that required inspections are being carried out in accordance with the QAPP: (2) that all defects discovered by the inspections were recorded and corrected; and (3) that all contractually required deliverables are being inspected and meet contractual standards.

3.3.2.2 <u>Validation Listing</u>. Government personnel shall be provided with a complete listing of all Technical Information which has been Validated prior to the commencement of the IPA. Validated TI shall prove to be logical, complete, safe, and technically accurate. Validated procedural TI must lead to successful accomplishment of the procedures by personnel who are representative of the intended users, with the information presented by means of a Government-specified Electronic Display Device. Audited Validation records shall accurately record the Validation efforts. (See 3.4.3 through 3.4.6)

3.3.2.3 <u>Inspections</u>. The Government reserves the right to make any inspection it deems necessary to assure that IETM delivered is of high quality. Government participation in the Quality Assurance process (including inspection and acceptance of the final product) will generally be exercised by means of Audits of the Contractor's Quality Assurance actions to ensure that the required inspections have been properly made. This shifts the emphasis from previously conducted In Process Reviews (IPRs) in which Government Inspection involved detailed assessment of product quality at an intermediate level of production, to a procedure which focuses Government attention on evaluation of the effectiveness of the Contractor's QA procedures as described in the QAPP.

3.3.3 <u>Contractor Audits</u>. The Contractor auditing process is a continuous effort designed to ensure that Contractor personnel responsible for TI generation are following the QAPP and applicable work instructions. Any deviations from the QAPP shall be explained in the Contractor audit records and corrected if they represent a hindrance to meeting contractual requirements.

3.3.3.1 <u>Contractor Audit Plan</u>. The Contractor is required to include in his QAPP a plan for auditing operating procedures, to assure proper performance of all actions described in the QAPP, and required by Sections 3.1 through 3.5 of this Specification.

3.3.3.2 <u>Audit Records</u>. The Contractor's auditing personnel shall maintain records documenting the periodic audits made. These records shall include:

(1) Name of the operation audited
(2) Date
(3) Name of auditors
(4) Defects found
(5) Method of defect correction or explanation for non-correction of defect
(6) Name of person making correction
(7) Name of person certifying that operation has been so modified, so as to be in accordance with the corrected written operating procedures.

3.4 <u>Validation</u>. The objective of Validation is to ensure that the Contractor has provided accurate and adequate IETMs, IETM Data Base, and required View Packages (if not provided by the government) for support of the equipment, in accordance with the approved Validation Plan. Validation shall be accomplished on all deliverables and changes thereto. The overall Validation process shall include the following steps:

(1) Preparation of a Validation Plan;

(2) Prevalidation Certification of TI;

(3) Validation;

(4) Validation of the IETM Data Base;

(5) Validation of View-Package Compilation Process;

(6) IETM System Validation.

3.4.1 <u>Validation Plan</u>. The Contractor shall prepare a Validation Plan which covers each IETM item and details the anticipated schedule, requirements, and procedures for performing this Quality Assurance function. This Validation Plan is an interim deliverable, part of the

QAPP, and forms part of the contract requirements. Specifically, a Validation Plan shall contain the following items:

(1) Titles and identification numbers of all deliverables to be Validated

(2) Schedules for Validation

(3) Cognizant Contractor organization and personnel responsible for accomplishing the Validation effort

(4) Site locations, support equipment, facilities, test equipment, materials, and tools required during Validation

(5) General characteristics relating to skill level of target audience personnel to be used in Validation of procedural TI.

(6) Next higher assembly(ies)/system(s) required to support the effort (e.g., if a procedure entails installing a black box on an aircraft, the aircraft or a mock-up of one is the next higher assembly)

(7) Associated TI recommended for concurrent or consecutive Validation

(8) Special safety precautions

(9) Any special environmental requirements

(10) Record-keeping system to be used in Validation of both procedural and non-procedural Technical Information (See paragraphs 3.4.3 through 3.4.5.)

(11) How Validation of procedures is to be accomplished

(12) A Fault-Simulation list for use in Validation of Troubleshooting procedures. (See 3.4.3.3)

(13) Approach to evaluation of usability of the IETM as generated by the Contractor; specifically, establishment of the adequacy and· accuracy of information-access procedures established by the author, and identification of any man-machine interface problems involving effective use of the IETM on the Government-specified Electronic Display Device.

