Previous Section

1.0 -- Introduction

CALS is a Department of Defense (DoD) strategy that enables more effective creation, management, exchange and use of data for the acquisition and support of defense systems and equipment. Technical Manuals (TM)/Technical Orders (TOs) are publications that contain instructions for the installation, operation, maintenance, and support of defense systems, defense system components, and support equipment. (**Note:** Throughout this section reference to "Technical Orders" will be implied by "Technical Manuals"). TMs can be in the form of traditional paper-based documents, Electronic Technical Manuals (ETMs), or Interactive Electronic Technical Manuals (IETMs). Using CALS standards to define the digital environment for the creation, management, and use of TMs will provide the method for the transition from paper-intensive defense system acquisition and support process to automated and integrated digital process.

1.1 -- Purpose

The planning processes for the creation, management, and use of TMs in a CALS environment needs to take advantage of the capabilities provided by the automation and integration of information systems. Various format options are available for the delivery of the TMs that are needed to define and support a defense system. The intent of this section is to:

- Provide an overview of the TM acquisition process
- Provide a step-by-step process for each TM decision
- Describe delivery options available for TM acquisition
- Provide a method to determine the cost associated with each option
- Provide guidance for specific contract language required to support the options selected
- Discuss contractor validation and government verification procedures.

This section contains ordering information for the deliverable media and digital data format for TMs. The Contract Data Requirements List (CDRL) guidance contained in this section applies to all types of TMs.

2.0 -- General Considerations

The development of a CALS strategy for TMs needs to be carefully examined to maximize the value for a specific defense system program. Program attributes such as technology, costs, quantities, and schedules have a profound effect on the delivery requirements for TMs. The technical data manager must consider the life cycle of the procurement and the infrastructure in place or being developed to support the TMs for their program.

TMs are any technical publication or other form of media used to install, operate, maintain, test, repair, overhaul, or provide logistic support of ships, aircraft, defense systems, or defense material. TM data may be presented or delivered in any media including, but not limited to, hard copy, audio and visual displays, on-line access, magnetic tape, discs, and other electronic devices. The acquisition guidance provided in this section applies to the three major TM categories: Description, Operation, and Maintenance with

Illustrated Parts Breakdown; Installation and Checkout Procedures; and Technical Repair Standards.

Considerations that must be addressed when the technical data manager is acquiring TMs in digital format include who will use the data, how they will use it, and what infrastructure they will need to use it. Three levels of activity exist, and all must have the ability to access and apply the digital data.

1. **Create:** The TM support agent must have the capability to review, comment, and process the TM that is being delivered, and must have appropriate hardware and software are in place to review the data before digital data is ordered and delivered.

2. **Manage:** The data delivered must be compatible with the existing infrastructure in place or being developed to manage and store the data.

3. **Use:** Each specific user environment must be determined. Many questions must be asked, such as:

   - What systems are available in the field?
   - For a specific user, what data media and formats are compatible with what they already have or are planning to get?
   - How will they acquire the new equipment and software they need if existing systems are inadequate?
   - How will these new systems be supported?
   - Who will pay for these new systems?

It is recognized that each defense system program is unique with individual constraints and access to a distinct infrastructure. This section is intended to provide the technical data manager with an overview of typical DoD business practices for the creation, management, and use of TMs in an integrated data environment while maintaining flexibility for innovative approaches. Specific implementation of this TM development process may be further tailored with guidance set forth by each DoD Service.

2.1 -- Types of TMs

One of the decisions the Program Manager will need to make is what form of TM will be most useful to the data end users. TMs can be delivered as traditional hardcopy documents, as ETMs, or as IETMs. Each option has its advantages and disadvantages. A brief description of each type of TM is provided in the following paragraphs.

