S1000D: The Future of Authoring, Managing & Publishing Content in Aerospace & Defense

Introduction

S1000D is an international specification for creating, managing and maintaining technical publications within the civilian and military Aerospace & Defense (A&D) industry. S1000D is now being embraced by many organizations developing A&D equipment, and is also being Implemented and in some cases mandated by Departments of Defense, aircraft manufacturers (civil and military), aircraft operators, ship-builders, builders of land systems, and manufacturers of most types of equipment designed for defense complexes worldwide.

If you produce equipment to be used in the A&D industry, or if you supply components to major contractors in A&D, compliance with this specification is likely to become a requirement for you in the near future.

This paper is designed to provide an overview of the S1000D specification and a review of key considerations to achieve compliance as part of an enterprise's product development environment.

A wealth of information regarding the S1000D specification, including the specification itself, is available at www.s1000d.org

Background to the Development of S1000D

What exactly is S1000D? This specification for the way A&D companies publish technical documentation is jointly owned by the AeroSpace and Defence Industries Association of Europe (ASD) and the Ministries of Defence of the member countries of ASD. Management of the specification is shared with the ASD, Aerospace Industries Association (AIA) of the United States, and the Air Transport Association of America (ATA) through their participation and membership in the Technical Publication Specification Management Group (TPSMG).

Through specialized agreements, other bodies are also involved, including the Advanced Distributed Learning (ADL) Initiative and the OASIS Consortium Product Life Cycle Support (PLCS) Technical Committee, among others.

The specification was initially created by the Association Européenne des Constructeurs de Matériels Aéronautiques (AECMA). In the 1980's and 90's there were a number of multinational projects in progress across Europe, but there was no multinational specification for the publishing of the technical data to support these projects. Consequently, efforts began to create a multinational specification to meet the technical publishing requirements of the A&D industry. The initial specification was based on the ATA 100 specification, and was subsequently modified to fit the needs of European government and military agencies. Over time, S1000D has become internationally recognized as the de facto standard for managing technical publications in A&D.

Why has S1000D evolved as a dominant standard in A&D and commercial aviation?

The value of the specification quickly became apparent to visionaries, programs and agencies outside the AECMA community, and was soon adopted by these organizations. These visionaries included not only personnel looking at the North Atlantic Treaty Organization (NATO) interoperability, but also others working on Interactive Electronic Technical Manuals (IETMs). The S1000D specification was seen as offering the most viable solution to the complex issues of NATO interoperability.

In response to financial constraints and the multitude of specifications and processes for managing technical publications, S1000D was viewed as an opportunity to adopt a single, standardized approach to managing publications and reusing technical content.

Initially, S1000D was not focused on interactive content, and accordingly, it was slow to be adopted in the United States, A&D industry. The Technical Publications Specification Management Group (TPSMG), which provides oversight of the specification, saw US knowledge of interactive content as a potentially significant contribution to the S1000D specification. Upon execution of a Memorandum of Understanding (MOU) in February 2003, members of the AIA became deeply involved with the S1000D specification. Among their first contributions was the addition of interactive content, which made the specification more suitable for use in the US military.

Due to the close relationship between technical publications and training, Advanced Distributed Learning (ADL) joined the S1000D community to exploit this relationship and establish a single standard for both. ADL began to make their contributions to the specification with the execution of their MOU in May of 2004. The S1000D specification now sought to embrace technical data and training.

The ATA viewed S1000D as providing value-added propositions that could be obtained by changing their specifications to use some elements and constructs of S1000D. These value propositions included providing interactive content and resolving data exchange issues. ATA's involvement provided an opportunity to assess the applicability of S1000D to the commercial airline industry. By joining with ASD and AIA, the ATA could leverage their efforts and resources for the benefit of all. The MOU was executed in June 2005 and the CAWG (Civil Air Working Group) was born.

Overview of S1000D Process Requirements for Publishing Technical Data

Today, compliance with the S1000D specification is mandatory in most European nations for delivery of technical information covering defense equipment to the governments. Adoption of S1000D in North America and Asia is increasing significantly as organizations begin to understand the value and savings derived from a single, standardized approach. Virtually all new global programs being launched in A&D are adopting S1000D, with Airbus and Boeing committed to it for new aircraft programs. There is also an impressive number of applications in sea and land systems, as well as emerging interest in the specification from other industries, especially power generation and the oil and gas industries.