(14) Application of results of Validation to the correction of deficiencies.

3.4.2 <u>Prevalidation Certification</u>. A Contractor's authorized technical representative shall inspect (i.e., "Prevalidate") the TI to ensure that it is complete, based on his knowledge and judgment. Based on his review, the Contractor shall certify that the TI permits efficient performance of the intended equipment-support functions for which the TI is designed.

Furthermore, the Contractor's authorized technical expert shall certify that the TI is safe, logical, and technically accurate.

3.4.2.1   **Prevalidation   Records**.   The   Contractor   shall   maintain Prevalidation records which include: the name of the authorized technical representative,   the   date   of   Certification,   and   name,   number,   and configuration of the deliverable item. The records shall also include the Certification by the authorized Contractor technical representative that each individual procedure is:

(1) Safe.   Danger to a user in the field is minimized when performing all procedures as written.

(2) Complete.   All steps necessary to the performance of the individual   procedure   have   been   included   and   the   procedure reflects the mission capability of the equipment.

(3) Logical.   The procedure is in an order which is the most efficient for completion of the maintenance or operation task.

(4) Technically Accurate. All operating procedures, fault-isolation procedures,   check-out   procedures,   alignment   procedures, calibration procedures, and system-descriptive statements, etc., are free of errors.

(5) Written in words included in the provided Word List, or otherwise approved by the Government.

3.4.2.2 **Certification Form**. The Contractor shall execute a Certification Form attesting to the adequacy and accuracy of the TI as stated above. The Certification shall be signed by an authorized Contractor representative. Individual errors noted during this process shall be corrected prior to Validation; alternatively, the whole TI item may be returned to the Author for improvement.

3.4.3 **Validation of IETM**. Validation of IETM shall be undertaken only after the Contractor's authorized technical representative has certified that the IETM is ready for Validation. The validation shall be performed by individuals who are of approximately the same education, experience, and skill level as the actual target audience for the IETM.   The Validator shall follow exactly the procedures set forth in the IETM and shall use a Government-specified Electronic Display Device to establish a display mode identical to that involved in Fleet use. An operational environment shall be used, if possible, or simulated, if practicable.

3.4.3.1 **Validation of Procedural TI**. Contractor personnel shall Validate each step in every procedure using a Display Device of the same type as that which will be used to display the IETM to the end user. The procedure shall be presented in final form exactly as it will be displayed to the end

user, with the same user-interface capabilities (i.e., input-output functions, special functions).

3.4.3.1.1 <u>Validation</u>. The Validator shall be able to perform the procedure without error. If for any reason a Validator fails to perform a procedure without error, the procedure shall be carefully analyzed for (a) technical errors and (b) incomprehensibility. If technical errors are found, corrections shall be made or alternative accurate TI shall be prepared and re-Validated. If portions of the TI are incomprehensible to the initial target-audience Validator, the procedure may be accepted if four additional target-audience Validators perform the procedure without error. If the procedure is reworked, the material shall be re-Validated with a new Validator. Minor corrections (which must be cited) may be made without re-Validation.

3.4.3.1.2 <u>Validation Records</u>. The Contractor shall keep Validation records for each item of Procedural TI. These records shall include the name of the Validator, his educational level, experience, and position classification, as well as the date, signature, identifying number, and configuration of the procedural TI Validated; method of correction used; and the signatures of both the person who made the correction (or other change) and the inspector who certified that all errors found were corrected. The records shall further include a copy of the procedure after any errors detected during Validation have been corrected and incorporated, and the procedure successfully Validated. Hand-annotated corrections are acceptable providing that they are fully legible and understandable by the Validator. When corrections are extensive, the material shall be reworked prior to re-certification and Revalidation.

3.4.3.2 <u>Validation of Non-Procedural TI</u>. The Validation of TI items which are not of a procedural nature, such as Descriptive Text, wire lists, schematics, IPB information, and the like, shall be accomplished by comparing them to the actual hardware or to applicable source data (reports, engineering drawings, etc.). This comparison shall be accomplished by Contractor personnel at the Contractor's facility, using a Display Device identical to that upon which the IETM will be displayed to the final user.