2.1.1 -- Hardcopy TMs

In general, paper TMs are no longer recommended. All TMs (and most documents in general) being developed today are being created in some sort of digital format. In spite of the advantages of digital format (e.g., processability, portability, reduced storage requirements, etc.), there are occasions when paper manuals could be shown to be more useful, especially to the end user, than digital formats. For example, a tank turret maintainer will have more information available in less space and weight with a digital TM, but an infantryman may not benefit from a digital TM when all the information needed for a small arm can be in a paper manual that does not require a display device.

The continuing requirement for hard copy can significantly influence the feasible or even the possible choice of IETM functionality. Hard copy cannot necessarily be mandated away. Field personnel still require it, because maintenance technicians need hard copy technical manuals to perform three primary forms of maintenance:

a) To support maintenance during casualties when power is not available;
b) To carry TM information to the place where maintenance is accomplished; and
c) To provide readable, usable data especially large drawings and schematics.

When paper TMs are required, contractors should also be required to deliver the TM in whatever digital format it was developed in, as a minimum.

2.1.2 -- Electronic TMs

Electronic technical manual (ETM) is a general term that describes all combinations of technical manual data in digital formats, stored in optical or magnetic media, and viewed through electronic display devices. As such, they include all interactive variants. However, the term ETM is commonly used to refer to a basic form of digital TM that does not include the data interconnectivity found in an IETM.

Typically, ETMs will provide full page viewing and print capability, and may include an intelligent index for user access to page images. Table 9-1 below contains descriptions of the various ETM/IETM classes; a basic ETM is considered to be a Class 1 IETM. Some examples of ETMs include raster format, page description language (PDL) files, and neutral file formats. ETMs are common for legacy data that has been converted from paper to digital format, and are useful for library or reference use.

2.1.3 -- Interactive Electronic TMs

An IETM is a package of information required for the diagnosis of a weapons system. It is a TM in digital form that possesses the following characteristics:

- It's prepared with an automated authoring system which is the system that links all the pertinent information;
- It's designed for electronic-window display;
- It's designed for a portable electronic display such as a desktop or laptop PC or other portable electronic display device;
- The elements of technical data are interrelated, meaning that the user is able to access the information through a variety of paths; and
- It can function interactively in providing supplemental information such as procedural guidance, navigational directions, and assistance in logistic-support functions supplemental to maintenance.

The range of functionality and formats of digital TMs have been generalized into five classes by the IETM

Working Group. These classes are shown in Table 9-1, and range from the elementary electronically indexed page images to an interactive electronic information system built around an integrated database. To facilitate discussion of options and differences, the classes are defined in fairly broad, general terms that necessarily overlap. They are insufficient to serve as a basis for contractual use (e.g., direct the Contractor to prepare a "Class 3" manual). The Statement of Work (SOW)/Statement of Objectives (SOO) or TMCR should specify exact functionality requirements without referring to this set of definitions. The functionality and considerations for the five Classes of IETMs are:

- Basic ETMs: Class 1 -- Electronically Indexed Page Images
- Advanced IETMs: Class 2 -- Electronic Scrolling Documents
- Advanced IETMs: Class 3 -- Linearly Structured IETMs
- Extended IETMs: Class 4 -- Hierarchically Structured IETMs
- Extended IETMs: Class 5 -- Integrated Data Base IETMs

