Previous Section

11.0 -- Interactive Electronic Technical Manual Specifications

11.1 -- Purpose

An IETM is a technical manual, prepared (authored) in a digital form on a suitable medium, by means of an automated authoring system; designed for electronic-window display to an end user, and possessing the following three characteristics:

The format and style of the presented information are optimized for window presentation in an electronic form, on a desktop PC, laptop PC, or other portable electronic display device, to assure maximum comprehension; that is, the presentation format is "frame-oriented", not "page-oriented".

The elements of technical data constituting the IETM 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.

The computer-controlled IETM display device can function interactively (as a result of users request 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.

The IETM specification suite consist of the following three IETM Specifications:

Military Specification MIL-PRF-87268. Manual, Interactive Electronic Technical (IETM): General Content, Style, Format, and User Interaction Requirements for. MIL-PRF-87268 provides a general set of Content, Style, Format, and User-Interaction requirements to be cited in all IETM acquisition actions.

Military Specification MIL-PRF-87269: Data Base, Revisable: Interactive Electronic Technical Manuals, for the Support of. MIL-PRF-87269 defines requirements for the weapon-system-related data base from which IETMs or View Packages are to be constructed. The data base elements are defined using SGML.

Military Specification MIL-Q-87270: Quality Assurance (QA) Program: Interactive Electronic Technical Manuals (IETM) and Associated Technical Information; Requirements for. **Cancelled**.

The DoD Specifications identify five classes of Electronic Technical Manuals.

- Class 1: Electronically Indexed Pages
- Class 2: Electronically Scrolling Documents
- Class 3: Linearly Structured IETMs
- Class 4: Hierarchically Structured IETMs
- Class 5: Integrated Data Base

Interactive Electronic Technical Manuals allow the user to locate required information faster and more easily than is possible with a paper technical manual. IETMs, when designed to the DoD IETM Specifications, are easier to comprehend, more specifically matched to the system configuration under

diagnosis, and are available in a form that requires much less physical storage space than paper. Powerful interactive troubleshooting procedures, not possible with paper technical manuals, can be made available using the intelligent features of the IETM display device.

11.2 -- Typical Applications

The architecture and use of the IETM specifications for new acquisitions (some class 3, class 4 and 5 IETMs only) are, in general, as follows:

- The IETM provider is contracted to build and maintain a revisable IETM Data Base structure conforming to MIL-PRF-87269 and then loaded with IETM content data conforming to the requirements of the Content and Style sections of MIL-PRF-87268.

- The Provider is then tasked to extract, compile, and format an IETM View Package according to a specific View Package Specification which spells out the functional requirement for the IETM as well as the precise format for the View Package.

- This IETM View Package, copied onto the official distribution medium by the Government, is then provided to the end user who views the IETM on an IETM Electronic Display System (EDS) which must present the IETM information in accordance with the Format and User-Interaction Sections of MIL-PRF-87268.

Two additional specifications are needed to support the procurement of an entire IETM system. While the drafts are not ready for coordination at this time, they will include: l) the hardware and software to be used by the user electronic display system (EDS), and 2) the computer readable View Package (Ref.5) which is the form of the IETM extracted, compiled, and electronically formatted for direct use (i.e., "read") by the EDS.

Because of the wide range of functionality existing across the five classes of IETM, almost all technical manuals/orders being developed or undergoing major revision today will fall into at least one of these classes with relatively minor effort. Even conversion of legacy data from paper or aperture cards to raster digital format can be easily adapted to a Class 1 IETM. Note that the IETM specifications are only applied to the higher classes of IETM, beginning with minimal application to Class 3 and extending to full implementation with Class 5.

11.3 -- Status and Planned Extensions

The three DoD IETM specifications were issued effective 20 November 1992. Both MIL-M-87268 and MIL-D-87269 have been converted to performance specifications. MIL-PRF-87268A was released in January 1997. MIL-PRF-87269A is still in draft form, and technical issues have resulted in a lengthy revision process for this document, for which release will probably not occur until late 1997. MIL-Q-87270 has expired in accordance with the Perry Memo rules on procedural Mil-specs. It will not be revised, although its content may eventually be incorporated into an IETM handbook or other guidance document.

11.4 -- Implementation Issues

These IETM Specifications are the first in a series needed for full IETM implementations. Although the technology required for adoption of IETMs exists today, full exploitation of the IETM capability requires resolution of a number of technical problems over the next few years. Examples of such technical issues are:

- A standardized tri-Service definition of user interaction (man-machine) features most useful for IETMs.
- Improved automation of processes for authoring IETMs.
- Improved techniques for Government IETM acceptance testing.
- Improved computer-controlled fault-isolation processes.
- Improved screen display of large-scale drawings and schematics.