S1000D defines the requirements for managing technical publications, and is based on the utilization of a Common Source Data Base (CSDB) for content data management and re-use.

At a high level, S1000D:

- Defines standards for the documentation of any civil or military vehicle or equipment.
- Is based on international technology standards, such as SGML/XML and CGM for the production and use of electronic documentation.
- Leverages a CSDB to provide source information for compilation of publications and for use in electronic logistics information systems to deliver modules of information directly to the relevant user.

Data Structure: Promotes Consistency and Standardization

S1000D takes a component-based approach to authoring and maintaining publications. It specifies that information be produced in a modular form, called a "data module." This is the smallest unit of self-contained information within a technical publication. S1000D also specifies the use of SGML/XML for creating technical publications. Data modules for a product are gathered and managed via a Data Module Requirements List (DMRL) in a database (CSDB).

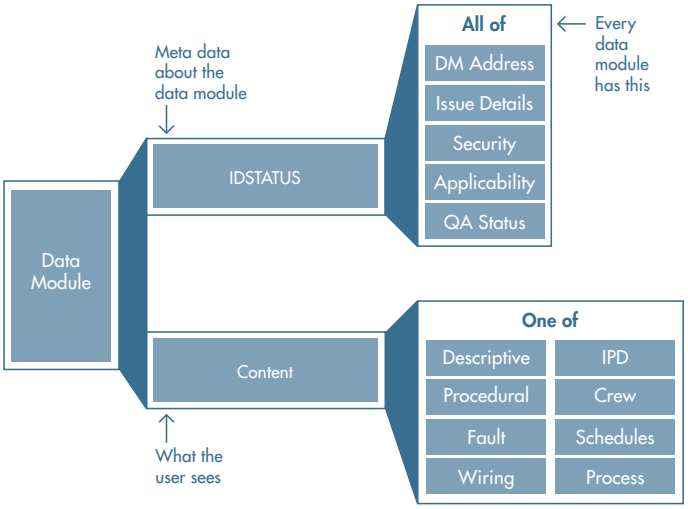

Figure 1. Data module content.

Using this construct, information is not duplicated and data modules can be reused , enabling considerable cost and time savings in publication development and maintenance. Data modules consist of "chunks" or pieces of content, such as text and illustrations. There can be as many as 10,000+ data modules in a typical project or program.

Each data module has a unique Data Module Code (DMC) that identifies relationships between document components and equipment.

S1000D defines the different data module types that are combined in a Publication Module. A Publication Module is a collection of data modules, in a specified order, which defines the content of a manual. The creation of a Publication Module allows quick assembly of a manual for a particular audience. With these data module types, authors can create the information required to support Air, Land and Sea systems and components. For example: Operators Manual, Wiring Manual, Repair Manual etc..

Benefits and Value of S1000D

According to the specification itself, the benefits of using S1000D include:

Easier Data Management

- The CSDB is designed to enable production of output as either page-oriented publications, Web-based publications, or Interactive Electronic Technical Publications (IETPs), without regard to the specific hardware or software in use.
- By leveraging a CSDB, users do not create duplicate information, although individual data modules can be used many times in the output. Time and cost savings are therefore achieved in the initial authoring and maintenance of the data, as it only needs to be created or changed once, while the information can be electronically promulgated throughout the outputs.
- The CSDB allows subsets of information to be generated to meet specific user needs based on filtering the data according to applicability information.
- Transfer of information and electronic output is facilitated between information technology systems, which use different hardware and software solutions, contributing substantially to ensuring and enabling collaborative ventures.
- Previously, the need for different output formats often dictated that authors work with different creation tools and formats. By using S1000D, authors can generate many different output forms from the same base data, thus ensuring data security and message consistency for every user, regardless of output form.

International Acceptance

- Based on internationally agreed upon, neutral standards.

Flexibility

- S1000D data module concept can be applied to legacy data.

Open System

- Non-proprietary, thus allowing neutral delivery and management of data.

Cost-effective

- Reduces maintenance costs for technical information through the use of a single, authoritative source for various forms of outputs.