IETM Class	Display	Data Format	Functionality
1	• Full page viewing • Page-turner/Next function • Intelligent index for user access to page images • Page integrity preserved • Can be printed if necessary	• BitMap (raster -- legacy data only) • Indexing and header files (Navy Mil 29532) • MIL-PRF-28001 or Postscript pages • Generic COTS imaging system formats (e.g., Portable Document Format [PDF])	• Access pages by intelligent index/header info • View page with pan, zoom, etc., tools • Limited use of hot-spots • Useful for library or reference use
2	• Primary view is scrolling text window • Hot-spot access (Hyper-links) to other text or graphics • User selection and navigation aids (key-word search, on-line indices) • Minimal text-formatting for display • User selectable call to (launch) another process • Can be printed if necessary	• Text -- ASCII • Graphics -- whatever viewer support -- e.g., BMP or CALS • Can be SGML tagged -- no page breaks (browser) • Access/index often COTS dependent with Hypertext browser • Generic: COTS with Hypertext browser	• Browse through scrolling info • User selection of graphics or hot-spot reference to more text • Hot-spot and cross-reference usually added after original authoring
3	• View smaller logical block of text -- less use of scrolling • Interaction through dialog boxes • Interaction per MIL-M-87268 to extent possible • Text and graphic simultaneously displayed in separate window • Can be printed if necessary	• Linear ASCII with SGML tags • SGML with content vice format tags • Maximum use of MIL-D-87269 • Generic: SGML tags equivalent to MIL-D-87269	• Dialog-driven interaction • Logical display of data in accordance with content • Logical **Next** and **Back** functions • User-selectable cross-refs and indices • Content specific help available
4	• View smaller logical block of text -- very limited use of scrolling • Interaction through dialog boxes with user prompts • Interaction per MIL-M-87268 • Text and graphics simultaneously displayed in separate window when keyed together	• Fully attributed database elements (MIL-D-87269) • MIL-D-87269 content tags with full conformance with Generic Level Object Outlines (architectural forms) • Authored directly to database for interactive electronic output • Data managed by a DBMS • Interactive features "authored	• Dialog-driven interaction • Logical display of data in accordance with content • Logical **Next** and **Back** functions • Useful as interactive maintenance aid • User-selectable cross-refs and indices • Content specific help

	• Electronic display devices required to use IETM	in" vice added-on	available
5	• Same as Class 4 for IETM function • Interactive electronic display per MIL-M-87268 • Expert system allows same display session and view system to provide simultaneous access to many differing functions	• IETM info integrated at the datalevel with other application info • Does not use separate databases for other application data. • Identical to Class 4 standards for IETM applications data • Coding for Expert Systems and AI modules when used	• Single viewing system for simultaneous access to multiple info sources • Same as Class 4 for IETM functions • Expert system to assist in **Next** functions, based on info gathered in session

Table 9-1. -- The Five Classes of IETM.

Operational tests performed by the three Services compared interactive electronic with hard copy delivery of TM data and showed that IETMs provide the following types of improvements in weapon system support:

a. increased overall ability to locate, comprehend, and retain required information, leading to greater effectiveness in maintenance performance;

b. decreased false removal rates of good components;

c. increased effectiveness in successful fault isolation (reduction in time, increase in percentages of successful fault isolation actions);

d. reduced time in integrating maintenance actions with collateral functions (e.g., with maintenance reporting);

e. improvement in maintenance management procedures;

f. potential for significant decrease in formal training time for individual systems, prior to assignment to organizational level work centers;

g. increased enthusiasm shown by technicians for IETM use over paper TMs in performing logistic support functions; and

h. potential for significant improvement in automated on-the-job training (both system related and other types) from availability of electronic display systems (EDS) equipment in work centers. (Courseware for this type of interactive, electronically displayed training material is currently being developed extensively by all three Services for schoolhouse training.)

2.2 -- TM Decision and Responsibility

The following paragraphs of this section are devoted to the acquisition of TMs in a digital environment. The purpose of the flow chart (see figure 9-1) is to lead the technical data manager through a logical series of decisions and responsibilities associated with the overall process of TM format and delivery media selection.

In addition to identifying the responsible agency or agent for each of the tasks, functions, and decisions, the flow chart also identifies supporting agencies and their inputs as required.

