
# Component Maintenance Manuals

## *Guidelines for Transitioning to S1000D Maintenance Publications*

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# Executive Summary

Commercial aircraft manufacturers and aviation military programs are increasingly expecting their suppliers to provide technical data using the S1000D Specification.

This large cross-over between civilian and military projects – many international in scope – has multiple communities sharing ever more complex data that needs to be compatible. Those with an S1000D data requirement may need to produce both ATA Component Maintenance Manual (CMM) formatted documents and Interactive Electronic Technical Manual (IETM) compatible documents. These requirements extend to the aircraft supply chain. By creating component maintenance data in S1000D, equipment providers who support both defense and commercial projects can more effectively manage multiple projects with diverse requirements.

Based on an S1000D User Forum presentation by author Vic Ortega, this white paper outlines how to plan and prepare for the transition to S1000D, and what is needed to get started. It includes specific guidelines for transitioning existing ATA format Component Maintenance Manuals (CMMs) to S1000D compliant Component Maintenance Publications (CMPs).

# Component Maintenance Manuals (CMMs): Creating S1000D Data Modules

A new chapter added in S1000D Issue 4.1 provides the requirements for component maintenance data, resulting in a definition very similar to an ATA CMM.

What is the relationship between a S1000D CMP and an ATA CMM? A CMP is not a specific object in S1000D, so there is no schema to support it directly. It is considered an 'information set', where the CMP data defines the same information required by a CMM. Similar in definition to a CMM, the CMP provides a range of procedures that enable an experienced technician who is unfamiliar with the component to restore it to a serviceable condition. The CMP coverage may apply to a single component or a collection of variants of the basic component. In the case of the CMP, it will be the set of modules needed. The CMP is based on the equipment set defined in S1000D Chapter 5.2.1.9 and the guidance for creating it is Chapter 5.3.1.4.

## Getting Started with S1000D

Making the transition to S1000D takes some planning and preparation. Performing these tasks will better prepare an organization, help to define its S1000D project requirements, and what capabilities of the specification are needed. A thorough analysis of legacy data and processes is the first step.

## S1000D Issue Number

Selecting which Issue of the specification (4.1 or 4.2) will be used for a project is generally based on contractual requirements. If a supplier is not required to deliver to a certain Issue, the decision is based on project requirements and the capabilities needed from S1000D.

## Legacy Source Data for Data Modules

Identifying the information contained in legacy source data will help to define the requirements for information sets, and data module types and codes that will be used in the project. Knowing this information allows the initial partitioning or 'chunking' of legacy data into data modules for the project, and helps start the development of a Data Module Requirement List (DMRL).

## Legacy Source Illustrations

Identifying the types of illustrations contained in legacy source data will ensure that the illustrations brought into the S1000D project are of optimal quality, resolution, and format.

## Provisioning Method & Parts Database

Determining the provisioning method and parts database helps to define the parts data requirements for the project. For example, is information being extracted from an S2000M database, or from engineering data for non-S2000M projects?

## Data Module Breakdown Structures

The data module breakdown structure for the project is determined by an organization's Product Breakdown Structure (PBS) and Repair policy. This is based on the Standard Numbering System's (SNS) methodology of system, subsystem and assemblies. The SNS plays a key role in the data module coding strategy and supports the development of the project's Data Module Requirement List (DMRL).

### Where to Begin?

**Transition Requires Planning, Preparation**

- S1000D Issue selection (4.1 or 4.2) for project data
- Data Module (DM) breakdown structure per Product Breakdown Structure (PBS)/repair policy
- Legacy source data for Data Module (DM) – metadata & content
- Authoring & QA/verification process workflows
- Legacy source illustration (raster/vector)
- Applicability model (effectivity)
- Provisioning method & parts database
- Publishing strategy (electronic/print or both)

### Authoring & QA/Verification Process Workflows

Determining authoring and quality assurance (QA) processes helps to establish the QA requirements for project data modules and deliverables. For example, is authored data being sent to peer reviews, QA reviews, or editor reviews? Are deliverables going through an in-process review, first QA review, first verification, or second verification? The organization's quality processes need to be defined and managed within the S1000D project.

