Previous Section

Section 10
CALS Standards Overview

1.0 -- Introduction

The DoD and Industry Continuous Acquisition and Life-Cycle Support (CALS) initiative is an effort to accelerate the use and integration of digital technical information in the weapon system acquisition and life cycle support process. CALS is one of the key initiatives in a DoD transition from a paper-intensive mode of operation to an integrated digital information environment aimed at improving the efficiency of these processes and quality of the products. Many organizations create and maintain data in digital electronic form. This data represents computer-based models, designs, drawings, engineering data, technical documentation, and manufacturing data.

This document presents a brief overview of the CALS standards including their purpose, current status, and implementation issues. This document describes the CALS Standards that have been designated as interface standards or performance specifications. All of the MIL-SPEC 28000 series have been transitioned to performance specifications, which define what the DoD needs in terms of form, fit, and function rather than how to build an item.

This section concentrates on the CALS specifications implemented by MIL-STD-1840, Automated Interchange of Technical Information, notably: MIL-PRF-28000 (IGES), MIL-PRF-28001 (SGML), MIL-PRF-28002 (Raster), and MIL-PRF-28003 (CGM). Also, sections have been devoted to STEP (Standard for the Exchange of Product Model Data), Electronic Data Interchange Format (EDIF), Hypermedia Time-based Structuring Language (HyTime), Interactive Electronic Technical Manual (IETM) Specifications, and Portable Document Format (PDF).

(See Appendix NATO for NATO CALS Standards Overview)

2.0 -- Standards & Specifications

OASD, Economic Security, memorandum dated 15 March, 1995, Subject: Information Technology Interface Standards and Performance Specifications stated that the asterisked (*) information technology (IT) standards identified in Table 10-1 satisfy the requirements for being designated as interface standards and/or performance specifications. Consequently, DoD activities may use them without a waiver, as permitted by DoD Policy Memo 95-1, "Waivers for Use of Specifications and Standards."

See the CALS Standards Web site at <http://www-cals.itsi.disa.mil> for the status of these documents or to download electronic copies of the most current revisions.

DoD Standard	Industry Equivalent	Applications
MIL-HDBK-59B: Continuous	None	Provides guidance on the technology,

Acquisition and Life-Cycle Support (CALS) Implementation Guide		transition from a paper intensive activity standards, and procurement process as related to the to one operating with digital information.
*MIL-STD-974: Contractor Integrated Technical Information Service (CITIS)	None	Provides service for electronic access and/or delivery of contractually committed business and technical information on a need to know basis.
*MIL-STD-1840: Automated Interchange of Technical Information	None	The primary defense standardization document for CALS standards. It identifies, by application, which industry standards and corresponding DoD standardization documentation to use. It also provides standard "enveloping" procedures for transferring standard data forms.
*MIL-PRF-28000: Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols	IGES, Multiple Classes	Initial Graphics Exchange Specifications (IGES). A neutral file format for the representation and transfer of product definition data among CAD/CAM systems and application programs.
*MIL-PRF-28001: Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text	SGML	Standard Generalized Markup Language (SGML). Markup requirements, tagging, and generic style specifications for page-oriented document text.
*MIL-PRF-28002: Raster Graphics Representation in Binary Format, Requirements for	ITU-T Group 4, TIFF	The efficient compression of scanned raster images. Uses the code from the Group 4 facsimile recommendation of the International Telecommunications Union Telecommunication Standardization Sector (ITU-T) (previously the International Telegraph and Telephone Consultative Committee, or" CCITT"). A "filed" form is described by using the architecture nomenclature of International Standard, IS 8613.
*MIL-PRF-28003: Digital Representation for Communication of Illustration Data: Computer Graphics Metafile (CGM) Application Profile	CGM	Computer Graphics Metafile (CGM). A neutral format for the description, storage, and communication of graphical information.
*MIL-PRF-87268: Manual, Interactive Electronic Technical; General Content, Style, Format, and User Interaction Requirements	None	Prescribes the requirements governing the creation of Interactive Electronic Technical Manuals and the development of IETM presentation software applicable to a computer-controlled electronic display system.
*MIL-PRF-87269: Data Base Revisable, Interactive Electronic Technical Manuals for Support Of	None	Prescribes the interchange format for delivery of an IETM database to the government.