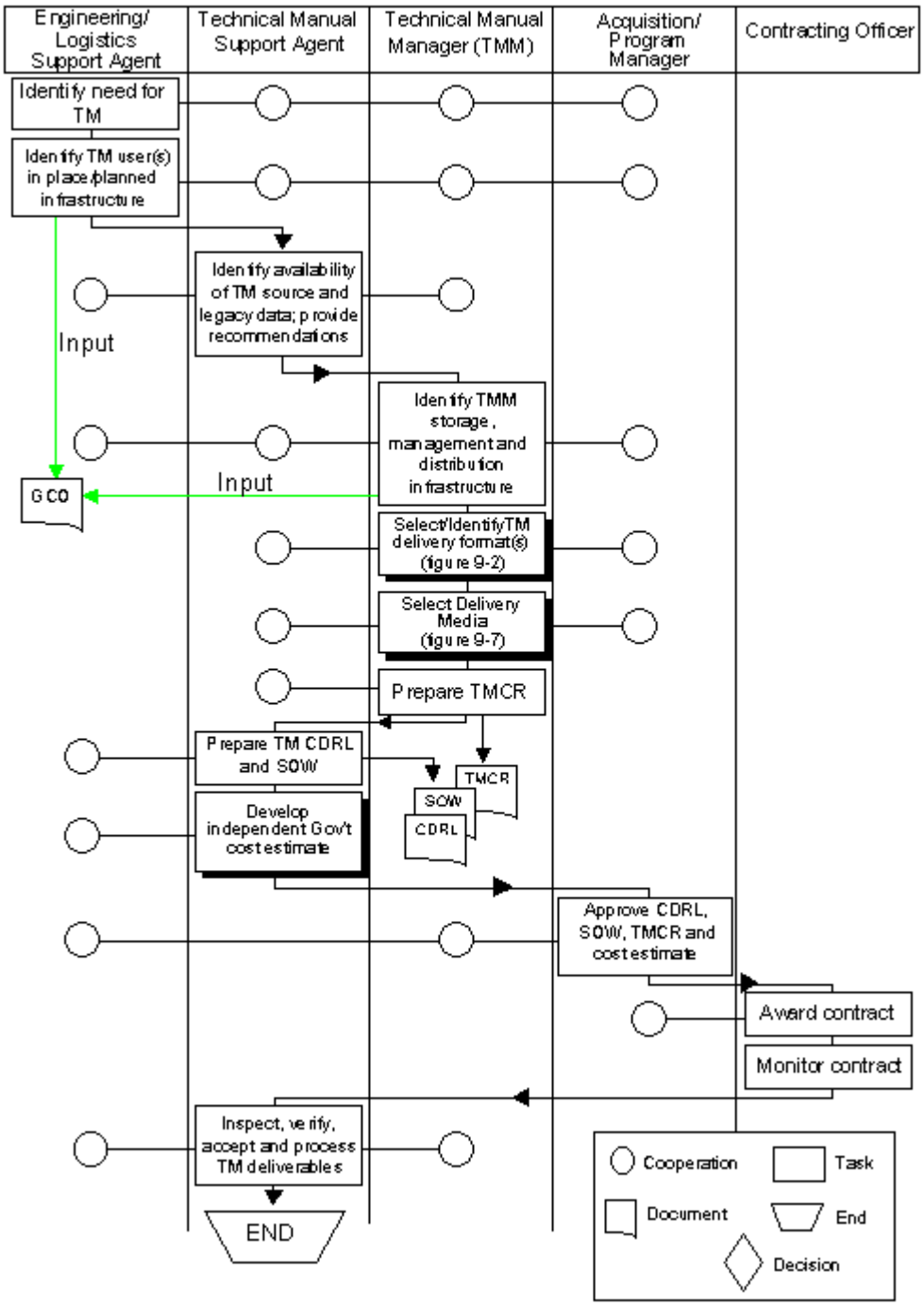

Figure 9-1. -- TM Decision and Responsibility Flow Chart.

2.3 -- Identify/Establish the Requirement for the TM

The technical manual manager will first identify the requirement to procure a TM through the development of overall supportability goals and the initial maintenance philosophy. This is brought about through Supportability Analysis. The analysis will quantify and define requirements such as the need to operate or perform maintenance on equipment. The supportability and logistics information will contain the necessary task narratives for the operation and maintenance of equipment and will be used as the primary source for the development of technical manuals of various types.