### Applicability Model

Determining the applicability model helps to establish and manage the applicability requirements for an S1000D project. Does data contain information that is only applicable to certain customer product configurations? Does data contain information that is only applicable under certain operational or environmental conditions?

### Publishing Strategy

How to deliver publications is generally based on contractual requirements.

## Mapping ATA Data Constructs to S1000D

When creating S1000D data modules for CMMs, there are certain ATA constructs to be taken into consideration.

### Pageblocks to Data Modules

As a one important step, consider the relationship between ATA pageblocks and S1000D data modules; the table shows how data modules are used to retain the structure of the legacy CMM. The structure of an ATA iSpec 2200 CMM is based on assigned pageblock numbers, with each set of pageblock numbers assigned to a specific section of information in a CMM.

In the table, the Description and Operation section is assigned pageblock 1 through 999. Pageblocks were provided as a means to subdivide the subjects within manual chapters into smaller groupings for ready reference and revision management. When converting a CMM to S1000D data modules, each pageblock or section of information is copied to a single data module. In some cases, more than one data module may be used based on the complexity of the information or the need for data reuse.

Also shown are the primary S1000D data module types and information codes that are used for each section of information in the CMM. For example, the Introduction information is authored in Descriptive data modules using the information code 018.

| CMM structure | pageblock | infocode | dmtype |
|---|---|---|---|
| Introduction | INTRO | 018 | Descriptive |
| Description & Operation | 1 - 999 | 040, 042, 044, 1XX | Descriptive |
| Testing & Fault Isolation | 1001 - 1999 | 3XX, 4XX | Procedural / Fault |
| Schematics & Wiring Diagrams | 2001 - 2999 | 051, 053, 054, 057, 058 | Descriptive |
| Disassembly | 3001 - 3999 | 5XX | Procedural |
| Cleaning | 4001 - 4999 | 25X | Procedural |
| Check | 5001 - 5999 | 34X, 36X | Procedural |
| Repair | 6001 - 6999 | 6XX | Procedural |
| Assembly | 7001 - 7999 | 7XX | Procedural |
| Fits & Clearances | 8001 - 8999 | 360, 361 | Descriptive |
| Special Tools, Fixtures & Equipment | 9001 - 9999 | 061 | Descriptive |
| Illustrated Parts List | 10001 - 10999 | 075, 941 | IPD / Descriptive |
| Special Procedures | 11001 - 11999 | 14X | Procedural |
| Removal | 12001 - 12999 | 52X | Procedural |
| Installation | 13001 - 13999 | 72X | Procedural |
| Servicing | 14001 - 14999 | 2XX | Procedural |
| Storage | 15001 - 15999 | 8XX | Procedural |

*ATA pageblock relationship to S1000D CMP information set*

## MTOSSS Numbering to DMCs

All S1000D data modules are identified with a Data Module Code (DMC) in the CSDB. Maintenance Task Oriented Support System (MTOSS) numbers contained in the legacy CMM help to determine the DMCs for a project. DMCs are similar to MTOSS numbering.

Of note, S1000D does not maintain all of the information found in the MTOSS number. MTOSS numbers are generally not required in the printed output, but if they are needed, the ID attribute on the appropriate element in the content may be used and styled accordingly on publish.

The MTOSS numbering system uses standard and unique number combinations to identify maintenance tasks and subtasks. It includes the ATA chapter, section, and subject number, as well as a function code and unique identifiers.

The S1000D Data Module Code (DMC) is the standardized and structured identifier of a data module and is broken down into several sections:

**Model Identification Code** identifies the Product to which the data applies. This is a project or organization decision.

**System Difference Code** is an SNS variant that identifies alternate versions of the system and sub-systems. In the illustration, A01 of the MTOSS number is used as the system difference code for the data module and represents a variation within the component.

**Standard numbering system** or SNS defines the product breakdown structure as systems, subsystems, and assemblies. The SNS is equivalent to the ATA Chapter, Section, and Subject numbers. In this example, 25-11-70 of the MTOSS number is used as the SNS for the data module code.

**Disassembly code and variant** identifies the breakdown condition of an assembly to which the maintenance data applies. It's also used for sequential numbering of data modules when more than one is used for the same SNS. For illustrated parts data modules the disassembly code would represent the figure number. The disassembly code is based on the assembly breakdown and maintenance data requirements for the project.