The benefits described above have driven and shaped the specification from its inception. Today, the specification is maintained by an active, technically competent group, ensuring that, as new technologies are introduced, the specification will effectively keep pace with relevant advances. While the specification is constantly evolving, care is taken to ensure backwards compatibility, whenever possible.

Implementing an S1000D Solution: Pitfalls of a 'Point Solution' Approach

No doubt, S1000D has tremendous benefits, which is why it has become the international publishing standard for the Aerospace & Defense industry. Since compliance is increasingly being mandated, the question that needs to be answered is: What are the common pitfalls in an S1000D implementation, and how can they be avoided

To meet S1000D requirements, organizations must deploy specialized product information delivery solutions within their operations. Solutions must include these five core elements:

- authoring capability for both text and graphics,
- a CSDB capability
- a publishing capability
- an IETP viewer;
- a business rule validation capability

To achieve S1000D compliance, companies often take a 'point solution' approach. Here, companies will select multiple, disparate solutions to fulfill a variety of capability requirements to meet both their own needs and the multiple parameters mandated by S1000D. In this approach, companies assume the burden of integrating the point solutions onsite, while investing significant time, effort and money maintaining these integrations over time. The point solution approach is fraught with risks, and increases total cost of ownership because integrations between point solutions are very "brittle"; every time a vendor revises their product the integration 'breaks.' This drawback limits the A&D company's opportunity to accept new capabilities, while increasing the cost of adopting them. Additionally, training costs are also higher with a point solution approach because each application has a unique user interface, and the applications were not designed to work together.

Even when a point solution is architected and deployed, it is often incomplete and lacks automation. Thus, organizations must define the process of accessing and reusing design information in S1000D publications, by creating graphics and illustrations specific to product configurations, and triggering documentation updates when designs or configurations change.

Additionally, the point solution approach for S1000D is not able to leverage rich provisioning information, or maintain a relationship between this valuable information and the documents being created. The absence of this linkage introduces quality issues and increased cost. Without a tight connection provisioning data can change without the realization that the impacted technical documents must also be updated. Where this link does not exist, authors must continually review provisioning data for changes, and then analyze the publication data for consistency with the changed data. This results in increased cost, slower time-to-market, and poor quality technical publications.

The PTC Solution: Single System, Single Vendor

PTC understands the challenges of selecting and deploying a publishing solution that complies with S1000D. Rather than wrestling with a point solution approach, PTC customers instead use a single system and single vendor approach to S1000D, delivering greater value while significantly reducing total cost of ownership and risk.

Power to Create. Collaborate. Control. Configure. Communicate.

The PTC solution for S1000D is a complete solution because it ensures compliance with the specification, automates the entire publishing process, and lowers system implementation and maintenance costs. PTC provides solutions for integration that reuse and repurpose S1000D data modules to meet e-Learning requirements. With the PTC solution for S1000D, A&D organizations have all the necessary capabilities to achieve an optimized and compliant S1000D publications process.

To achieve an optimized and S1000D-compliant publications process, PTC's solution provides capabilities for:

- creating content
- collaborating to develop content
- controlling content and configurations; and
- communicating the content to people and systems