2.4 -- Identify the TM Users Requirements

The technical manual manager must now identify the intended TM user's infrastructure and data use requirements. The users include those involved in system acquisition, review, and approval; the people involved in TM management; and the end user. The technical manual manager should consider the existing and planned infrastructures for both Government and contractor facilities; available CALS data exchange standards; data use requirements, and the various digital data deliverable options in terms of media, format, and access. Documentation of this infrastructure review will take the form of a Government Concept of Operations (GCO). Section 5 of this Desktop Guide provides detailed guidance on the preparation and contents of a GCO.

Acquisition requirements for user hardware and software to support a fielded defense system are normally under the funding discretion of the technical manual manager and must be considered during the CALS implementation strategy and planning process.

2.4.1 -- Infrastructure Development

Effective acquisition of digital data can be done only with full consideration of the ability of support activities to receive, store, distribute, and use digital data that complies with the selected CALS and industry standards. The technical manual manager must establish the uses for which the data is required (see 2.4.2) and the Automated Information Systems (AISs) available to support this data. In response to DoDI 5000.2, defense activities are incrementally upgrading their infrastructure toward a comprehensive technical information management architecture through joint service programs like Joint Engineering Data Management Information and Control System (JEDMICS). The evolution of this infrastructure is a key consideration in implementing the CALS strategy on any given acquisition. Deficiencies in the Government's infrastructure may require investments by the technical data manager to implement the CALS strategy effectively.

The availability of digital data processing and telecommunications technology and approved standards for creation, storage, transmission, data protection, and integrity of data at the time of delivery or access are important criteria for acquisition decisions. The current and projected capabilities of both the contractor and DoD components must be assessed with respect to program needs and schedules. The GCO, Contractor's Approach to CALS (CAC), and CALS Implementation Plan (CALSIP) are excellent vehicles for making these determinations.

The data user infrastructure is the computing environment available to a particular user. This environment establishes the data processing capabilities of that user. The following areas identify a user's infrastructure:

- **Hardware:** Determine the current and planned hardware available to support the defense

system program.

- **Software:** This is the most critical element. Interoperability will normally be achieved through the use of software. Again, determine both present and future software applications and availability.

- **Networks:** Determine the local- and wide-area networking capabilities and whether CITIS will be used.

Specific AISs designed to aid in the creation, management, and use of TMs are listed in appendices **Air Force**, **Army**, and **Naval Forces**.

2.4.2 -- Data Uses

TMs are subject to all data uses defined below. The technical manual manager will need to identify the use of the data by all organizations involved in the acquisition program in order to make good decisions on digital data requirements. The five defined categories of data processing typical of most defense system programs are:

- **View only:** The ability to examine a data file without the ability to change it. This includes viewing selected portions of one or several documents as well as side-by-side comparisons of documents.

- **Comment/Annotate:** The ability to evaluate and highlight for future reference or to make annotations, approvals, and comments without the ability to change the original file. Annotations are associated with a specific item or location within a document such that the annotations are displayed whenever that point or area of the document is displayed.

- **Update/Maintain:** The ability to change data, either directly or through controlling software, in the active files on the host computer.

- **Extract/Process/Transform:** The ability to extract and modify the format, composition, and structure of the data into another usable form.

- **Archive:** The placing of data into a repository to preserve it for future use.

2.5 -- Life Cycle Considerations

TMs are generally not required until the later acquisition life-cycle phases of a defense system program. TMs available during the earlier phases may be preliminary copies that have not been verified or have not received final acceptance but are useful for test verification, training, and operation. Final Reproducible Copies (FRC) are available in the later phases. The technical data manager must consider the information volume and typical use of the data generated during each of these phases (see 2.4.2) to determine the appropriate TM deliverable format. Note that the deliverable format may be different for each phase (e.g., preliminary versions delivered in mutually-agreeable word-processing format and final versions in SGML format).

