THE MOVE TO PAPERLESS TECHNICAL MANUALS IN THE US DOD

by

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Abstract

In this paper Mr. Jorgensen will attempt to categorize and describe the various moves in the US Department of Defense from paper-based Technical Manuals to a variety of forms of Electronic Technical Manuals (ETMs). The three principal Services have agreed to a categorization of five Classes of ETMs and this discussion will follow these five categories, which range form simple Class 1 "page-flippers" to a complete Class 5 Technical Information Systems under consideration which utilize a common data base derived from Logistic Support Analysis Records (LSAR) and support Maintenance, Operations, Training, and Logistics Support functions. In between these two extremes are the Interactive Electronic Technical Manuals (IETMs) specified by the two US Military Specifications MIL-M-87268 and MIL-D-87269. The paper will conclude with some of Mr. Jorgensen's observations and opinions on the possibility of obtaining consensus on International Standards to guide the production of standard paperless and interactive electronic support systems which can be used across International borders.

INTRODUCTION

The US DoD collection of Technical Manuals is one of the largest inventories of paper publications in the World. These documents are used to support the operation, maintenance, training, and logistic support of the many weapon systems in the DoD inventory. For many years the US DoD has been able to effectively operate and maintain its large inventory of constantly changing weapon systems in an effective and efficient manner using these paper documents as the principal source of information. However, the printing, distribution, and storage of these publications is requiring a greater and greater allocation of resources and is utilizing a larger and larger infrastructure to support the active inventory of Technical Manuals and other related Publications. During the 1980's each of the Services in the DoD began looking to emerging paperless digital information technology to offer solutions to this emerging flood of paper products. Additionally, research projects undertaken in the same period began to demonstrate that not only were

these digital information systems less costly in terms of media, storage, and distribution costs, they were also a more effective and efficient to use in their primary role to support system operations and maintenance than were the paper-based information products. This paper will attempt to describe, in broad terms, some of the alternative approaches that are being planned and utilized and look to the specific standards that are being used to support these alternatives now and possible sources of the standards in the future.

ALTERNATIVE APPROACHES TO ELECTRONIC TECHNICAL MANUALS

Alternatives is a key word in describing the US DoD approaches, as there is no one single direction in which the DoD activities are moving as they convert form paper-based information products to electronically processable digital information products. The approaches vary from simply utilizing the least expensive method to put Technical Information on some digital medium, typically an "electronic page turner" product, where the page images are simply recorded on an electronic imaging system. Other approaches find their roots in significant DoD sponsored research conducted in the 1980's which indicated that a product called an Interactive Electronic Technical Manual (IETM) was the best approach to present technical Information. An IETM is especially formatted for display and user-interaction on an electronic display system and is not an electronic version of a printed page. This new technology was, at least partially, specified in a series of DoD Military Specifications (MIL-M-87268 and MIL-D-87269) which are being used by major new weapon systems.

Since pure IETMs were designed for new-start weapon systems, other approaches were being used for conversions of legacy information into electronic Technical manual form. These approaches were often driven by a low-cost requirement, and resulted in a product which provided more functionality than an electronic page turner but typically less functionality than that specified in MIL-M-87268, the IETM User-view specification.

The net result has been a wide variety of approaches, methods of authoring and life-cycle maintenance of the source data, and end-user functionality. This resulting in a major communication problem in technical exchange meetings since each program attending these meetings had a different view of what an Electronic Technical Manual (ETM) was. To address this communications problem, a Tri-Service Working Group for IETMs representing the Army, Navy, and Air Force, agreed on a categorization of ETMs, which while not precisely defined, did introduce a sense of rationality to discussions on Electronic Publications in general. This categorization (which was initially developed by the author of this paper) consists of Five classes of ETMs. The following sections of this paper will discuss each of these class categories and then use the categories to present some typical examples of how the US DoD has digitized Technical Manuals.