3.4.3.2.1 <u>Validation</u>. All non-procedural TI shall be Validated against the actual equipment when possible, or in unusual cases against source data, and shall correspond to it in all respects. If source data are used in the Validation process, the Contractor shall ensure that they correspond to the actual equipment. All defects (errors) shall be corrected. Validation of descriptive TI, where some basis of comparison is used other than the actual equipment, shall be approved by the Government.

3.4.3.2.2 <u>Validation Records</u>. Validation records for each item of non-procedural TI shall be kept by the Contractor. These records shall include

the signature of the Validator; date; name, number, and configuration of the TI; method of correction used; and the signatures of both the person who made the correction and the inspector who certified that all errors found were corrected.

3.4.3.3 <u>Validation of Troubleshooting Procedures</u>. Validation of major established branches of the Troubleshooting procedures shall be performed with the weapon-system hardware to which the Troubleshooting TI applies. This part of the validation effort, shall be performed in conjunction with (1) tabletop comparison with source data to ensure the accuracy and consistency of fault isolation paths, and (2) the IETM System Validation (see 3.4.6). This effort shall be planned and carried out so as to establish a high degree of confidence in the IETM troubleshooting procedures as a whole.

3.4.3.3.1 <u>Troubleshooting Procedures List</u>. The Contractor shall prepare a list of troubleshooting branches to be validated, and a list of proposed fault simulations to be used during Validation of Troubleshooting procedures. The list will include a wide variety of faults. It will be part of the Validation Plan of the QAPP. When the Validation Plan is approved, the list will be used to select faults to permit Validation of the Troubleshooting TI. The Fault-Simulation List shall contain:

a. Fault symptoms

b. Fault simulated

c. Fault to be inserted

3.4.3.3.2 **Example List**. The following is an example Fault Simulation List. Requirements cited under Section 3.4.3.1, Validation of Procedural TI, shall apply.

	SYMPTOM	**FAULT SIMULATED**	**FAULT INSERTED**
(1)	Hydraulic pump fails to run or makes abnormal noise	Defective turret-power relay box	Disconnect wires from relay on C/B in turret-power relay box
(2)	Hydraulic pump fails to run or makes abnormal noise	Defective pump motor	Open connection to brushes in pump motor.
		Defective pressure switch	Disconnect pressure switch.
		Low fluid level in reservoir	Reduce fluid level in reservoir below normal level.
(3)	System pressure is incorrect	Defective pressure switch	Install defective pressure switch

3.4.4 **Validation of the IETM Data Base**. When required by the Contract, the Contractor shall provide, as an adjunct to the IETM, an IETM Data Base, as described in MIL-M-IETMDB. This extensive automated data base consists of a wide variety of information elements related to the weapon-system (or other equipment), a series of assigned information element attributes, and a series of defined relationships linking the information elements. Validation of this data base will normally represent the final action in the QA chain, which has been exercised during the assembly of the Data Base from source data, and its organization into a form which conforms to the requirements of MIL-M-IETMDB.

3.4.4.1 **Validation Procedures**. Validation of the IETMDB shall be carried out procedurally (in accordance with 3.4) in the same fashion as the Validation of the several types of TI included in the IETM. Specifically, Validation of the IETMDB shall establish that the Contractor has successfully met the following four overall requirements in establishing the File:

(a) The IETMDB meets all specific requirements of MIL-M-IETMDB.

(b) All information contained in the IETMDB is technically accurate, based on comparison of the data elements with actual system hardware, or (where approved by the Government) with source data.

(c)   All relationships (established links), as defined in the Data Element Dictionary of the IETM Data Base, are in place and operable.

(d)   The IETMDB is capable of being used, in accordance with MIL-HDBK-IETMVP, to construct individual View Packages to support the Weapon System.   (See 3.4.5.)

3.4.4.1.1   Human Participation.   Requirements (a), (c), and (d), and to some extent (b), lend themselves to automated (computer-based) processes as the most effective method of assuring that the IETMDB meets the requirements cited.   It is not intended that the IETMDB Validation procedure be entirely automated; human participation in Validation is considered necessary, specifically in satisfying requirement (b) above.