3.0 -- TMs in the CALS Environment

The technical data manager should be aware that it is possible to acquire TMs in a variety of forms depending upon the needs of the users. Documents such as maintenance manuals may be highly beneficial when procured as Interactive Electronic TMs (IETM) (see paragraph 2.1.3). The IETM user would be the technician whose main concern is finding the desired maintenance-related information quickly and easily without being burdened in the field with the entire maintenance manual. Description and operation, and installation and checkout manuals, however, may be procured best in neutral or native (e.g., word-processing) file formats since these manuals are not used as often.

Primary considerations for the technical data manager to address when applying CALS to the creation, management, and use of TMs is the media, format, and content of TM data deliverables and their respective end users. This section provides definitions/descriptions of the different types of TM and their formats.

Paper, microfiche, and microfilm have been included in this discussion of CALS because much of the Government's TM inventory is still available on these media. Government CALS initiatives are being developed to reduce or eliminate the need for these forms of media in the future. The benefits associated with using digital data far exceed what is being discussed in this section. For TMs some benefits of digital data include: (1) Improved handling and reduced storage of TM data with electronic filing and archiving; (2) reduced costs associated with printing and distributing TMs by providing on-line access to the TM data, so that defense personnel could access the data repository from their field activity and view and/or print the specific TMs they require; and (3) improved accuracy and timeliness of the TM data, due in part to the simplified incorporation of change pages.

3.1 -- Nondigital Data Deliverables

3.1.1 -- Paper

Paper or final reproducible copy has long been the traditional media for delivery of Government product data and related information. TMs delivered on this media may have originated from many sources including other existing paper documentation, microfiche, microfilm, or any of the digital data formats described in the following paragraphs. TMs provided on paper are governed by the individual weapons program.

No digital data infrastructure requirements are necessary for TMs delivered on paper. However, converting the data content of paper to a digital data format requires infrastructure systems that include scanning hardware and software to support the conversion of both text and graphics from hardcopy to electronic format.

3.1.2 -- Microfiche/Microfilm

Microfiche and microfilm are other traditional media for delivery of data to the Government. They are not recommended media for obtaining new data, but are discussed here since legacy data in this form already exists. The data provided on microfiche and microfilm are governed by specifications such as MIL-M-38748 and MIL-M-9868, which provide guidelines for data format and content. Converting the

data contents of microfiche or microfilm to a more flexible digital data format requires additional infrastructure requirements that include scanning hardware and software to support both text and graphics.

3.2 -- Digital Data Deliverables

The technical data manager must choose from a variety of digital data formats and media options. For TM delivery, the list includes:

Data Formats:

- Raster (legacy data only)
- Illustrated Text Data Files:

    a) Text:

        1) American Standards Code for Information Interchange (ASCII)
        2) Native word-processing/Mutually Agreeable Commercial Software (MACS) formats
        3) Standard Generalized Markup Language (SGML)

    b) Illustrations:

        1) Raster (legacy data only)
        2) Native graphic format/MACS formats
        3) Computer Graphics Metafile (CGM)
        4) Initial Graphics Exchange Specification (IGES)

    c) PDL
    d) Neutral data files

- Interactive Electronic Technical Manual (IETM)

Media:

- On-line access (e.g., CITIS)
- Physical media (e.g., optical disk, magnetic tape or disk)
- Mutually agreeable media

3.2.1 -- Raster

Raster data is a binary representation of an image. Raster may be thought of as the electronic version of a paper document. It contains no intelligence and must be reviewed through human interpretation. Raster files can be converted to digital (word processor or desk top publishing) documents using Optical Character Recognition (OCR).