The DoD Multimedia Standards Working Group (MSWG) has been formed to coordinate DoD positions on Multimedia standards and standardization for insertion into federal, national and international standards through various industry organizations and forums.

With so much technical and training information becoming electronically delivered, the issue of merging IETMs and Interactive Courseware (ICW) functions is being explored. This involves having both technical manual information and interactive courseware available in one system to the trainee. Since there are many ways to implement that, the issues are under discussion. The Air Force XAIDA Program used an IETM to help develop course curriculum. Other types of functions are also being discussed as relevant additions such as administrative, supply, and security. Thus, the nature of IETMs is dynamic and changing.

Other issues revolving around development of IETMs include:

1. whether to use HTML or SGML
2. how to convert legacy documents in a cost effective manner
3. how to define the functionality needed by the specific program because this greatly affects the cost of the IETM
4. how to handle the printing of hard copy backup documents

11.4.1 -- Standards for Hypermedia Information Systems

The CALS Industry Steering Group (ISG) Standards Division published a white paper on "Standards for Hypermedia Information Systems" in October of 1996. This white paper outlines the technologies and issues pertaining to the use of hypermedia information system standards, and proposes a course of action that will accommodate use of this technology in mission-critical applications within the Department of Defense (DoD). Among the primary uses of hypermedia information systems in DoD is the use and development of IETMs.

With the shift from formally managed and maintained military specifications to industry and international standards has come uncertainty as to the availability and appropriate use of standards for development of hypermedia systems. Such standards are needed, as is guidance in their application to IETM developments. The approach outlined in the white paper establishes a foundation for interoperability, portability, common "look and feel," and control of the development and acquisition process for

hypermedia information systems (HIS) in the DoD.

The stated overall objective of the Special Project-Hypermedia Information Systems (SP-HIS) committee is to achieve an integrated suite of standards to support the full range of document types represented in state-of-the-art hypermedia systems. In support of this goal, the committee proposes an architecture that represents the essential components of any hypermedia document. This architecture used as its starting point the 5 IETM classes in MIL-PRF-87268, but classifies the behavior and components of HIS in a more useful manner. For example, a hypermedia application must contain, in addition to its content, all information necessary to describe its own behavior in an interactive environment, its own structure, and its own rendering instructions. This approach maximizes the transportability of the documents among current and future presentation programs.

This HIS architecture is defined in terms of its unique requirements when applied to IETM applications. Standards deemed by the committee to be applicable to hypermedia information systems are matched to the architecture. The paper presents the recommendations of the ISG regarding the use of specific standards that will best protect investments in hypermedia information over the long term, as well as providing maximum interoperability among the applications that use the information. Finally, the paper recommends actions that will help to infuse appropriate hypermedia technology into Government projects, particularly those that include IETMs.

11.5 -- Extent and Nature of User and Vendor Support

Several large Military Suppliers have developed Independent Research and Development (IR&D) programs to support IETMs. In the past there have been few commercial products to support the Specifications, however, with the formal release of the Specifications late in 1992, suppliers of IETM authoring and presentation products and support are expected to greatly increase in the very near future. Bridge products (i.e., migration aids from paper-based publishing systems to IETMs) while not fully conforming to the IETM specifications, have emerged in the form of modified HyperText viewing software and add-on products to conventional automated publishing systems to output SGML-tagged files with IETMDB (i.e., MIL-PRF-87269) tagged data.

Following is a list of the programs that have fielded IETMs:

Air Force

- F-16 IETM, class 5 in the field

Army

- Towed Howitzer
- Palletized Load System (PLS) vehicle
- M915/916 Trucks
- All Source Analysis System
- Team Mate
- Trail Blazer
- Heavy Equipment Transporter
- Patriot Missile System

- Avenger Missile System

Navy

- Gas Turbine, Electrical and Mechanical, located in the Service School at Great Lakes; a Class 3 IETM.
- Mine Counter Measures, located in the Service School at Great Lakes; a Class 3 IETM.
- Navy, Radio Communication System for AEGIS, located in the AEGIS Training Center; class 3.