3.4.4.1.2   QAPP.   The Con..ractor shall describe in the QAPP the technical approach proposed for Validation of this material.   The approach shall fully differentiate between computer-supported technical procedures, and those to be accomplished by humans.

3.4.4.1.3   Revalidation.   When the IETMDB is changed in any way after Validation, the changed material and other portions of the IETMDB affected shall be re-Validated.   This process shall assure that all linkages previously established are still operable and valid; specifically, that no effect on the accuracy of any related information has been adversely affected by the change.

3.4.5   Validation of View-Package Compilation Process.   One of the options involved in acquiring Interactive Electronic Technical Manuals involves use of the IETM Data Base as the source of Technical Information which will be assembled automatically, or nearly automatically, into individual View Packages, as described in MIL-HDBK-IETMVP.   If a Government View Package is not provided, the Contractor-generated algorithms and software for individual View-Package configurations shall be Validated.

3.4.5.1   Demonstration.   The Contractor shall provide complete demonstration of the capability of the Contractor-generated programs to extract appropriate (defined) information elements from the IETMDB, to compose their elements into coherent procedural or descriptive Technical Information, and to format this TI for display to the end user using a Government-specified or Government-furnished Electronic Display Device. The Validation procedure shall include a complete exercise of all TI sequences (procedural, descriptive, or fault-isolation) contained in the View Package;   i.e., validate the compilation process by validating the functionality of the compiled product.

3.4.5.2 Validation Procedure. The QAPP shall contain the Contractor's proposed procedure for accomplishing this critical function. (The QAPP shall show the means of establishing the technical accuracy of the actual data used in Validating the IETMDB; once this accuracy is established, it need not be re-established during Validation of the View-Package compilation process.)

3.4.6 IETM System Validation. In addition to validation of the individual tasks and non-procedural data, the IETM system, with its various utilities and special functions, shall be validated. The IETM system validation shall be performed prior to the delivery of IETM data to the Government, and shall consist of two parts: (1) a demonstration of the system, and (2) system software tests.

3.4.6.1 IETM System Demonstration. The field version of the IETM system hardware and software shall be demonstrated to the extent required to establish confidence in its accuracy, capabilities, and compatibility with Government systems and contractual requirements. The extent of the demonstration shall be in accordance with a sampling plan included in the Contractor's Validation Plan. Specifically, the IETM system demonstration shall:

a. Be performed entirely on an EDD, as specified and approved by the Government;

b. Demonstrate the system's compliance with applicable specifications and compatibility with Government systems;

c. Demonstrate maintenance tasks, displayed for a selected sampling of the various aircraft systems, in various levels of complexity;

d. Introduce a selected sampling of simulated faults to exercise the retrieval capabilities (linking) of the system;

e. Demonstrate all system utilities and special functions, including ad hoc user access to data; and

f. Demonstrate the general visibility and readability of the IETM data as displayed on the Government-furnished EDD.

3.4.6.2 System Software Tests. The Contractor shall develop a software routine capable of exhaustively testing the IETM system. This program shall be developed in accordance with MIL-STD-2167 and MIL-STD-2168, and shall, as a minimum:

a. Check that all data access links and branches are valid and operable;

b. Verify that there are no "open loops" in the fault isolation tasks (i.e., that each task ends in a single resolution, and each retrieval string ends in isolation and repair of a discrete fault);

c. Verify that there are no unreferenced or inaccessible data in the system; and

d. Check that all special functions are fully operable.

3.4.6.3 <u>Support Equipment</u>. Government approved support equipment shall be utilized in the performance of validation. Simulation or substitution of support equipment shall be approved by the Government. It is the responsibility of the Contractor to obtain Government furnished equipment in order to support the validation effort.

3.5 <u>Post-Validation Review</u>. The Contractor shall perform a post-validation review. This review does not apply to the IETM Data Base.

3.5.1 <u>Discrepancies</u>. This review shall assure that all discrepancies noted during validation have been addressed prior to the certification and acceptance of the IETM. This includes review of remedial actions taken by the IETM preparation group in response to the discrepancies recorded in the applicable validation records.

