The Interactive Electronic Technical Manual Overview "Setting the Stage"

by

Eric L. Jorgensen Carderock Division, Naval Surface Warfare Center

ABSTRACT

This paper presents a general overview of DoD Interactive Electronic Technical Manuals (IETMs) and opens with a short discussion of the problems leading up to the need for IETMs, the general characteristics of an IETM, and an identification of the major research programs in the three Services leading up to IETMs. It then discusses the need for standards to define this new presentation medium and the general areas for which initial standards have been developed for "new start" weapons programs. However, with the close of the Cold War, many new-start programs have been delayed and the emphasis in DoD is on converting existing TMs into IETMs. The three services have developed a variety of applications to effect this conversion and the paper itemizes a set of categories or Classes to group the varying emerging applications of IETM-like and near-IETM systems. The paper includes a discussion of what is and what is not an IETM, and finishes with a call for standards for each of the emerging Electronic Technical Manual Classes.

The Existing Technical Manual Problem

The goal of true integration of the Technical Information (TI) in DOD weapon-system logistic-support systems is effectively impossible to obtain when the Services have to rely on paper-based Technical Manuals (TMs) for the great bulk of this information. In addition to contributing to the serious long-term logistics problems involved in producing, stocking, controlling, modifying, and using large quantities of paper, TMs as currently constructed are inherently incapable of incorporation into an automated, standardized, interactive, real-time system for the transfer and sharing of logistic-support information in a highly comprehensible form. Specifically, paper Technical Manuals are unnecessarily costly to produce and manage, are very difficult to integrate into an automated integrated logistics support system, and are of such poor usability and comprehensibility as to seriously slow up the maintenance process, increase false part-removal rates, and significantly increase training time.

To reduce the magnitude of these problems, major efforts are underway within the DOD to automate the paper-based TM production and management processes. However, existing TM automation attempts, although they may provide limited improvements at specific points in the logistics-support chain, cannot provide a full solution; in particular, they cannot satisfy the requirement for real-time integration of TI in standardized form among many participating activities. The best approach to automating the Technical Information processes lies not in the automation of the present paper-based product but in the use of a new information presentation medium, the Interactive Electronic Technical Manual (IETM).

Characteristics of an IETM

An IETM is intended to be the functional equivalent of a paper-based Technical Manual and in most cases a total replacement for the paper manual. It is different in that it is intended to be displayed on an electronic display device of some sort and has been redesigned to take advantage of the electronic medium and its associated computerized control system. It is specifically formatted for the electronic display screen, with less but more focused information being presented to a user at any one time. The electronic display allows features not readily available in the paper medium, such as displaying the specific graphic or portion of a graphic specifically associated with a text statement whenever that text is displayed. This is much more effective that the typical "see Figure x" annotation used to reference a graphic in a paper manual. The IETM can be designed to be interactive with the user, at times requesting information from the user and based on that input determining what information to display next. By this interactive mechanism, the IETM can effectively guide a user through a procedure in a way that paper can not.

There are several other characteristics for IETMs specifically designed to operate in and come from a CALS data-base environment. TMs contain a vast amount of information and much of that information is highly structured and organized around factors such as hardware components, operational sub-systems, or factors such as a catalog of troubleshooting failure modes. However in a paper manual, it is left to the human reader to access and use the implicit organization presented to him as a paginated scroll of what the computer (i.e., publishing system) considers free-form text. In the CALS world, this implicit organizational information is gathered into explicit computer processable categories for subsequent automated access, value-added processing, and end use. An IETM Revisable DataBase can be designed with these characteristics. In this case, the IETM Viewing System becomes the tool to the end-user to access and use the CALS data base.

RDT&E Leading up to IETMs

All three Services established in the 1980s RDT&E programs which have assessed the applicability, technological availability, and cost effectiveness of the IETM concept in satisfying the logistic-support needs of the Services. Principal Programs included: the Navy Technical Information Presentation System (NTIPS) Program¹, The Air Force Computer-based Maintenance Aid System (CMAS)² and the Integrated Maintenance Information System (IMIS)³ Programs, and the Army Miniaturized Electronic Information Delivery System (MEIDS)⁴. The results of these programs are included in the attached references, but the net result is that all three Services have proven the feasibility and the desirability of using IETM systems to support military technicians in the operation, maintenance, and logistic support of weapon systems.

The Need for IETM Standards

At this time there are many efforts now underway in the DoD to develop some type of IETM or IETM-like capability. The serious problem now arising is the non-standard nature of these, largely, spontaneous, activities. There is a strong need to develop a meaningful strategy to manage the evolution to IETMs⁵. A key factor necessary to manage this evolution is the establishment of common IETM definitions, standards and the accompanying specifications.

To set the stage for standardization of IETMs and after an extensive coordination process within the three Services, the DoD issued three general IETM Specifications in November of 1992.

Major Aspects for IETM Specification.