Current R&D Efforts:

- Naval Surface Weapons Center has the LOG Program, funded by Naval Sea Systems Command, to develop cost effective ways to handle legacy data. This involves developing functional scanning capabilities for conversion of paper based data into digital data.
- Navy and Marine Corps have a research program underway to develop a class 4/5 IETM for the F/A-18 with an authoring system called AMIDD. This effort is being field tested at El Toro.
- Armstrong Laboratory has a program, Advanced Instructional Design Advisor underway to develop automated and intelligent tools to support novices who are developing interactive courseware from data extracted from the F-16 IETM by subject matter experts.

11.6 -- Additional Documentation

- Military Specification MIL-M-87268. Manual, Interactive Electronic Technical (IETM): General Content, Style, Format, and User Interaction Requirements for. Tri-Service Working Group for IETMs. 20 November 1992.

- Military Specification MIL-D-87269: Data Base, Revisable: Interactive Electronic Technical Manuals, for the Support. Tri-Service Working Group For IETMs. 20 November 1992.

- Military Specification MIL-Q-87270: Quality Assurance (QA) Program: Interactive Electronic Technical Manuals (IETM) and Associated Technical Information; Requirements for. Tri-Service Working Group for IETMs. 20 November 1992.

- Jorgensen, Eric L. Draft Handbook MIL-HDBK-EDS(NAVY): Electronic Display System for Navy Interactive Electronic Technical Manuals. David Taylor Research Center. DTRC/TM12-91/11. July 1991.

- Jorgensen, Eric L. Draft Handbook MIL-HDBK-IETMVP: Preparation of View Packages in Support of Interactive Electronic Technical Manuals. DTRC/AFLC/AFHRL. CDNSWC/TM12-92/84. July 1992.

- Jorgensen, Eric L. DoD Classes of Electronic Technical Manuals. CDNSWC. CDNSWC/TM-18-94/11. April 1994.

- Kribs, H.D. Mark, L.J., Morris, B.A. & Dickason, D.K., A Survey of Interactive Electronic Technical Manuals Used for Training and Education. Navy Personnel Research and Development Center, San Diego, CA, TN-96-35, March 1966.

- Kribs, H.D. and Mark, L.J., "The Impacts of Intractive Electronic Technical Manuals: Issues, Lessons Learned, and Trends in Training and Education". Journal of Instruction Delivery Systems, Fall, 1995, p.17-23.

- Mark, L.J., Kribs, H.D., Morris, B.A. & Dickason, D.K., Cost Benefits Analysis of Interactive Electronic Technical Manuals/Automated Classroom (IETM/AC) Technology. Navy Personnel Research and Development Center, San Diego, CA, TN-96-34, March 1966.

- Morris, B. and Dickason, D.K., "Evaluation of the Interactive Electronic Technical Manual/Automated Classroom", Navy Personnel Research and Development Center, San Diego, CA., TN-96-39, April 1996.

- Standards for Hypermedia Information Systems, October 1996, White Paper report of the CALS ISG Special Project for Hypermedia Information Systems (SP-HIS).

12.0 -- Portable Document Format (PDF)

12.1 -- Purpose

Although no official standards are yet associated with it, Adobe Systems' Portable Document Format (PDF) has become a de facto military and industry standard for the interchange, presentation, and storage of digital data. The goal of PDF is to enable users to easily and reliably exchange and view electronic documents independent of the environment in which they were created. PDF relies on the imaging model of the PostScript® language to describe text and graphics in a device- and resolution-independent manner. To improve performance for interactive viewing, PDF defines a more structured format than that used by most PostScript language programs.

Almost any text and/or graphics document that can be output from an application can be output as a PDF file by using the Adobe Acrobat application. The PDF file can be read by anyone having a freely distributed Acrobat reader (currently available for Windows, Macintosh, OS/2, and UNIX platforms). Users can view and print documents exactly as formatted by the original application without having to load and run that application. Users can navigate through the document using thumbnail sketches, hypertext links, and bookmarks. PDF files can contain hyperlinks within a single document, across multiple documents, and to the World Wide Web. The document's text may be searched and extracted for use in other applications.

PDF is designed as a "final form" document format. That is, a PDF file is optimized for the publication and distribution of documents which will not be changed. A PDF file is not a source file which might be used by an author, but rather an electronic print of the document for a reader.

The availability of PDF files blurs the distinction between composed documents and processable data files. Users can view a document in a PDF file exactly as it appears to the originator of the document (e.g., with

the same pagination). The user can also, however, retrieve some or all of the information in the file for use in other documents, providing many of the advantages of processable data files. With the proper software, users can also annotate PDF files with comments and return them to the originators.