MIL-PRF-87270: **Expired**	None	Prescribes QA for IETMs.
MIL-HDBK-28001 Standard Generalized Markup Language (SGML) Implementation Guide	SGML	Provides guidance in the application of MIL-PRF-28001, which is based on ISO 8879, Standard Generalized Markup Language. Data prepared in accordance with these guidelines will facilitate the automated storage, retrieval, interchange, and processing of technical documents from varied data sources.

CALS Interface standards and Performance Specifications that can be used without waivers.

Table 10-1 -- Standards & Specifications.

3.0 -- Automated Interchange of Technical Information MIL-STD-1840

3.1 -- Purpose

MIL-STD-1840 is often called the "parent" or "umbrella" standard for the Continuous Acquisition and Life-cycle Support (CALS) program because it identifies other standards, specifications, and practices to be used in a CALS solution. It applies selected Federal, DoD, International, National, and Internet standards, specifications, or practices for the exchange of digital information between organizations or systems, and for the conduct of business by electronic means.

This interface standard defines the means for exchanging large quantities of engineering and technical support data among heterogeneous computer systems. MIL-STD-1840 applies to technical information which is part of the traditional technical data package used for system or item acquisition; technical information used to design, manufacture, field, and dispose of a system or item; and the technical documentation used for system or item support.

MIL-STD-1840 defines the format of the data to be exchanged in the CALS environment as well as the mechanisms and the parameters of those mechanisms, required for the exchange to take place. Additionally, MIL-STD-1840 addresses electronic product data, new packaging of data for electronic trade business transactions, and electronic product data technology.

The MIL-STD-1840 standard defines, or references, the formats and structures of the data files used for the transfer and archive of technical data in digital form. It clearly defines the formats, standardized header records, contents of the files used for the exchange of data as well as requirements during transfer for the labeling, protection, packaging, and the marking of media.

3.2 -- Typical Applications

MIL-STD-1840 is designed to be usable for all CALS-related applications where the information can be prepared and received as ASCII (American Standard Code for Information Interchange) text files, product definition data files, raster image files, graphics files, or contract defined data files. The areas addressed by this standard involve the interface of computers for automating the creation, storage, retrieval, and

delivery of product data and support information. The standard defines a logical file identification and bundling convention for device- and medium-independent transfer of technical information. This standard also addresses the transfer of electronic product data for engineering uses and the packaging of data for electronic commerce. This standard is not designed to be usable for specific applications, but is not restricted in any way in its application.

This interface standard is intended for technical information which includes product data, product acquisition and implementation data, and product support data. Product data includes engineering drawings and specifications, as well as new and evolving digital data forms which provide the data in a platform independent form directly usable by computer applications. Product acquisition and implementation data includes parameters and data necessary to manufacture and/or acquire an entire defense system. Product support information includes training and maintenance manuals with their associated illustrations needed to maintain a defense system in a required state of readiness. The scope of this data covers the entire life cycle of a weapon system.

MIL-STD-1840 provides general requirements for Technical Publication, Product Data, and Electrical/Electronic Application Data File document types. The Technical Publications document type includes files that contain MIL-PRF-28001 SGML (Standard Generalized Markup Language), Document Type Declaration with no text, FOSI (Formatting Output Specification Instance), SGML text entity, MIL-PRF-28000 IGES (Initial Graphics Exchange Specification), MIL-PRF-28002 Raster, MIL-PRF-28003 CGM (Computer Graphics Metafile), PDL (Page Description Language), gray scale or color illustration, or special word data.

