S1000D - An Overview

Background, Benefits, and Overview of S1000D Data Module Structures

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What is S1000D?

S1000D is an international specification for technical publications, utilizing a Common Source Database. It was originally introduced to the European community by the Association Européenne des Constructeurs de Matériel Aérospatial (AECMA), representing the European aerospace industry. Based on the Air Transport Association's ATA Spec 100 it was intended for use in aviation within the European defense community, but has since expanded into a global specification, supporting land, sea and air including support for civil aviation requirements. S1000D provides standards and guidelines that enable the production of technical documentation in internationally recognized neutral standards; it also provides a clearly defined methodology for exchanging technical information between partners, suppliers and customers.

The S1000D specification is now supported by the successor to AECMA, the AeroSpace and Defence Industries of Europe (ASD), the Aerospace Industries Association of America (AIA) and the Air Transport Association (ATA). The specification is controlled by an international body, the S1000D Steering Committee (SC), which is responsible for maintaining the specification. The SC includes members from both government agencies and industry. To address the rapid development of information technology, the SC is supported by several standing working groups and temporary task teams that conduct the day-to-day work of developing, reviewing, and managing changes to the specification and XML schemas.

S1000D and Commercial Aviation

After a review of existing standards, the ATA e-Business Steering Committee has decided that the next generation of technical data standards for the civil aviation industry should be developed in S1000D in order to provide a single global standard for both civil and military applications.

Clearly, with legacy data being what it is, it will likely be many years before the major aircraft manufacturers and suppliers switch completely to S1000D. Also, given consideration to the length of time that some aircraft remain in service, it may not make commercial sense for some models to convert from ATA iSpec2200 to S1000D. S1000D is therefore unlikely to be widely used in the commercial aviation sector except for new aircraft models, at least in the near term. In contrast, current

military and defense aircraft and equipment programs are electing to transition to S1000D to a greater degree than the commercial sector.

Interestingly, S1000D is referred to a total of 29 times in Revision 2009.1 of ATA Specification 2300, Data Exchange Standards for Flight Operations. In fact, the Flight Operations Mark-up Language follows the same modular approach, uses S1000D naming conventions, and (where applicable) uses the entire or partial S1000D XML Schemas modules instead of redefining them.This clearly demonstrates an effort to facilitate consistency across specifications and implementations, by employing many concepts from S1000D.

Benefits of S1000D

S1000D describes itself as “an international specification for the procurement and production of technical publications.” However, it has advantages outside procurement and production that aid the through life management of technical publications content, as it covers the planning and management, production, exchange, distribution and use of technical documentation that supports the life cycle of any civil or military project.

S1000D is intended to provide cost savings in how information is generated, by avoiding duplications, providing uniform standards for all participants in a project, and enhancing economic support planning. In addition, it provides enhanced interoperability and a standard format for data exchange, resulting in lower costs for deliverable publications, and better collaboration between multiple partners and suppliers. It is designed to accommodate product and project requirements through the development of project-specific business rules. Many governments, agencies and organizations have developed their own business rules to govern application of S1000D. For example, the use of S1000D within civil aviation constitutes a single project for which the ATA has provided a set of business rules. If those ATA business rules do not offer a decision on a particular application of an aspect of the specification, then individual projects are able to make that decision as to how the specification should be applied based on their own unique requirements.

Book-Based Structures vs. S1000D Data Module Structures

With the more traditional book-based specifications or standards, specific chapter numbers, sections and subsections are designated as the identifiers to detail how pieces of equipment are presented, and in what sequence. As an example, in an ATA standard compliant Illustrated Parts Catalog for commercial aircraft, Chapter 32 always contains information about landing gear equipment and parts, regardless of manufacturer or aircraft type. Likewise in the Aircraft Maintenance Manual, Chapter 32 always addresses the repair and maintenance procedure for the landing gear. The end result is that because of the book-based structure, new technical documents based on these structures are usually written and maintained as standalone manuals for individual products, without regard to how similar data might be reused across different publications.

In S1000D, content is documented in reusable “chunks” known as Data Modules. Each data module typically represents a task, which may range from a couple of steps to many. For example, task instructions such as apply electrical power, open access panel, and remove unit may each be created as separate data modules. By utilizing S1000D data modules, common tasks such as “apply electrical power” and “open access panel” can be reused and shared across multiple publications or other data delivery platforms. Each data module must be able to stand alone, in that it must make sense and have meaning when viewed without any supporting data (other than perhaps accompanying graphics or multimedia elements). It must also be capable of supporting integration into a larger publication, such as a book or an interactive electronic publication.

This modular approach is a break from the traditional page-oriented elements such as book, chapter, section, subsection, page, etc. It moves technical documentation away from the document-centric approach of previous standards and specifications to a more data-centric approach and promotes content reuse. The data modules are stored in a database known as a Common Source Data Base or CSDB. The CSDB also stores other assets associated with a documentation project such as graphics and multimedia files.

S1000D Data Module Types

S1000D data modules are structured according to their content "type". There are currently 21 data module types, with content that ranges from descriptive and procedural content, through to the added functionality brought by the applicability and technical repository data modules. S1000D provides the SGML Document Type Definition (DTD) and XML Schemas to support these data module types. It should be noted that beginning with Issue 4.0 of the S1000D specification, only XML Schemas are defined. A list of the current S1000D data module types is shown in Table 1.