The DoD IETM Specifications were designed to set standards for three major aspects of the overall IETM preparation process. The first aspect for specification is the overall general specification for the IETM itself, effectively an electronic replacement for MIL-M-38784 (the paper TM Specification). This general IETM specification, MIL-M-87268, has requirements for several areas. The first area includes requirements for the administrative information and certain generic content required for any IETM, no matter what the subject matter. The second area includes the style requirements for the information elements (e.g., text blocks, graphics, warnings, audio displays, etc.) in a form that applies when the element is added into the unformatted source data base, but also holds when the elements are displayed on a computer screen. A third area of requirements is for the format of the IETM displayable information when it is displayed on an electronic display screen. A forth requirement area sets the standards for user interaction to the displayed information. These later two areas of requirement are often referred to as the "look and feel" of the IETM. This specification actually applies to at least two critical aspects of the IETM procurement process: it sets the standards for authoring the IETM data base, and it also sets the standards for the development of (or the selection of) the IETM presentation system software.

The second aspect requiring specification is the Quality Assurance (QA) process for the creation of the IETM itself. The need for this specification comes from a basic perspective that it is more important to have accurate and correctly presented information than it is to have an ultimate presentation system for the IETM information. While the Quality Assurance Specification, MIL-Q-87270, does define requirements for a QA Program, it does so indirectly. The specific requirement is for the providing contractor to develop a Quality Assurance Program Plan (QAPP) and present it to the Government for approval. The specification outlines areas which are to be detailed by the QAPP, but the responsibility to develop the detailed procedures for the Program is placed on the contractor. A particular thrust of the QA Specification is to provide more controls on the IETM creation process itself, as the actual deliverable is in electronic form and not easy to subject to a one-time acceptance test. It also stresses the need for a final validation on the actual display device to be used by the eventual enduser maintenance technician.

The third aspect of IETM specification is the Data Base that is used to develop the IETM and reflects an emphasis area substantially different from that specified with conventional paper-based TMs. As the IETM Data Base is a new and emerging concept, the Data Base Specification, MIL-D-87269, has been constructed to apply to many different situations. The underlying nature of some IETM implementations is that the IETM is a mechanism for viewing information from an integrated data base, which contains more information than actually needed for a particular application. The IETM viewer presents only the data actually required for a particular application and only that data needed at a particular point in time. In other uses of the Information in the IETM (e.g., browsing parts information, developing training materials), the Source Data Base is critical because IETM information was authored once but may be displayed out in several different applications, using different presentation systems, and in certain cases for differing customers. The Data Base must therefore be developed in a form which contains all the logical content but without tying it to a particular presentation format.

Legacy Data Driven Electronic Technical Manual Standards

The official IETM Specifications (MIL-M-87268, MIL-D-87269, and MIL-Q-87270) were developed by DoD for those programs which were able to start the IETM development process at the original authoring stage, i.e., what the DoD refers to as "new starts". However, with the ending of the Cold War, many of the candidate "new start" programs have been canceled or sharply curtailed. Thus many programs looking to IETMs at this time are those that want to convert their existing TMs into IETM form and take advantage of the benefits of automated their TI. This situation has resulted in the emergence of other classes of highly productive IETMs, all of which have been designed to improve the particular situation in which they will be used. These share many of the qualities of a DoD Standard "new-start" IETM, but do not demonstrate all the features outlined in the IETM Specifications because of limitations imposed by the Legacy data. This situation has led the DoD Tri-Service IETM Working Group to define multiple classes of Electronic Technical Manuals (ETMs), some of which are IETMs and some of which are not. The ones that are not IETMs typically involve electronically imaged replicas of the paper TMs, but employ very few interactive features other than an index which allows branching to the page images.

The Classes of Electronic Technical Manuals

The ETM classes defined by the Tri-Service IETM Working Group are as follows. Note, Class 0 is included for completeness to define a full spectrum; and Class 5 is intentionally left open ended to include future innovations not yet available.

Class 0. Non-Electronically-Indexed Page Images [Not an ETM] -Systems of Digitized Page Images that are intended for electronic archival filing or Print-on-Demand. These allow pages to be viewed on an electronic display but have no detailed index for navigation through the document for the purpose of on-line usage.

Class 1. Electronically Indexed Page Images - Systems of Digitized Page Images intended for Full-Page Display and use allowing navigation by means of an automated intelligent index to the page images for user access (e.g., Navy Advanced Technical Information System - ATIS). These systems can be used in a library or reference setting for reading and research use.

Class 2. Electronic Scrolling Documents - Systems for Interactive Display of ASCII-Encoded Documents using an intelligent index and Hypertext tags inserted into a tagged document file. In general, the document is the result of a simple conversion from a page-oriented document but with little or no reauthoring by a subject matter expert with the exception of adding hypertext tags. These allow a user to navigate through the document, but have very limited, if any, author inserted navigation aids or a content-driven "NEXT" function.