**Information code and variant** identifies the information within a data module and is equivalent to the ATA function code. In this example, function code 87 of the MTOSS number, which is reserved for Description and Operation data, is translated to the S1000D information code 040, which is reserved for Description data.

**Item Location code** identifies where the maintenance task will be performed.

MTOSS: **TASK 25-11-70-870-801-A01**

DMC: **XX-A01-25-11-70-XXXX-040A-X** (using MTOSS above)

DMC: **AA-BBB-CC-CC-CC-DDDD-EEEE-F** (generic definition)

| Generic Code | DMC Breakdown | Description |
|---|---|---|
| AA | Model Identification Code | Identifies the Product to which the data applies |
| BBB | System Difference Code | Relates to the MTOSS variation within the component (MTOSS-A01) |
| CC-CC-CC | SNS | ATA (Chap/Sec/Subj) equivalent to S1000D SNS |
| DDDD | Disassembly Code /V | For IPDs this would be the Figure Number |
| EEEE | Information Code/V | Relates to the ATA Function Code (MTOSS-87) |
| F | 4001 - 4999 | Where the maintenance task will be performed (A=on product, B=on major assembly removed, C=on bench) |

## Creating S1000D DMs for CMM

### How the S1000D Publication Module (PM) Works

- PM is used to structure appropriate DMs
- Each CMM defined pageblock becomes a <pmEntry> with the title element defined as the required pageblock title
- DMs appropriate to each pageblock are listed in the appropriate s/b <pmEntry>
- An ACMM may only contain one DM per pageblock

## Front Matter Data

S1000D provides two options for generating front matter data. The first is to use descriptive data modules for authoring. The second utilizes the Front Matter Schema introduced in Issue 4.1 to support the generation of Title Page, Table of Contents (TOC), List of Effective Pages (LOEP), List of Effective Data Modules, and Highlights. Others require the descriptive data module. The schema may be used to minimize manual authoring and in most cases supports the auto-generation of front matter data.

With S1000D, most front matter data can be auto-generated for print output including lists of information, like the Table of Figures or List of Acronyms. Extended title page information, such as part number, may be encoded in the Publication Module (PM). Highlights and LOEP (new/changed) can be created from Reason for Update/Amendment and change information.

## Front Matter Data for CMMs

- Title Page
- Record of Revisions
- Record of Temporary Revisions
- Service Bulletin List
- List of Effective Pages
- Table of Contents

**And the optional:**

- Index of Repairs
- List of Illustrations
- List of Tables

## Descriptive Data

In S1000D, all descriptive data is authored in descriptive data modules. Start by adding the Introduction pageblock to a <pmEntry> element in the publication module. This retains the structure of your legacy CMM publication.

The MTOSS task number (as previously discussed) is used to generate the DMC for this data module. The DMC is also added to the publication module and is referenced under the pageblock entry.

The Introduction section is authored using the <levelledPara> element in combination with the child element <title>. All remaining subsections of information would be nested inside each proceeding <levelledPara> element. This retains the hierarchical structure of the data content.

| ATA descriptive data structure | S1000D-authored |
|---|---|
| INTRODUCTION | <pmEntry> (publication module) |
| TASK 25-11-70-99F-801-A01 | DMC-XX-X-25-11-70-XXA-018X-X |
| 1. Introduction | <levelledPara><title> |
| Subtask 25-11-70-99F-001-A01 | |
| A. General | <levelledPara><title> |
| (1) This manual... | <levelledPara><para> |

*Descriptive data is authored in an ATA iSpec 2200 CMM and the data constructs used to author it in S1000D*

## Procedural Data

This example shows how procedural data is authored in an ATA iSpec 2200 CMM and the data constructs used to author it in S1000D. It focuses only on the relevant ATA-constructs to be considered when authoring procedural data in S1000D.