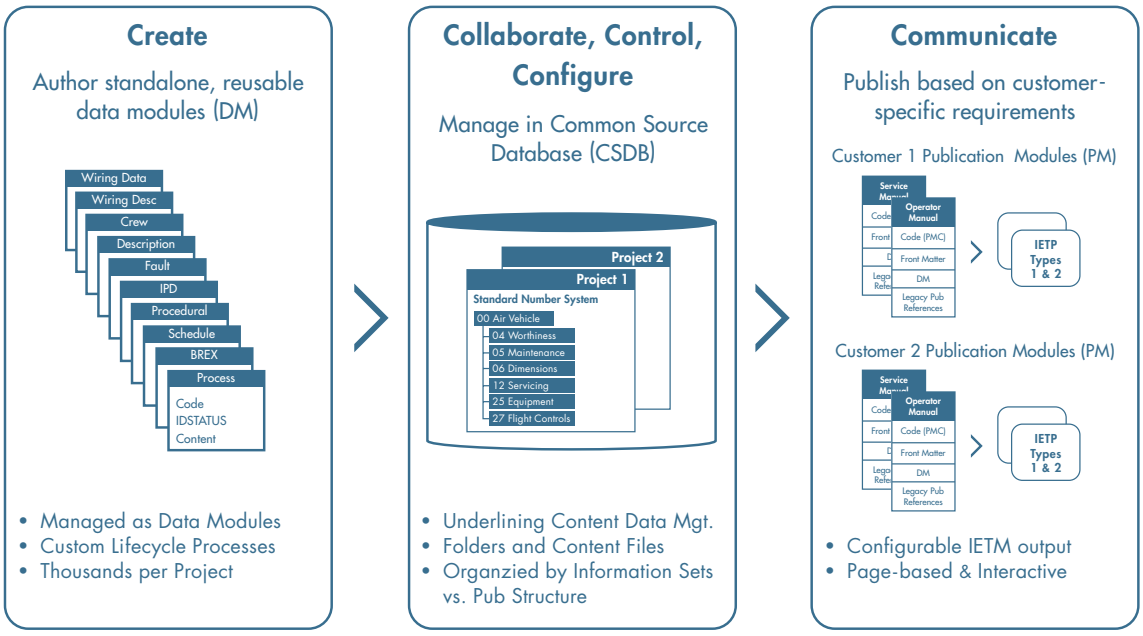

Figure 2. PTC's single system approach to S1000D compliance provides a complete solution.

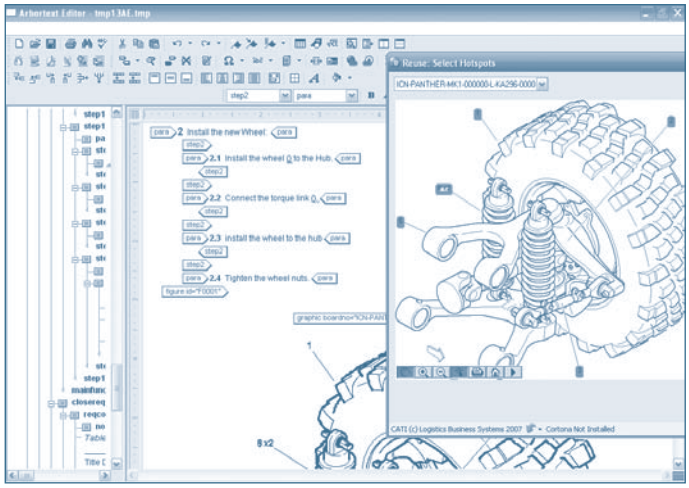

Figure 3. Within PTC's solution for S1000D, text authoring is seamlessly integrated with illustration and graphics creation to facilitate an S1000D-compliant and optimized technical publishing process.

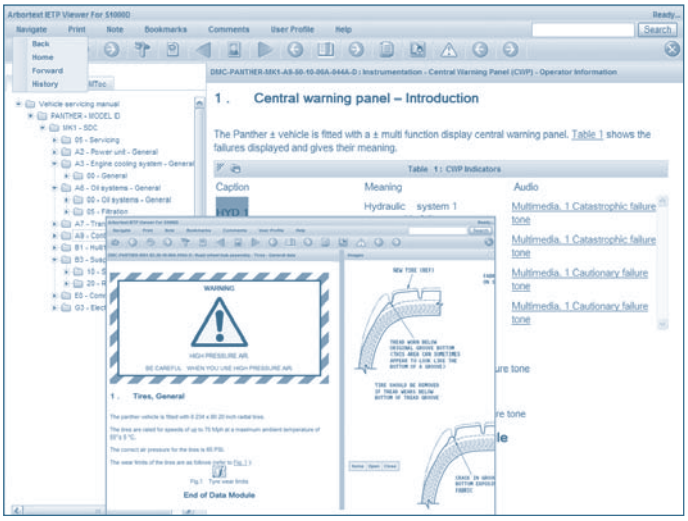

Figure 4. During the editing process, a complete end-user view of the data module can be generated providing the author with Page Oriented Publications or Interactive Electronic Technical Publications.

PTC Solutions for S1000D: 'Create' Capabilities

All major components used in our solution are delivered by PTC, and as such, they all work together to deliver a seamless user experience, for lower cost of ownership.