Electronically Indexed Page Images

The vast majority of paper to digital conversions of technical publications to date has been accomplished at the Class 1 level. Class 1 is a electronic document system that captures an encoding of an entire document with the "page" as the primary object. The display system is then effectively an electronic page turner which must be able to recreate the image of the page, possible using a pan and zoom feature to present partial page images at a greater magnification. Typically these systems have a comprehensive indexing capability to allow the user to go to the specific page of interest. Using Class 1 technology, the Navy was the first US Service to accomplish a digital conversion on a whole-sale basis and has converted most of the active TMs used on Navy ships to a custom designed Class 1 capability called ATIS (Advance Technical Information System). The encoding standard for this system is based on the CALS raster-format (MIL-R-28002) for the page images with an peculiar Navy standard for the intelligent index capability accompanying the page image.

Based on the success of this system, the other Defense Services (Army and Air Force) have begun to convert the bulk of their active Technical Manuals to a Class 1 capability. However, they are, in general, using a capability based on the Adobe Corporation's PDF (Portable Document Format) standard rather than the CALS raster standard. This is viewed as being a more advanced technology that the older raster scan format.

The implementations in the Services using these Class 1 ETMs are for the most part limited to reference library use and emergency backup capability to the paper manual and are not used very often to support maintenance or operation tasks at the job site. For these tasks another form of electronic document is needed.

Paths to Interactive Electronic Documents

For these other forms of ETMs, there are emerging two separate paths. One, primarily for existing legacy data, is a Class 2 and Class 3 product, modeling after scrolling hypertext systems which are widely available off-the-shelf. The other route to ETMs is the MILSPEC compliant IETM, or Class 4 IETM which utilizes a data-base oriented authoring system. These latter systems are being used to support the larger and newer weapon systems such as most new aircraft and many new combat weapon systems. A pure Class 5 capability, which is an extension of a Class 4 IETM to that of a total electronic product-support system with functionality beyond that of the traditional Technical Manual, and will be discussed briefly at the end of this paper.

Use of SGML in ETMs

Before discussing the ETM Classes further, it is necessary to discuss the use of SGML (Standard Graphics Markup Language) in the publishing of ETMs. In the early days of

CALS, the US DoD established a standard application of SGML for paper-based Technical Manuals in MIL-M-28001. This practice of using SGML based standards has carried over into the electronic Technical Manual products. Thus most Class 2 and Class 3 ETMs are based on a SGML specification, rather than an electronic viewing capability and associated markup standard which may be offered by a paper-based publishing system application.

Electronic Scrolling Documents and Linearly Structured IETMs

Class 2 and Class 3 ETMs are related in that Class 3 is typically an enhancement of a Class 2 ETM to make it approach the functionality of a MIL-M-87268 Class 4 IETM. One way to describe a Class 2 ETM is to view it as a scrolling version of a single column book with the page borders eliminated and all the single columns tapped together end to end. Other than forward and back, enhanced viewing navigation features are generally limited to point to point hot-spot links and traditional table of contents linked to specific points in the scroll. In a class 2 all information navigation decisions (i.e., where to go next) are made by the user who is restricted to using word searches, indexed access to a point in the scroll, and the scroll forward and backward controls. A Class 2 may also contain hot spots which link to another part of the document being viewed or transfer the viewing to the top of another document. In general, there is little use of Class 2 ETM technology for Technical Manual type information in the DoD for weapon-system support, because the primary motive to convert to an IETM is to add some of the very subject-matter oriented interactivity that requires it to be a Class 3 ETM.

Differences between Class 2 and Class 3 ETMs

In a Class 3 enhanced ETM, the content author has explicitly added navigation features controlling branching and other content sensitive features such as a logical next button. For those familiar with the World Wide Web, a typical HTML 2.0 page is a class 2 ETM portion. Adding forms features, cgi maps, or other "plug-in" functions typically upgrade the ETM to a Class 3 ETM.

A key consideration in the US DoD between Class 2 and Class 3 products is that a paper document can be converted into a Class 2 ETM by a service bureau with little or no knowledge of the subject matter (since the SGML tags involved are printing structure tags such as paragraph or section) where as a Class 3 conversion requires the services of a more expensive subject matter expert even if the conversion house has the capability to add more functionality tot he product. Because Class 3 interactive enhancements generally require the services of such a subject matter expert, they demonstrate a substantial increase in the cost of conversion. On the other hand, when the services of such a subject matter expert are available, the actual ETM can be upgraded such that it

can be displayed and viewed with a look-and-feel coming very close to that required by the IETM specification, MIL-M-87268.