Class 3. Linear Structured IETMs - Interactive Display of Technical Information which is SGML tagged using MIL-D-87269 tags to the maximum extent possible and using a Hypertext presentation system for display in accordance with MIL-M-87268. It is based on a linear SGML document file and not a heirarcharically based Data Base. Navigation is based on author developed constructs employing features such as prompted dialog boxes and content driven logical "NEXT" function.

Class 4. Hierarchically Structured IETMs - Interactive Electronic Display of Technical Information specifically authored into and maintained in a nonredundant relational or object-oriented hierarchical data base. These source data are subsequently packaged (i.e., "view-packaged") as a run-time data base for Interactive Presentation in accordance with the DoD IETM Specifications (MIL-M-87268, MIL-D-87269, and MIL-Q-87270). This class differs from Class 3 largely in the manner in which the source data is managed. The user presentation may be very similar. **Class 5. Integrated Data-Base IETIS** - Integrated Electronic Technical Information System (IETIS) for Interactive Presentation of Class 4 IETMs integrated with the data for other processes, including Expert-System rules for the display of information and other user-applications such as diagnostics or computer-managed training. This Class is intended to include future applications and features not yet developed or sufficiently mature for production use.

What makes an ETM an IETM?

To be called an IETM, the ETM must have extensive provision for the authoring activity to include authored interactive features into the IETM (e.g., prompts, dialogs for obtaining data from a user, alternative branches which the user must choose). There are two classes of IETMs: Class 4 which fully conforms to the IETM Specifications and includes a DBMS-managed formal database for the IETM Revisable Source Data; and Class 3 which does not fully conform to Class 4 (especially in the use of a revisable database for the source data) but has many of the features of a Class 4 IETM. To the end user, Class 3 and Class 4 IETMs may appear to be the functional equivalent; however, the source data management system used to prepare them will be substantially different. Class 5 is a functional super-set of Class 4 with additional features, but which still conforms to the Class 4 IETM

Class 1 and 2 are for ETMs which do not have authored-in interaction contained in the information itself. Class 2 ETMs is reserved for automated document viewing systems which employs a viewer which gives the reader some interactive features, but which operate on a document file whose only authored-in interactive information is hypertext references to another spot in the document. Class 1 applies to conventional printed document page images, whereas Class 2 eliminates the pagination restrictions and scrolls through the document without page breaks.

The above summary is not a full explanation of the DoD ETM Classes, but it does allow the following to be said. DoD implementors and policy officially now have to address the many ETMs of Classes 1, 2, 3, and 4 of which only Class 4 is formally specified by the IETM Specifications. The individual Services will address some of the issues to properly require Class 4 standards for new systems, but to also accommodate Class 1, 2, and 3 applications for existing systems where often the implementation of a different Class of ETM has a place and makes more sense that an costly Class 4 implementation. For a more detailed discussion of the ETM Classes see the article "Tri-Service Working Group Defines Six Classes of ETM" in the July 1994 issue of the **CALS/CE Report** published by Knowledge Base International, Houston TX.

The Future for IETMs

At this point in time, the potential benefits of IETMs are widely recognized and major acquisition programs are moving to procure them in place of conventional paper Technical Manuals. The question now is how standard these IETMs and IETM-like products will be. The DoD Specifications definitely provide a basis for standardization, however, they are, by design, general specifications intended to include a variety of implementations. Detailed guides or additional specifications are needed to assure either an identical "look and feel" for multiple presented IETMs or for any real degree of interoperability, that is for an IETM for one system to be displayable on another Program's display system.

The IETM technology is new and just now reaching an initial level of maturity. Vendors are now beginning to bring useful products to the market place and are using the DoD Specifications for guidance. The next few years will be a time of testing and involve a substantial amount of trial and error. The IETM concept works; there is little dispute on that issue. However, determining the optimal use of available technology and, even more importantly, the achieving of a meaningful level of commonality and interoperability among differing IETMs remains a challenge for the vendor community and the DoD Standards setting activities.

The author of this paper is from an RDT&E organization and is actively advising several major Navy programs in their development of IETMs. However, the cultural change and the required infrastructure modernization must be managed by others who in most cases are not familiar with the details of IETM technology or the implications it will have on the mainstream Navy operations. In spite of the problems, the opportunities with IETMs are immense and with patience and perseverance, the DoD will move into this new era with the paperless maintenance in its operational entities.

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Author: ERIC L. JORGENSEN Technology Manager - IETM Programs Carderock Division, Naval Surface Warfare Center Department of the Navy

Mr. Jorgensen has been involved for 20 years in research programs directed at the development and implementation of Interactive Electronic Technical Manuals (IETMs) for military applications. Today he is part of a team which advises Navy Acquisition Program Managers and Policy Officials on matters regarding the Navy's use of this new medium, designed to replace the paper based technical manual and diagnostic aids. He also is a member of the Navy AEGIS Shipbuilding teams developing IETM applications for these programs, and a DOD participant in the CALS ISG Standards Committee and the IETM Committee. Mr Jorgensen's educational background includes a BS in Mathematics (Computer Science) from the Massachusetts Institute of Technology and a MBA from the Stanford Graduate School of Business.