With the advent of raster scanning technologies, the ability to convert existing paper TMs to digital data files has become readily available. Raster conversion became the easiest and most cost effective method

for digitizing the existing paper TMs. Although the quality assurance (QA) process by human interpretation required to verify the data content may increase costs substantially, OCR capabilities are improving rapidly to reduce the amount of document "clean-up" required. Also, raster image files require a large amount of memory storage due to their file structure and contain no additional information other than each tile's position on a grid. Technologies are evolving that will be able to convert the raster images to other digital forms (such as vector) for processing. Raster format is only recommended for legacy data, not for new TM acquisitions.

3.2.2 -- Illustrated Text Data Files

Illustrated text data files provide a dynamic form of source data with two possibilities: (1) Separated files for text, graphics, alphanumeric and audio/visual data; or (2) integrated files consolidating some or all of these different data representations. The lower classes of IETMs (1-3) typically consist of these types of files. Text data files include word processing and desk top publishing applications. Such data files can provide the source data for multiple data applications that allow creation of standard and custom documents as well as manipulation of the data for annotate/excerpt or update/maintain purposes. Illustrated text data files can also import generic text and graphics from other sources that may be otherwise incompatible. In addition, there are PDLs, sometimes called text presentation metafiles, which are used to drive output devices such as printers. Finally, acquisition managers may want to consider using platform-independent neutral data files that allow users to save information created in a variety of software applications and formats into a platform-independent file format, which can then be viewed and printed by anyone possessing the appropriate reader software.

3.2.2.1 -- Text Formats

The possible text formats include ASCII, native word-processing, and Standard Generalized Markup Language (SGML). They are described below.

- **ASCII**
  ASCII was developed as a method of translation for computer processors to interpret alphanumeric characters and symbols through binary representation. ASCII is the basic text information used by most word processing applications and contains no formatting information other than line feed and/or carriage returns. ASCII text can be used for most interim deliverables since it can also be imported into an SGML application where it can be SGML-tagged to become a CALS-compliant deliverable.

- **Native Word-processing**
  Native word-processing formats are those resulting from creation of documents using Commercial Off-The-Shelf (COTS) software. Most word-processing packages allow users to import both text and graphics from many other sources, including raster, ASCII, other word-processing formats, COTS illustration software formats, and native Computer-Aided Drawing (CAD) formats. Many packages available today possess data conversion capabilities, substantially reducing the file format incompatibility problems that have existed in the past. This makes native word-processing format ideal for most interim deliverables since it can also be imported into an SGML application where it can be SGML-tagged to become a

CALS-compliant deliverable.

- **SGML**
  SGML is defined as "A standard that defines a language for document representation which formalizes markup and frees it of system and processing dependencies. The advantage of SGML is that the same text can be used in another document that is governed by a different DTD. It provides a coherent and unambiguous syntax for describing whatever a user chooses to identify within a document." In the SGML scheme, the document contains only generic tags identifying such structural elements as paragraphs, sections, etc. but no typesetting markup. SGML tagging can be difficult and time-consuming, although COTS software packages are currently being developed to provide various levels of automatic tagging. Because of its comparative difficulty, SGML format may be best suited for final data deliverables rather than interim deliverables. When considering SGML as a deliverable format, the technical data manager must determine whether the applicable Document Type Definitions (DTD) and Formatting Output Specification Instances (FOSI) exist and whether the necessary computer environment is available and in place to accept the SGML documentation. Any TMs that will be maintained throughout the life cycle of a defense system should be delivered in SGML format. SGML requirements are stated in MIL-PRF-28001 and MIL-PRF-87269, and a description of these standards and their contents can be found in section 10 of this Desktop Guide.

3.2.2.2 -- Graphics and Illustration Formats

The possible graphics formats for consideration are raster, native graphic formats, Computer Graphics Metafile (CGM), and Initial Graphics Exchange Specification (IGES). These formats are described below.

- **Raster**
  See 3.2.1 for a discussion of raster.

- **Native graphic format**
  Native graphic/illustration formats include graphics created in COTS illustration software as well as data created using COTS CAD software. Native graphic formats are typically fairly easy to import into word-processing files, and are therefore suitable for interim deliverables.