The Product Data document type includes files that represent engineering drawings in IGES or raster formats as well as Numerical control manufacturing and 3-dimensional piping data files.

The Electrical/Electronic Application Data Files document type includes files that contain information in the following formats: Electronic Design Interchange Format (EDIF), the Very High Speed Integrated Circuit (VHSIC) Hardware Description Language (VHDL), IGES Electrical/Electronic application data files, and Institute for Interconnecting and Packaging Electronic Circuits (IPC).

In any typical application, the hardware and software must prepare the files for transfer on the sending system by adding header information and writing the files to the selected media type. The hardware and software on the receiving system must process the files by reading the files from the selected media type and stripping the added header information. If physical media is used, it must also be labeled, protected, packaged, and marked appropriately during shipment in accordance with this standard.

3.3 -- Status and Planned Extensions

MIL-STD-1840 Revision C is expected to be published in March 1997. MIL-STD-1840B was released on November 3, 1992. It supersedes MIL-STD-1840A which was released 5 years earlier on December 22, 1987.

MIL-STD-1840 is recommended for the delivery of technical CALS data. It is an approved interface standard for use by all agencies of the Department of Defense (DoD). It has been implemented and used successfully by numerous vendors. The use of MIL-STD-1840 will undoubtedly continue to grow since

this standard is at the heart of the CALS interchange environment.

To accommodate operational needs and technology advances for information transfer, Revision C of MIL-STD-1840 adds five (5) new data format types, adds three (3) new data file header records, provides for six (6) new transfer media types to complement 9-track reel tape, and defines increased Information Security (INFOSEC) capabilities including digital signature and encryption. The "dtype: "record has been redefined as an extensible means of automatically transferring data file subtype information when using this standard. The Joint Engineering Data Management Information and Control System (JEDMICS) is explicitly supported in this revision.

Transfer media requirements have been moved into a new Appendix A. In addition to the new transfer media types, this revision of the standard supports the transfer of data by electronic as well as physical media. It provides for the use of Electronic Data Interchange (EDI) or the Internet for electronic data file transfers. The Multipurpose Internet Mail Extensions (MIME) type, "Application/CALS-1840" is a registered media type for the electronic exchange of transfer units via the Internet.

Packaging requirements have been moved into a new Appendix B, for guidance only.

A new Appendix C contains instructions for product data indexing and metadata, and documents some requirements from the now-cancelled MIL-STD-804 for the transfer of legacy data and data originating on aperture cards.

A new Appendix D establishes the redefined format and use of the "dtype: "record. This allows data file subtype information to be exchanged without requiring human intervention in an automated transfer. This is an extensible capability, establishing a naming convention for both MIL-STD-1840-defined and project-defined data types to improve interoperability during information transfers.

This revision of the standard is fully "Year 2000" (Y2) compliant.

This standardization document will continue to be updated as new technologies, formats, and media for the transfer of digital product and technical information emerge. In particular, some of the transfer media types presented in appendix A have received only general interface requirements in this revision. This is due to the lack of the necessary mature international or commercial standards and detailed Publicly Available Specifications (PASs) to define detailed interface requirements at this time. As the use of some of these technologies will be too valuable to preclude, these transfer media types are introduced for use with the recognition that many of their detailed interface provisions will need to be individually defined by each project, in the contract or other form of agreement.

Many of the standards and specifications required or referenced by MIL-STD-1840 are evolving significantly due to rapidly advancing technologies. These will have to be further implemented in future revisions of this standard.

3.4 -- Implementation Issues

MIL-STD-1840 is required for the delivery of CALS technical data. MIL-STD-1840 has been designated as an "Interface Standard" by the DoD, and may be used in acquisition contracts without a waiver. The

improved tailoring guidance in Revision C facilitates the proper application of the interface standard without contractually levying unnecessary or onerous requirements.