- Author Data Module types defined by the specification
- Author Information Modules defined by the specification, including:
  - Publication Modules
  - Commenting
  - Data Dispatch Notes
  - Data Module Lists
- Author S1000D-compliant illustrations and graphics (in CGM and other formats) by leveraging rich CAD data and embedding graphics in documents PTC's long-term roadmap will extend the solution by enabling reuse of native CAD and PLM product data, as well as change management integration to ensure content synchronization.
- Simplify creation of complex logic trees using the integral Process Data Module editor.
- Leverage Provisioning data to produce the Illustrated Parts data modules from the Provisioning data.
- Manually authored constructs and fragments are automatically populated through direct interaction with the CSDB, including:
  - referenced data modules
  - referenced entities
  - graphical hotspot insertions
  - hotspot cross-referencing

PTC Solution for S1000D: 'Collaborate', 'Control', and 'Configure' Capabilities

- Simplify CSDB project creation by providing the user with a series of project-level parameters for selection.
- Automatically configure the project for the selected S1000D Issue or Revision and generate necessary supporting data libraries and SGML DTD or XML Schema mappings.
- Additional 'wizards and builders' enable the efficient configuration and tailoring of other project-level settings, including:
  - Standard Numbering System
  - Data Module Coding (DMC) Schemes
  - Entity or Illustration Coding (ICN) Schemes
  - Data Exchange Partners and Options
  - Project Default Values
  - Information Code Libraries
- The PTC solution for S1000D provides advanced and intuitive workflow capabilities to enable the definition, automation, and management of common processes used throughout the product lifecycle.

PTC Solution for S1000D: 'Communicate' Capabilities

- The on-demand preview capability allows all users to preview data modules formatted as they will appear in either Page Oriented Publications or Interactive Electronic Technical Publications.
- Supporting interactive viewing of embedded technical illustrations.

The Process of Creating Technical Publications Using PTC's Solution for S1000D:

1. Using the business rules chosen by the project, PTC's S1000D solution will guide the author through the process of creating the Data Module Requirements List (DMRL).
2. Data modules will be created with appropriate structures, providing the author with a customized starting point for content creation.
3. Workflows for the data modules can be initiated, managed and captured as an electronic audit trail of actions.
4. The author will create the technical content based on his/her analysis of the design data.
5. Graphics to support the text information will be directly created from the native design data.
6. The author will return the data modules to the CSDB upon completion.
7. The publications manager can examine the CSDB, along with the information contained about each data module and the design criteria, to determine if the data modules are complete and up-to-date.
8. Generation of publications can either be automatically triggered by workflow, or directed by the project team, and can be tailored to meet specific project and customer needs.
9. Publication output formats can be PDF, Web, IETP, or any combination of outputs, to meet specific project needs.
10. During the creation and publication processes, authors will be guided via content creation "wizards" in making optimal choices, and checks will be made to insure that the data modules comply with the business rules selected by the project.

Summary

S1000D is the specification for technical publishing that has been broadly adopted in Europe and is being widely implemented elsewhere for the support of commercial and military products. If you are in this market, it's time to make plans to meet these demands for your technical publication process.

S1000D will enable A&D companies to lower costs to author, maintain, and manage the technical data throughout the lifecycle of the product. It promotes reuse of data, and through its rigorous structure and use of neutral, international standards, S1000D promotes interchangeability of information among partners, contractors, subcontractors, and customers. It also provides the net-centricity demanded by today's national and international forces.

The PTC S1000D Solution offers far more than specification compliance; it has also been optimized to automate the entire technical publications data management process. The PTC solution is designed to support the full lifecycle of the technical publications process. By providing a single vendor-single system approach, PTC offers far lower total cost of ownership than can be gained by a 'point solution' approach. And because the system leverages rich product information created by engineering, tremendous additional value can be realized through improved data reuse and higher-quality publications.

By offering a complete solution for S1000D, complemented by a comprehensive set of service offerings, PTC is well positioned to help A&D and commercial aviation companies to overcome the typical hurdles experienced in an S1000D implementation and realize maximum value from their S1000D initiative.

Note: Forward looking information subject to change without notice

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