In S1000D, all procedural data is authored in procedural data modules. Procedural data may contain a lead-in descriptive paragraph that precedes the task information and is authored using the <commonInfoDescrPara> element.

| ATA procedural data structure | S1000D-authored |
|---|---|
| DISASSEMBLY | <pmEntry> (publication module) |
| TASK 25-11-70-000-801-A01 | DMC-XX-X-25-11-70-XXA-520A-X |
| 1. General | <commonInfoDescrPara> |
| (1) This procedure contains... | |
| (2) Before you disassemble the... | |
| (3) Refer to IPL Figures 1 thru 11... | |
| TASK 25-11-70-000-802-A01 | |
| 2. Equipment and Materials | <commonInfoDescrPara> or <preliminaryRqmts> |
| (1) See SPECIAL TOOLS, FIXATURES... | |
| TASK 25-11-70-000-803-A01 | |
| 3. Crew Seat General Assembly Removal | <proceduralStep> or <techname>/<infoName> |

Procedural data may also contain a section for Equipment and Materials. To author this information use the <commonInfoDescrPara> element or the <preliminaryRqmts> element.

The task information (in this case, Crew Seat General Assembly Removal) may be authored using a <proceduralStep> element or using the <techname> and <infoname> elements of the data module.

## Illustrated Parts Data

The Illustrated Parts List (IPL) in a CMM contains several sections; Introduction, Equipment Designator Index (or Numerical Index), an optional Vendor Index, and the Detailed Parts List.

In S1000D, the data for each of these sections is contained in data modules. In this example, the Introduction and Numerical Index information is authored in descriptive data modules and the detailed parts list information is authored in an IPD data module. In the IPD data module, the Figure is added as a child element of the <illustratedPartsCatalog> element and the parts list items are added as repeatable <catalogSeqNumber> elements. Each of these data modules will be referenced in the Publication Module under the <pmEntry> “Illustrated Parts List”, which retains the structure of the legacy CMM publication.

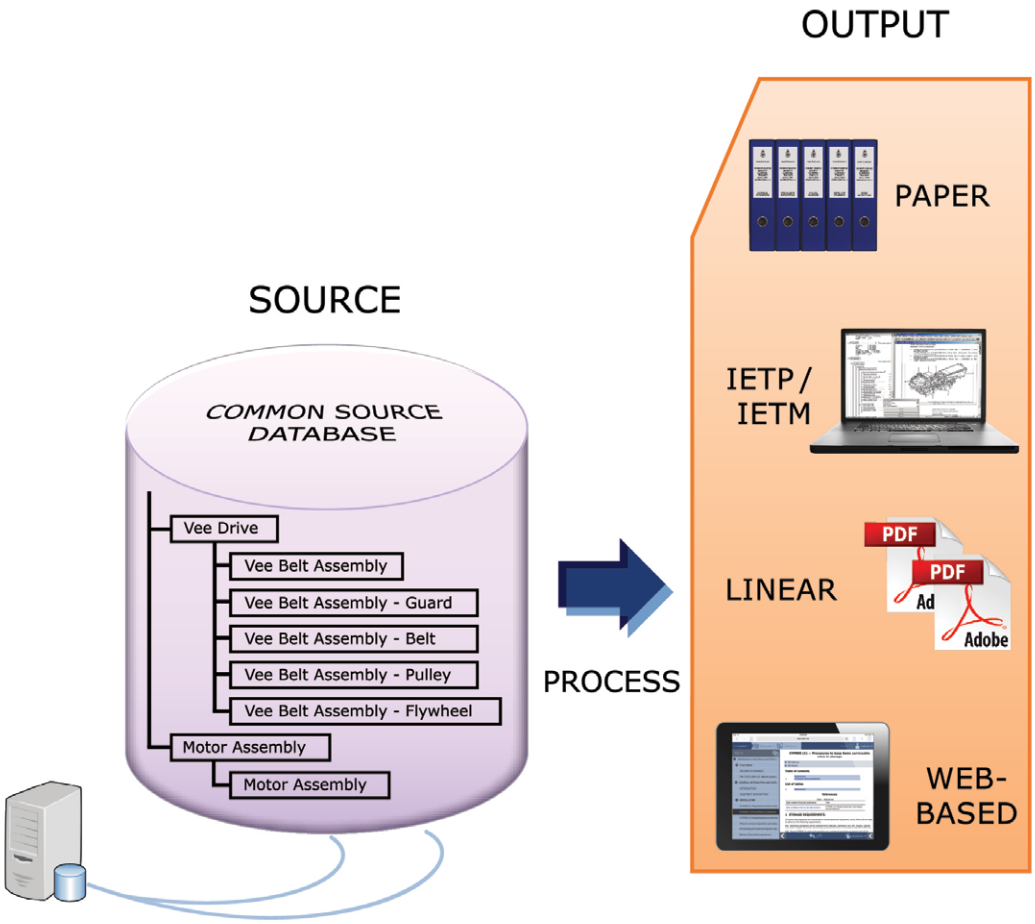
| ATA parts list data structure | S1000D-authored |
|---|---|
| **ILLUSTRATED PARTS LIST** | **<pmEntry> (publication module)** |
| **TASK 25-11-70-99F-801-A01** | **DMC-XX-X-25-11-70-XXA-018B-B** |
| **1. Introduction** | **<levelledPara>** |
| **Subtask 25-11-70-99F-001-A01** | |
| **A. General** | |
| **NUMERICAL INDEX** | **DMC-XX-X-25-11-70-XXA-942A-B** |
| **Part Number \| Airline Stock Number \| Fig \| Item \| Total** | |
| **2. Equipment and Materials** | **Auto-generated or <table>** |
| **TASK 25-11-70-000-802-A01** | |
| **DETAILED PARTS LIST** | **<pmEntry> if more than one IPD** |
| **General Assembly, Crew Seat** | **DMC-XX-X-25-11-70-01A-941A-B** |
| **Figure 1 GRAPHIC 25-11-70-000-101-A01** | **<illustratedPartsCatalog>** |
| **FIG-ITEM \| PART NUMBER \| AIRLINE PART NUMBER \| NOMENCLATURE \| USAGE FROM TO \| UNITS PER ASSY** | |
| **-1 \| 3A383-0007-01-3 \| GENERAL ASSY, CREW SEAT \| RF** | **<catalogSeqNumber>** |