Many of the older existing Weapon Systems in the DoD have, in fact, converted their TMs to a Class 3 IETMs and achieved a level of user functionality approaching the true MILSPEC conforming IETM. The Army has developed its own Government owned software (IADS) and is using it extensively to display their version of Class 3. On the other hand the Navy typically uses commercially available ETM browsers using SGML encoded source data. However, the general situation is that there are many different Class 3 systems used in the US DoD, and with the exception that most employ SGML encoded source data, these capabilities are incompatible with each other. This results from the use of differing Document Type Definitions (DTDs) with the SGML encoding.

DoD Specification Compliant IETMs

The larger DoD weapon systems, especially those new-start weapons systems are almost all looking to developing MILSPEC compliant Class 4 IETMs. There are not many commercial sources for Class 4 authoring systems, so many large weapon systems have developed their own custom Class 4 capability. While Class 4 IETMs do have advanced interactive functionality over a Class 3, the primary difference between them and the more advanced Class 3 capabilities is that Class 4 systems have their data objects (e.g., text segments, graphics, table cells, safety alerts, etc.) stored in and managed by a (typically object oriented) data base management system. Of the two primary IETM MILSPECS, one (MIL-D-87269) specifies the general data model for the source data base, and the other (MIL-M-87268) specifies the end user product itself.

When the IETM Specifications were issued in 1988, they were intentionally designed to allow flexibility in implementation. MIL-M-89268 included many options that are to be established when a procurement was made. The Data Model in MIL-D-87269 has a fixed part which should not be violated, called the generic level, and it has an modifiable and extensible part called the content specific level. This structure has proved to be very powerful in that it has given common overall structure to the IETM data bases, while giving the developer the ability to add or modify data elements and attributes to meet their specific Program needs. The down side of this flexibility has been that the data bases will not interoperate with each other without some conversion.

At this time, there are many programs in the early stages of planning for MILSPEC compliant IETMs. However, there are few DoD Programs that can be said to have a mature IETM capability in an actual production status. That situation is one or two years away for most programs.

Interactive Electronic Technical Information Systems

The Tri-Service definition for Class 5 is a multifunctional Weapon System Support System (called an Interactive Electronic Technical Information System - IETIS) providing operator instruction, maintenance aids, training modules, and logistic support functions, all operating from the same data base which is constructed according to a MIL-D-87269 Data Model and viewed through the same Graphic User Interface. There are few, if any, operational systems that meet this definition, though some are being developed in R&D. There are a few less pure Class 5 systems which have much of the user functionality, achieved by including separate applications for each of the functions loosely integrated under a Operating Systems Shell such as MS Windows.

CONCLUSION

A principal reason this paper presents this diverse situation is to lay the foundation for making one main point. It is becoming apparent that there is a need for more standards interpretation documents, if not more standards, in order to limit this variableness. In the beginning of the technology evolution, such diversity served many uses. It allows the entire community to explore alternatives and to pick-up net technologies as it becomes more available and not be stuck with an obsolete solution. However, over time this diversity can become a nemesis as one wrestles with life cycle management issues, consolidations issues, data sharing issues, and the "three terminals on every desk" situation experienced by many in the early days of office automation. The US DoD will be facing a electronic legacy problem orders of magnitude more complex that the current paper legacy conversion program, the center of much activity at this time.

US DoD policy since 1995, has been to not develop DoD specific specifications and standards but to look to Industry, National and International Standards communities. Studies and investigations have been initiated to find such standards bodies with in place standards and all have, in general, reached the same conclusions, in particular, there appear to be no equivalents to the US DoD IETM specifications, and the stable standards that are available will not meet Us DoD needs. If suitable Standards were in place, there are mechanisms for the US DoD to adopt them and the current climate encourages such.

The intent of this paper is not to brag or report status, but to report honestly and seek out International partners who may see their organization, be it large or small, entering the same uncertain waters and together chart a sound path through the shoals. There are many opportunities to achieve International consensus of the standards to use for the paperless Technical Manual in its many possible forms and functions.

There are many known problems, but also many lessons-learned that can be shared to mutual advantage in an International forum such as CALS Europe. With the level of interest so high in Europe, on the pacific Rim, and in the United States Department of Defense,

surely there can be adequate standards identified and developed for all parties to use in a manner to profit all.