3.5.2 <u>Records</u>. Contractor personnel shall ensure that all applicable inspector's records cited under Section 1.4 are available prior to the post-validation review and that they indicate full compliance with Specifications. Contractor personnel shall ensure that every procedure on the task list is included in the TI, that all procedures have both a Prevalidation Certification and target-audience Validation record, and that the final draft of all procedural TI conforms exactly to the Validation records. Specifically:

a. Validation records for all non-procedural TI shall show that all the TI is in conformance with the associated equipment.

b. Documentation shall be presented to show that the final drafts of all IETM items are in exact compliance with, all Contract Specifications, including Format, Style, and User-Interaction Specifications. (See 3.1.3 b.)

c. Records shall be maintained of the inspections, the signatures of the inspectors, identifications of the deliverables inspected, discrepancies found, if any, and Certifications that the deliverable fully meets Contract Specification requirements. Any deviations shall be explained in writing by the Contractor's authorized technical authority.

3.6   Verification Support. Verification shall be performed on validated IETM's under the jurisdiction of the Government, and may include Contractor support. Verification of tasks and system operation shall be conducted on the Government-furnished EDD and supporting systems. Verification shall be conducted to:

   a.   ensure that the IETM data is suitable for the intended maintenance environment;

   b.   ensure that it is usable by its intended audience; and

   c.   ensure its compatibility with Government systems.

3.6.1   Verification Procedures. Verification is accomplished by qualified personnel, of the prescribed skill level, from the operating command or facility assigned to operate and maintain the weapon system to which the IETM data applies. The Government will perform final acceptance tests on the IETM data subsequent to approval of changes incorporated into the data as a result of verification findings.

3.6.2   Verification Support Plan. As part of the QAPP, the Contractor shall develop a verification support plan, describing the Contractor's general approach to supporting a Government-conducted verification. The plan shall be reviewed and approved by the Government. The Contractor shall prepare a supplement to the verification plan, detailing the plan for providing contractor support of the verification effort. Contractor support of verification shall consist of the following:

   a. Technical support, as required;

   b. Assistance in performing verification procedures;

   c. Recording and disposition of verification comments; and

   d. Certification that all discrepancies and defects noted during verification have been corrected or resolved.

3.7 Sampling. Sampling of TI is authorized for In-Process Audits but is not permitted for Validation nor for the Post-Validation Review. Any sampling plan prepared by the Contractor, for IPAs or any other critical-operation audits, shall be cited in the QAPP and approved by the Government.

4.   Definition of Terms.

Acceptance Test
        The final test series performed by the Government on the IETM, following Verification. If the IETM is considered satisfactory as

a result of these tests (meets all contractual requirements), it
will be accepted by the Government.

Final Draft
The version of the complete IETM submitted for final inspection by
the Contractor's QA organization after corrections noted during
Validation (of procedural, non-procedural, and fault-isolation TI)
have been incorporated, but before Verification.

In-Process Audit (IPA)
A review of contractual status, on-going QA efforts, interim
deliverables, or draft TI under preparation, which may be carried
out at any time during the IETM development, to permit the
Government, to the level desired, to:
(1) assess the extent to which the Contractor is following the QAPP
    in the conduct of his QA program and to evaluate the success of
    this program;
(2) ensure that the technical-requirements, documentation, and
    Technical Information are being developed according to the
    applicable Specifications and the QAPP;
(3) ensure that TI items under preparation correctly reflect
    currently approved configurations of the appropriate hardware
    and have taken into account any engineering changes; and
(4) evaluate the product on a sampling basis as considered
    desirable.

In-Process Review (IPR)
As the term is generally used, an IPR is a formal review conducted
by the Government to examine TMs, TM source data, and TM products.
As such, IPRs are essentially an evaluation of the product at
intermediate stages of development. In this Specification, the
term In-Process Audit is used to imply an increased function,
specifically, a concern with the Contractor's adherence to his QAPP
as well as with the quality of the TI being developed.