## Publishing

In S1000D, the publication module defines the content and structure of a publication. The <pmEntry> is the central element for a publication module. Multiple elements may be used to build the structure of a publication. Nesting elements (one inside the other) builds a hierarchical structure in variable depth for a publication. Inside each element data modules are added, which are referenced by data module code, to provide the data for the publication.

In ATA-based CMMs, the publication page is equivalent to an S1000D publication module, where each high-level <pmEntry> element represents a pageblock. Under each pageblock are the data modules, referenced by data module code.
The nested structure of levelled paragraphs and procedural steps authored in the data supports the legacy CMM numbering structure of a publication.

When publishing the CMM, XML style sheets or XSL-FO (for PDF) may be used to create the appropriate output look and feel in order to retain the format of a legacy CMM publication.



# Summary

Many aerospace and defense suppliers will soon be required to accommodate transitioning existing Component Maintenance Manuals into S1000D compliant Component Maintenance Publications (CMPs). There are actually many similarities between these two publication types.

Clearly identifying elements such as the S1000D Issue selection (4.1 or 4.2), data module breakdown structures, source data metadata and illustrations formats, applicability models, provisioning and parts databases and publishing strategies up front will be essential to the success of any publications transition project. Proper planning and analysis of these factors will make the transition to S1000D a much smoother process.

CDG offers Professional Services supported by a staff of S1000D subject matter experts to provide technical training and consulting on the S1000D standard, and to assist with project customization to suit the specific needs of your organization. Contact the CDG Sales Team at sales@cdgnow.com to learn more about the benefits of transitioning to S1000D, and discover how the Inmedius Spectrum™ suite of software products can help in managing multiple data sets to achieve significant cost savings.

## About the Author

*Vic Ortega is an S1000D Architect at CDG, a Boeing Company. As an S1000D subject matter expert, Vic has more than 25 years of experience working with technical publications data and solutions that span the Computer, Electronic Design Automation (EDA) and Aerospace industries. For the last 10 years, Vic has served as the CDG technical lead for all U.S.-based S1000D Services and Solutions, supporting both Military and Commercial applications.*

*In 2016, Vic assumed the additional role of System Architect for Inmedius software. This role includes contributions to the ongoing development of the new Inmedius Spectrum™ architecture, and the S1000D Publishing Suite™ v6.0 module releases.*

*Vic is a member of the United States S1000D Management & Implementation Groups (USSMG/ USSIG), Boeing S1000D Working Group, and DITA communities.*

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