12.2 -- Typical Applications

PDF offers great flexibility for Program Managers who must share text-and-graphics files among a user community with a variety of hardware and software installations, and is therefore applicable to a majority of weapons system programs. Because if its ease of use and ability to handle scanned in documents, PDF has also become popular for conversion of legacy data from paper to digital formats.

12.3 -- Status and Planned Extensions

The 3.0 version of Adobe Acrobat was made available in November 1996 and in addition to the functionality of the older versions, it also provides for easy integration of PDF files with HTML pages and several popular Web browsers. The new version also includes an Acrobat Capture plug-in that allows rapid conversion and recognition of any scanned in document to PDF.

An Encapsulated PDF (EPDF) block formatter application called Juggler is currently under development. An EPDF file stores blocks such as headings and paragraphs as distinct objects in such a way that they can be extracted and used in other documents. Juggler performs this task using a Document Description File (DDF) to determine the layout of the new document. Of particular interest is Juggler's method of visual splitting of blocks across columns and pages.

The design of EPDF aims to enable block-based reformatting of PDF documents with minimal changes to existing PDF-generating software. In PDF, nothing is known of what a block is; just what it looks like. Through the simple addition of a type field for a block, Juggler can treat different objects in different graphical ways. However, it still doesn't know what the blocks are: it just knows where to put them. Any attempt to type blocks more strongly, to create a set of 'standard' types (for tables, figures, graphs etc.) and to insert semantic information would make PDF more difficult to generate and would make the format specific to certain types of content. At the moment, PDF can represent any kind of printable material. It should remain that way. The types in EPDF can be compared with the elements in an SGML document, the DDF with the DTD. Types will be standard for a particular set of documents or particular project, but should not be standardized for EPDF. PDF, like print, is considered a final form of a document. Juggler and EPDF go some way towards enabling reuse of this final form.

12.4 -- Implementation Issues

Programs considering PDF must insure that users possess the platform-appropriate version of the Acrobat Reader software in order to view PDF files. These readers can be freely distributed to anyone who needs them, and can be downloaded off the Internet at http://www.adobe.com. Special provision must be made to supply copies of the Readers to users without Internet access. Also, Reader software is currently only available in Windows, OS/2, Macintosh, and UNIX versions, and therefore users of some computer platforms will not be able to access PDF files.

Programs considering using PDF must also be aware of its nature as a final form document format. Source

documents in an editable form must be maintained as part of the life cycle data management solution for a project, to ensure that revisions and updates can be made to project information without the costly and error-prone conversion or re-creation of missing source files.

12.5 -- Extent and Nature of User and Vendor Support

Although PDF is not a defined standard, and thus not a CALS standard, the application of this portable document file capability to capturing legacy data has been authorized on a number of CALS and CALS-like project efforts. PDF is widely used throughout the military and industry for both legacy data and active program data. PDF files are especially common on the Internet, where many organizations offer PDF as one of their standard text file download options. Several software development companies have created their own "plug-in" applications that plug in to the Adobe Acrobat software to allow greater user capabilities such as links to the World Wide Web, easy bookmark and hyperlink generation, and document comment/markup capture.

Since 1995, the Air Force has been converting its paper Technical Order inventory to Indexed PDF (IPDF) files. These digital TOs will be distributed electronically by the Joint Computer-aided Acquisition and Logistics Support (JCALS) System at most Air Force bases worldwide. The current Air Force Digital Data Strategy document identifies IPDF as the format for legacy data and for delivery of page-oriented TOs prior to JCALS implementation. Appendix II of the Digital Data Strategy provides core format guidelines for IPDF files.

The Army uses PDF as the distribution medium for its H-60 helicopter field maintenance data on CD-ROM, with plans to extend this approach to other weapon systems.

PDF has been released as a Publicly Available Specification, has undergone some review in the CALS standards community, and fulfills a documented DoD data format requirement. With projects like the Air Force and Army initiatives described above, PDF is a likely candidate to become formally recognized by the DoD as a standard for final form document management.

12.6 -- Additional Documentation

- Bienz, Tim, Cohn, Richard, and Meehan, James R., Portable Document Format Reference Manual Version 1.1, Adobe Systems Inc., 1 March 1996.

- Smith, Philip N., "Block-Based Formatting with Encapsulated PDF", Electronic Publishing Research Group, Department of Computer Science, University of Nottingham, Technical Report NOTTCS-TR-95-1, 2nd January, 1995.

- Adobe Systems Incorporated, PostScript Language Reference Manual, Second Edition, Addison-Wesley, 1990, ISBN 0-201-10174-2.