Because of the extensive coverage in MIL-STD-1840C of data types, media selections, and other features such as INFOSEC, numerous choices must be made to ensure the proper application of this standard to your project. Invitations for bids, requests for proposals, and contractual statements of work should tailor the requirements in sections 4 and 5, and appendices A, B, C, and D of this standard, to exclude any unnecessary requirements and to stipulate project-specific details.

The frequent use of the term "as specified in the contract or other form of agreement" throughout sections 4 and 5 and the appendices, highlights the importance of detailed communications and agreement between sender and receiver (formally or informally) to ensure complete and successful transfer of data.

Corresponding hardware and software tools must be present at the preparing (source, sending) site and the receiving (destination) site to accommodate the selected media for the information interchange. The files on the sending system must be prepared for transfer by adding header information to them and writing them to the selected media type. The files must be processed on the receiving system by reading them from the selected media type and stripping the added header information. These steps are usually done automatically by the software tool. The configuration management functionality of MIL-STD-1840 requires careful management within the software to assure that correct information is added to the file headers.

MIL-STD-1840 does not handle the occasionally encountered problem of multi-volume files. If a file is spread across several volumes, there are many different ways that the information could be recovered. This is a problem with implementation that has been raised, but not adequately handled in the standard. Note, however, that the file would have to be larger than 4 gigabytes to be too large to fit on any of the media choices in 1840C.

When this standard is referenced by contract, it only applies to contract data called out in the Contract Data Requirements List (CDRL), Contract Line Item Number (CLIN), or Exhibit. Each item in the CDRL/CLIN/Exhibit must be annotated on the appropriate form indicating that MIL-STD-1840 specifies the format for delivery.

As it has no commercial equivalents, this standard also could be employed for many information exchange applications not specifically described. Its use is not limited to technical data exchange in a defense acquisition environment. The U.S. Patent and Trademark Agency and the American Railways Association are both fielding interchange standards based on MIL-STD-1840.

3.5 -- Extent and Nature of User and Vendor Support

MIL-STD-1840 is approved for use by all agencies of the Department of Defense. This military standard specifies other standards which are widely supported and accepted by national as well as international standards organizations. This provides a strong foundation for user and vendor support. Several Government-owned tools are available to support MIL-STD-1840.

At least two commercial vendors and one Government agency have voiced an intent to develop or upgrade

tools to support MIL-STD-1840 Revision C. Given the number of projects already applying MIL-STD-1840B, it is expected that other existing systems will also be upgraded to the Revision C standard.

Throughout the development of Revision C, an effort was made to retain maximum compatibility between this interface standard and its earlier versions. Although it is unlikely that a transfer package prepared in accordance with MIL-STD-1840C could be read by tools written to comply with earlier versions, well-written software tools for this revision should be able to successfully decode transfer packages prepared to earlier versions of the standard.

The real extent of the use of MIL-STD-1840 depends upon the use of the standards of interchange which it specifies. Additional information can be obtained about users and vendors who are implementing MIL-STD-1840 as a part of their implementation of these CALS standards and specifications by reviewing the summaries for MIL-PRF-28000 (IGES), MIL-PRF-28001 (SGML), MIL-PRF-28002 (Raster), or MIL-PRF-28003 (CGM) in this section of the Desktop Guide.

3.6 -- Additional Documentation

Specifications

MIL-M-38761/2	Microfilm Aperture, Tabulating Cards and Ships Drawing Index for Naval Sea Systems Command Ships, Systems, and Equipment, Preparation of.
MIL-PRF-28000	Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols.
MIL-PRF-28001	Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text.
MIL-PRF-28002	Requirements for Raster Graphics Representations in Binary Format.
MIL-PRF-28003	Digital Representation for Communication of Illustration Data: CGM Application Profile.
PPP-B-636	Boxes, Shipping, Fiberboard.
PPP-C-1842	Cushioning Material, Plastic, Open Cell (for Packaging Purpose).