CREW/OPERATOR DESCRIPTIVE PROCEDURAL FAULT ISOLATION ILLUSTRATED PARTS DATA MAINTENANCE PLANNING WIRING DATA WIRING DATA DESCRIPTION MAINTENANCE CHECKLISTS AND INSPECTIONS TRAINING	COMMON USAGE FRONT MATTER SERVICE BULLETIN
PROCESS	INTERACTIVE
CONTAINER INFORMATION COMMON INFORMATION REPOSITORY APPLICABILITY CROSS-REFERENCE PRODUCTS CROSS-REFERENCE CONDITIONAL CROSS-REFERENCE	ADDED FUNCTIONALITY UPDATE
BUSINESS RULES EXCHANGE	BUSINESS RULES

Table 1 - S1000D Data Module Types

Each data module is divided into two main parts:

- An “ID and Status Section” (which is common to all data module types)
- A “Content Section” (specific to each data module type).

As the name implies, the ID and Status Section contains all the information required to identify the data module in terms of its identification, or “data module address”. It also contains information relevant to its status, such as its verification status, source information, security classification, applicability, and other useful information.

The Content Section contains all content intended for the user of the information and is specific to the data module type.

The production of data modules utilizes either SGML or XML to tag the information in both the ID and Status, and the Content sections of a data module. This is done in accordance with the relevant SGML DTD, or XML Schema, as defined by the specification.

Identification of each data module is achieved using a coding system that gives each data module its own unique identification code and prevents duplication. This code is also used for file identification, as it is used to form the data module’s filename. S1000D is very specific on the rules for this coding system, which is known as the Data Module Code, or DMC.

The DMC uses the coding to identify data module content in terms of the hardware breakdown, information type and the location where the information should be used. It identifies the equipment, the hierarchical position in the structure, its place in the disassembly sequence, information content and where content is used (i.e. what it is part of, where it fits in the structure, how it’s taken apart, etc.). By analyzing the DMC, one can determine:

- The equipment to which the data pertains
- Where the assembly to which the data pertains fits into the functional or physical breakdown of the product
- Where in the disassembly sequence it fits
- The type of task it is

An example of a data module code structure is shown in Figure 1.

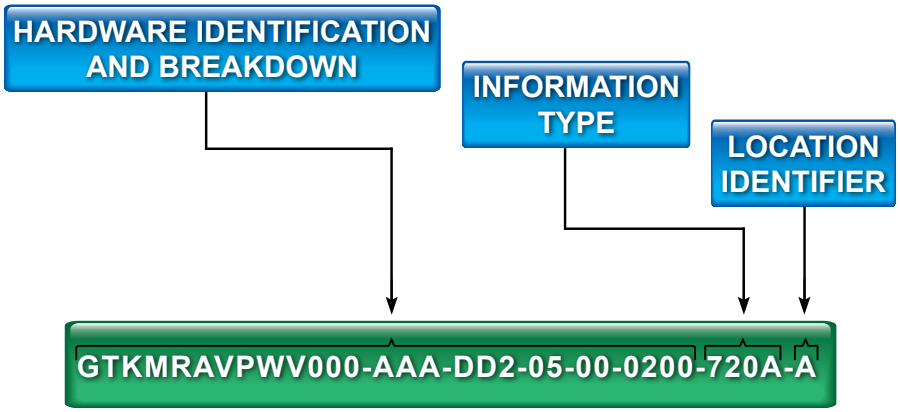

Figure 1 - An example of a data module code

A Standard Numbering System (SNS) based on the original ATA 100 numbering system is used to give the functional or physical equipment breakdown. This SNS forms part of the data module coding. The SNS is only “Standard” to a particular equipment type, such as air vehicle, engines and equipment, general surface vehicles, general sea vehicles, etc. The SNS can be tailored to suit the design and maintenance philosophy of the equipment.

From Data Modules to Publications

S1000D provides a mechanism for building publications from the data modules, be they paper or electronic. The mechanism, known as the publication module, contains a list of the required data modules in the order they are required to appear within the publication. Publication modules may also contain references to other publication modules. Allowing for this “nesting” of related publications means any structure of publication may be built. S1000D also provides for delivery notes and exchange of data module lists, as well as a mechanism for commenting on the content of both data and publication modules during initial content verification phases, as well as after they are published and in-service. In addition, S1000D is designed to work with AIA/ASD logistic support standards, as well as with ISO 10303 AP 239 Product Life-Cycle Support (PLCS).

Summary

S1000D brings substantial benefits to numerous military and commercial publication projects worldwide. Publications can now be built from modules of data that are authored once and reused where appropriate. Information documented in S1000D data modules is extremely flexible and is equally suited to both paper and electronic output. With the ability to structure the information into both linear and interactive output, its use brings substantial benefits to both the authoring and through life management of technical documentation, not least of which is the ability to reuse data. Changes to technical information now only have to be made once, and information written for an operations manual can easily be inserted into or referenced in a maintenance manual.

S1000D is a complex specification (the current issue 4.2 is in excess of 3,500 pages), and it will continue to develop further. While it may not be the solution for all technical publication production projects, it is showing promise as the future path for complex equipment such as aircraft, ships and other long lifecycle equipment. For more information, please contact us at **marketing@cdgnow.com**.

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