- Adobe Systems Incorporated, Adobe Type 1 Font Format, Addison-Wesley, 1990, ISBN 0-201-57044-0.

- Adobe Systems Incorporated, Adobe Type 1 Font Format: Multiple Master Extensions,

Adobe Developer Support Technical Note 5086.

- Berners-Lee, T., and D. Connolly. Internet RFC 1866, Hypertext Markup Language 2.0 Proposed Standard. November 1995. For updates, see http://www.w3.org/pub/WWW/MarkUp/html-spec.

13.0 -- Metafile for Interactive Documents (MID)

13.1 -- Purpose

CALS specifications MIL-D-87269 and MIL-PRF-87268 define requirements for the revisable database that stores IETM source data and the system that presents it. It was hoped that these specifications would enable one-time-purchases of technical information databases for new weapons systems. Further, it was hoped that presentation systems could be purchased to render a variety of IETM databases. However, it became increasingly obvious that even with two development standards, IETMs were not portable.

The problem focused on the encoding of interactive elements of technical manual presentations. Solving this problem required the addition of a representation layer between the IETM database and the presentation system. This new representation layer would standardize methods for encoding document behavior, connecting data content to presentation in different ways depending on conditions such as user inputs. The resulting portable IETM could then be created from neutral data by different authoring systems and structured for display by presentation systems at runtime.

The solution to this problem, called the Metafile for Interactive Documents (MID), provides target structures for authoring systems to write to and for presentation systems to read from. It is an intermediate structure that, once specified, completes the electronic pathway for preparing and using IETMs, successfully separating an IETM authoring system from any singular presentation system.

Based on the international standards for SGML (ISO 8879) and HyTime (ISO/IEC 10744), MID is an abstract, vendor-neutral programming language that specifies a method for transporting multimedia information from IETM authoring systems to presentation systems. It provides for the referencing and retrieval of information residing in many different locations and formats by using an external reference format based on HyTime. Its standardized scripting language enables authors to control presentation sequence, interaction, and conditional behaviors governing the rendering of information content. The result is interoperability across different authoring and presentation systems through the representation of IETM information in a technology- and application-neutral, internationally standardized form.

13.2 -- Typical Applications

Because of its applicability to any IETM, MID should be considered by any program using IETMs that wants a vendor-independent solution to IETM portability.

13.3 -- Status and Planned Extensions

Developed in response to U.S. Navy requirements, MID is equally at home within the international CALS community because it applies to any interactive hypermedia document for which presentation sequence

and branching need to be scripted. Both DoD and international standards efforts are considering the adoption of the MID standard. The Special Project-Hypermedia Information Systems (see para.11.4.1) of the CALS ISG has included MID as a key strategy in standardizing hypermedia systems. Furthermore, DISA has proposed that ANSI X3V1 and ISO WG8 consider MID as an approach in defining a Standard Multimedia Scripting Language (SMSL).

To date, MID project results include the development of the:

- MID Application Guide, which includes a draft performance specification for encoding of interactive documents
- MID Reader (i.e., HyMID) Software, a publicly available 32-bit MID reader that operates with Windows 95 and Windows NT
- HyMID Technical Reference guide, describing the architecture of the HyMID software providing for its reuse in other applications
- Design for a MID document development environment (authoring system)
- Sample MID-encoded interactive documents, including one that reuses a DoD IETM data set
- MID Home Page for disseminating information and sharing MID products (http://navycals.dt.navy.mil/mid/mid.html)

13.4 -- Extent and Nature of User and Vendor Support

The CALS ISG Standards Division will be forwarding a report from its Hypermedia Information Systems (HIS) Committee that cites MID as a recommended approach for transporting and archiving hypermedia information such as that used in IETMs.

Mantech WVa has implemented software that will render a MID document in a Web browser. The software resides on the Web server and converts the document on-the-fly to HTML.

NAVAIR has established a program to address interoperability issues among IETM systems. MID provides the framework for exchanging interactive data.

Several commercial and international corporations and programs are adopting the MID approach for their product lines. These applications include both information authoring products and internal data structures for maintenance of technical data in support of hardware products.

13.5 -- Additional Information

- Jorgensen, Eric L., and the MID-2 Design and Development Team; **Metafile For Interactive Documents**, **Version** 2 Application Guide and Draft Performance Specification for the Encoding of Interactive Documents -- MID-2; March 1996. Document available at http://navycals.dt.navy.mil/mid/mid.html.

Next Section