Standards

MIL-STD-1840B	Automated Interchange of Technical Information
MIL-STD-804	Formats and Coding of Aperture Cards.

MIL-STD-974	Contractor Integrated Technical Information Service (CITIS)
MIL-STD-1189	Standard Department of Defense Bar Code Symbology.
MIL-STD-1806	Marking Technical Data Prepared by or for the Department of Defense.

(Copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Ave, Philadelphia, PA 19111-5094.)

Federal Information Processing Standards (FIPS)

FIPS PUB 4-1	Representation for Calendar Date and Ordinal Date for Information Interchange.
FIPS PUB 46-2	Data Encryption Standard (DES).
FIPS 161	Electronic Data Interchange (EDI).
FIPS PUB 180-1	Secure Hash Standard.
FIPS PUB 185	Escrowed Encryption Standard (EES).
FIPS PUB 186	Digital Signature Standard (DSS).
FIPS PUB 188	Standard Security Label for Information Transfer.

(Copies of the Federal Information Processing Standards are available to Department of Defense activities from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Others must request copies of FIPS from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161-2171.)

Department of Defense Handbooks

MIL-HDBK-59	Continuous Acquisition and Life-cycle Support (CALS) Implementation Guide.
MIL-HDBK-331	Directory of DoD Engineering Data Repositories.
MIL-HDBK-9660	DoD-Produced CD-ROM Products.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094)

Other Government Documents

DoD Cataloging	Commercial and Government Entity (CAGE)
Handbook H4/H8	Codes.
DI-EGDS-80811	VHDL Modeling Guidelines for DID Compliance.
Metafile for	Application Guide and Draft Performance
Interactive	Specification for the Encoding of Interactive
Documents	Documents

(Unless otherwise indicated, copies of other Government documents are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

International Organization for Standardization (ISO)

ISO 3592	NCM NC Processor O/P, Logical Structure.
ISO 4342	NCM Basic Part Program Reference Language.
ISO 4343	NCM NC Processor O/P, Minor Elements of 2000-type Commands, Post Processor Commands.
ISO 8879-1986	Information processing -- Text and Office Systems Standard Generalized Markup Language (SGML).
ISO 9660	Volume and File Structure of CD-ROM for Information Interchange
ISO/IEC 10179	Information technology -- Processing Languages -- Document Style Semantics and Specification Language (DSSSL)
ISO/IEC 10180	Information technology -- Processing Languages -- Standard Page Description Language
ISO/IEC 10744	Information technology -- Hypermedia/Time-based Structuring Language (HyTime).
ISO/IEC 10918-1	Information technology -- Digital compression and coding of continuous-tone still images -- Part 1: Requirements and guidelines.
ISO/IEC 11172-1	Information technology -- Coding of moving pictures and

	associated audio for digital storage media at up to about 1.5 Mbit/s -- Part 1: Systems.
ISO/IEC 11172-2	Information technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s -- Part 2: Video.
ISO/IEC 11172-3	Information technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s -- Part 3: Audio.

(Copies are available from the American National Standards Institute, 11 West 42nd Street, 13 Floor, New York, NY 10036.)

American National Standards Institute (ANSI)

ANSI X3.4-1986	American National Standard Code for Information Interchange.
ANSI X3.27-1987	File Structure and Labeling of Magnetic Tapes for Information Interchange.
ANSI X3.37-1987 (R1993)	Programming Language APT.
ANSI X3.39-1986	Recorded Magnetic Tape for Information Interchange (1600 CPI, P.G.).
ANSI X3.54-1986	Recorded Magnetic Tape for Information Interchange (6250 CPI, Group coded Recording).
ANSI Y14.1	American National Standard -- Engineering Drawing and Related Documentation Practices -- Drawing Sheet Size and Format.
ANSI MH10.8M	American National Standard Material Handling Bar Code Symbols on Unit Loaded Transport Packages.

(Application for copies should be addressed to American National Standards Institute, 11 West 42nd Street, 13 Floor, New York, NY 10036.)