Interactive Electronic Technical Manual (IETM)
A Technical Manual, prepared (authored) by a Contractor and
delivered to the Government, or prepared by a Government activity,
in digital firm on a suitable medium, by means of an automated
authoring system; designed for electronic-screen display to an end
user, and possessing the following three characteristics:

(1) The format and style of the presented information are optimized
    for screen presentation to assure maximum comprehension; that
    is, the presentation format is "frame-oriented", not "page-
    oriented".
(2) The elements of Technical Information constituting the TM are
    so interrelated that a user's access to the information he
    requires is facilitated to the greatest extent possible, and is
    achievable by a variety of paths;
(3) The computer-controlled TM-Display device can function
    interactively (as a result of user requests and information
    input) in providing procedural guidance, navigational

directions, and supplemental information; and also in providing assistance in carrying out logistic-support functions supplemental to maintenance.

Non-Procedural TI

TI including, but not limited to, Descriptive Information including principles of operation, system and component descriptions; parts lists, and other IPB information; source codes, functional diagrams, schematics; and wiring data.

Procedural TI

TI detailing operation, maintenance, and troubleshooting procedures; including, but not limited to, checkout, calibration, alignment, test, scheduled maintenance, removal, replacement, and repair.

Quality Assurance

A planned and systematic series of procedures carried out by the Contractor as monitored by the Government, necessary to ensure a high degree of confidence that deliverable TI conforms to contract requirements. The culminating action in a QA program is Contractor support of the Government Verification procedure.

Target Audience

Personnel who in terms of training, capability, and experience closely resemble the Navy personnel who will actually use the TI.

Technical Information (TI)

Used in this Specification to denote any element, or combination of elements, of information composing an IETM, IETM Data Base, or View Package. Thus, an IETM contains, and is composed of, Technical Information. In generating an IETM, an Author creates TI and a QA organization evaluates the quality of the TI as well as of the completed IETM.

Technical Manual (TM)

An organized collection of information, in any form, and on any medium, designed to provide all guidance required by a technician or other end user to carry out a specific weapon-system logistic-support function such as maintenance, operation, or training.

Troubleshooting TI

TI designed to permit fault isolation in corrective maintenance. Troubleshooting or Fault-Isolation TI is a special type of Procedural TI (differing primarily in the interactivity involved between Display Device and technician, and in the presence of extensive branching in the logic).

Validation of Procedural TI

Test of TI against the associated hardware by actual performance of the procedures by target-audience personnel using the actual hardware or other Government-approved support equipment in accordance with the Validation Plan.

IETM View Package Definition

A View Package is a fully organized and formatted item of computer-processible Technical Information derived from an IETM Data Base and capable of interactive electronic display to an end user by means of an Electronic Display System (EDS). In function and design, a View Package is completely equivalent to an individual Interactive Electronic Technical Manual. A View Package may be constructed (1) entirely by an Author using an automated authoring system; (2) completely automatically using a series of automated processes (software) which perform the data-selection, structuring, and formatting processes; or (3) by a combination of the two approaches. A View Package is designed to support a specific function in the operation or logistics-support of a weapon system or other military equipment.

WYSIWYG

What You See Is What You Get. Used in this Specification to describe an authoring system with the ability to provide the Author with a view of an item (e.g., screen) of Technical Information identical to the view which the using technician will see.

APPENDIX A: SUMMARY OF IETM ACCEPTANCE TESTS

This Section summarizes (for information purposes only) IETM acceptance tests which will be performed by the Government on the digitized data stream delivered by the Contractor for Government acceptance after all deficiencies observed during the Verification process have been corrected and re-Validated as required. The physical form of the digital data stream on delivery by the Contractor will be in accordance with MIL-STD-1840.

This summary is provided for the convenience of the IETM Contractor so that he can assure that IETMs delivered will respond satisfactorily to the Government's tests which are intended to assure conformity of the IETM to requirements of the Contract Specification.

Provision of this summary of acceptance tests in no way limits the Government in carrying out any additional tests that it may deem advisable in assuring that the IETM meets contractual requirements and is error-free, comprehensible, and operationally suitable for the purpose intended. Nor does the Contractor's own ability to show a satisfactory result when performing these tests show conclusively that the IETM, IETM Data Base, or View Package submitted is in accordance with Contract Specifications.