- **CGM**
  CGM data is a two-dimensional vector presentation used primarily for charts, figures, and simple drawings. Many types of TMs contain illustration data in this category. CGM is the preferred format for incorporating graphical digital data into TMs. Graphical enhancement has been added to the format, including complete integration of tiled compressed raster. Application structuring is currently in the process of being added to the CGM format. Extensions will allow CGM generators to tag "objects" of application significance. It will therefore serve to meet the needs of leading edge and future applications of hypertext and hypermedia documents, multimedia documents, IETMs, network-distributed graphical applications, and graphic object databases. CGM requirements are stated in MIL-PRF-28003, which is described in section 10 of this Desktop Guide.

- **IGES**
  IGES is a two-dimensional vector presentation used primarily for engineering drawings. IGES may be the preferred choice for graphical data if a CAD database was used as the source. Note that IGES is expected to be replaced by the Standard for the Exchange of Product Model Data (STEP) in the near future. IGES requirements are stated in MIL-PRF-28000 and STEP is defined by ISO 10303, both of which are described in section 10 of this Desktop Guide.

3.2.2.3 -- Page Description Language (PDL)

A PDL file is executed by an interpreter that controls a printer or other output device. A PDL can be used to ensure that the composed document produced by an electronic publishing system would produce nearly identical hardcopy output on the widest possible spectrum of printer devices. However, PDLs are currently not standardized, and a Standard Page Description Language (SPDL) is still being developed. PDL document image files can be acquired as interim deliverables or as final deliverables in addition to, but not in place of, other digital data deliverables developed in accordance with the CALS standards.

3.2.2.4 -- Neutral Data Files

Several industry-developed software products for creating platform-independent neutral data files are available that allow users to save information created in a variety of software applications and formats, including text, graphics, and spreadsheets, into a platform-independent file format. These files can then be viewed and printed by anyone possessing the appropriate reader software. Many applications also allow reader-software users to annotate data and copy information to paste into other word processing programs. Neutral data file formats have become especially popular for the digitization of legacy data, and can be used to develop Class 1 and 2 IETMs.

3.2.2.4.1 -- Portable Document Format (PDF)

Adobe Systems' Portable Document Format (PDF) is currently the most popular neutral data file format. PDF has become a defacto military and industry standard for the interchange, presentation, and storage of digital data.

Almost any text and/or graphics document that can be output from an application can be output as a PDF file. The PDF file can be read by anyone having a freely distributed PDF reader. 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. The document's text may be searched and extracted for use in other applications. Section 10 of this guide contains detailed information about PDF.

3.2.3 -- Interactive Electronic TM (IETM)

An IETM is a computer-based collection of information needed for the diagnosis and maintenance of a defense system. It is optically arranged and formatted for interactive presentation to the end user on an electronic display system. Unlike other optical systems that display a page of text from a single document, IETMs present interrelated information from multiple sources tailored to user queries. The five classes of IETM are defined in para.2.1.3 and Table 9-1.

An IETM is essentially a hypertext document, which consists of a collection of "interconnected writings." These interconnections allow a user to browse through a document by selecting points of interest or hotspots that may be connected to other related text, hotspots, or menus. The user could then continue to follow along these "paths" to other cross-referenced points in that collection of writings. This creates a "pageless" document that, depending on the source database, can contain a collection of information from a variety of sources. Text, graphics, audio, video, and/or computer programs can be incorporated into the content of the document.

By streamlining access to the desired information and by providing multiple paths to other related information, the IETM offers a more efficient and more comprehensive method of using technical information. Unrestricted by the page-oriented display and the use of sole-source information, the IETM displays only the actions appropriate for resolving a specific problem; provides fault-isolation tables and diagrams; and guides the technician through the troubleshooting process via a user-friendly query method. IETMs permit the user to locate information more easily and to present it faster and more comprehensively in a form that requires much less storage than paper.

IETMs require a computer environment with the appropriate presentation systems and software to invoke them.

Next Section