United States Product Data Association (US PRO)

ISO 10303-21	Industrial automation systems and integration -- Product data representation and exchange -- Part 21: Clear text encoding of the exchange structure.

ISO 10303-201	Industrial automation systems and integration -- Product data representation and exchange -- Part 201: Explicit Draughting.
ISO 10303-202	Industrial automation systems and integration -- Product data representation and exchange -- Part 202: Associative Draughting.
ISO 10303-203	Industrial automation systems and integration -- Product data representation and exchange -- Part 203: Application protocol: Configuration controlled 3D designs of mechanical parts and assemblies.
ANS US PRO/ IPO-111-1996	Initial Graphics Exchange Specification (IGES) Layered Electrical Product Application Protocol

(Application for copies should be addressed to the United States Product Data Association, SCRA, Trident Research Center, 5300 International Boulevard, North Charleston, SC 29418. The US PRO has been designated by ANSI and the ISO as the distribution agency for the Standard for the Exchange of Product Model Data (STEP) standards and selected American National Standards within the United States.)

Electronic Industries Association

EIA-274	Interchangeable Variable Block Data Contouring, Format for Positioning and Contouring/Positioning Numerically Controlled Machines
EIA 494	32 Bit Binary CL (BCL) and 7 Bit ASCII CL (ACL) Exchange Input Format for Numerically Controlled Machines.
EIA 548	Electronic Design Interchange Format (EDIF).
EIA 5670000	Commercial Component Model Specification.

(Application for copies should be addressed to the Electronic Industries Association, 2001 Pennsylvania Ave., North West, Washington, DC 20006.)

Institute for Interconnecting and Packaging Electronic Circuits (IPC)

IPC-D-350	Printed Board Description in Digital Form.
IPC-D-351	Printed Board Drawings in Digital Form.
IPC-D-352	Electronic Design Data Description for Printed Boards in Digital Form.

IPC-D-354	Library Format Description for Printed Board Digital Form.
IPC-D-356	Bare Board Electrical Test Information in Digital Format.

(Application for copies should be addressed to the Institute for Interconnecting and Packaging Electronic Circuits, 7380 N. Lincoln Avenue, Lincolnwood, IL 60646.)

Institute of Electrical and Electronics Engineers (IEEE)

IEEE 1076	VHSIC Hardware Description Language (VHDL).

(Application for copies should be addressed to The Institute of Electrical and Electronics Engineers, Inc., 345 E. 47th Street, New York, NY 10017.)

Internet Engineering Task Force (IETF)

RFC 822	Standard for the Format of ARPA Internet Text Messages.
RFC 1108	U.S. Department of Defense Security Options for the Internet Protocol.
RFC 1421	Privacy Enhancement for Internet Electronic Mail: Part I: Message Encryption and Authentication Procedures.
RFC 1866	Hypertext Markup Language -- 2.0
RFC 1895	The Application/CALS-1840 Content-type.
RFC 2045	Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies.
RFC 2046	Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types.
RFC 2047	MIME (Multipurpose Internet Mail Extensions) Part Three: Message Header Extensions for non-ASCII Text.
RFC 2049	Multipurpose Internet Mail Extensions (MIME) Part Five: Conformance Criteria and Examples.

(Application for copies should be addressed to the Internet Engineering Task Force. Copies of these documents can be accessed via the Internet. Download from the Worldwide Web, Uniform Resource Locator (URL) <http://www.itef.org/>, or the library at <http://ds.internic.net/ds/dspg1intdoc.html>.)

Publicly Available Specifications (PASs)

ISBN 0-201-62628-4 Portable Document Format Reference Manual

(Application for copies should be addressed to the Adobe Systems Incorporated, 411 First Avenue South, Seattle, WA 98104-2871. Copies of this documents can be accessed via the Internet. Download from the Worldwide Web, URL <http://www.adobe.com/>.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

Next Section