A.1   Test Systems

Government acceptance tests will be performed entirely on an Electronic Display System such as that defined in MIL-HDBK-EDS, Electronic Display System for IETMs, and which meets all the requirements of that Specification. Such a device will have been specified by the Government and acquired and used by the Contractor in Validating the IETM and in performing other QA inspections. Compatibility with an Electronic Display System of this type is a primary contract requirement for the IETM, since the entire interactive-display concept of digitized Technical Manual information requires establishment of information-calling sequences and the exercise of special functions, with both processes dependent on software which is functionally common to the automated authoring system and to the Display Device. The proof that an IETM is satisfactory, therefore, is that it may be scrutinized in a way which demonstrates conformance with all Specification requirements on the Device which the end-user (e.g., a Fleet or flight-line technician) will use to view it.

A.2   Test Sequence

Tests will be conducted in two phases:

a.   Tests to assure that the IETM functions satisfactorily when viewed with a test Display Device; specifically, that all special functions are available, calling sequences are correct, and in general that all capabilities requested have in fact been provided.

b.   A thorough review of the content of each screen to assure that no procedures have been left out, that the material is written

comprehensibly, that the Technical Information is error-free, that troubleshooting Information in fact leads to Fault Isolation in all branches, and that the technician is informed as to the calling sequences for required information and can obtain it quickly and directly.

These tests are outlined in greater detail below.

A.3 Tests of IETM Functions

A.3.1 Screen Sequencing

Using the required calling algorithm based on screen references, every screen in the IETM will be viewed from the first to the last, and the logical sequences applicable to the Maintenance Procedure and to Troubleshooting will be evaluated.

A.3.2 Special Functions

Each of the special functions provided in the Electronic Display System (specified in Section 3.4 of MIL-M-GCSFUI) will be checked to see that it performs properly with the IETM being evaluated.

The ability of a technician to exercise these functions using the function keys and touch-screen capability of the Display Device will be evaluated.

A.3.3 Display Characteristics

Tests outlined in this Section are not tests of the Display System but of the IETM. The individual screens shall be displayed so that they can be seen and understood properly by the technician, within the limitations of the screen size, resolution, etc. The visibility of each screen provided will accordingly be checked in this context. (This test was also performed during Verification.)

A.3.4 Capability to Access Information

One of the primary reasons for preparation of IETMs is to provide a technician with the ability to reach needed information immediately, without searching through hundreds of paper pages. For this reason, the IETM is designed to provide multi-path calling methods to access the information required directly (i.e., without proceeding via numerous successive menus). The ability of the technician to retrieve the information he needs for specific problems will accordingly be evaluated based on a number of input requests, as described in MIL-M-GCSFUI.

The Government will develop a software routine capable of being used to test exhaustively this aspect of the Automated TI when used with the Government-Specified or Government-Furnished Electronic Display Device, to assure (1) that all calling sequences (data-access links) established by the Author are valid and operable; (2) that calling sequences implied by special function keys are fully operable; (3) that user-established calling sequences perform as indicated; and (4) that there are no "lost" (unreachable) data in the entire body of TI. This software, which will be identical (or very nearly so) to a software-test routine which will be a permanent part of the fielded Electronic Display Device, will be made available to the Contractor to aid him in continued performance of QA checks. (See MID-D-EDS, Section 3.9.)

A.4   Evaluation of IETM Content, Format, and Style

Selected screens will be used to perform a detailed evaluation of TM Content, Format, Style, and User-Interaction characteristics. For example, a number of Maintenance Tasks will be followed through each Subtask and Step to evaluate completeness, accuracy, competence of the graphics, arrangement, conformance to Style requirements, inclusion of Warnings, Cautions, and Notes, completeness of the setup information, and the like.

A.4.1   Evaluation of Troubleshooting TI

Beginning with operationally realistic defective-performance reports, a series of troubleshooting paths (including Fault Verification) will be followed in detail to establish the effectiveness of these test sequences in isolating the fault. Experienced technicians will evaluate not only the mechanical effectiveness, but also the technical competence of the troubleshooting procedure designed by the Author for Fleet-system Troubleshooting under operational conditions.

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