

# THE CHALLENGES OF SUPPORTING \$1000D AND ATA IN A SINGLE CONTENT SYSTEM

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# AGENDA

1. Introduction
2. What is driving the quest for one system
3. Fundamentals
4. Software Engineering Challenges
5. Solutions
6. Q&A

# WHAT IS DRIVING THE REQUIREMENT FOR MULTI SPEC CMS

- Mixed Fleets and operators
- Adoption of S1000D by commercial aviation
- COTS platforms adapted for military usage (mixed data sets)
- Lifespan of aircraft
- FAA regulations regarding supportability of flying aircraft
- A350, A320, B737, B787
- Tanker, ASTOR/Sentinel, JSTARS
- + 30 years and up

# VOICE OF THE CUSTOMER

- I have common graphics
- I have common warnings
- I sell the product to civil and military operators
- I have to maintain my ATA data until the thing stops flying ...
- I can't afford to keep two publishing systems and have two IT solutions
- I don't want to train my authors to use two different systems
- I want a common toolset
- I want a common process for technical data
- I want a single point of contact for technical issue

# S1000D VS ATA FUNDAMENTALS

## S1000D

- More recent standard with historically more military based applications starting with aircraft extended to support land and sea
- Module based with standalone addressable units of data
- Promotes re use
- Abstracted content from publication context
- Externalized content (CIR)
- XML based with Schema
- Business rules validation
- Discourages customization

## ATA

- Older standard (1956) with always commercial based applications
- Book/Manual based with minimal reuse
- No formalized codification methodology for smaller units of information (like ICN)
- Some content is peculiar to a type of manual
- No defined system for externalized content
- DTD based (inclusions)
- No business rules mechanism
- Customizations commonplace

# HOW TO COMBINE BOTH ATA AND S1000D IN ONE SYSTEM

- We chose to use XML as the master source format for everything
- We chose to apply S1000D best practices to object naming
- We utilize an automatic conversion process to XML for legacy data
- We control the bursting and granularity
- Some ATA fundamentals retained:
  - Publication Structure
  - Stylesheets and OEM specific customizations
  - AMTOSS coding

# CMS SOFTWARE ENGINEERING CHALLENGES

| Name           | Cl | S1000D Description         | Object Type                  | Technical Name                                  |
|----------------|----|----------------------------|------------------------------|---|
| PTC UAV S1000D |    |                            | S1000D 4.0.1 Informatio...   |   |
| PTCUAV         |    |                            | 4.0.1 Model Identificatio... |   |
| A              |    |                            | 4.0.1 System Difference ...  |   |
| 00             |    | General information fo...  | 4.0.1 System Code            | Product - General                               |
| 04             |    | This System provides ...   | 4.0.1 System Code            | Worthiness (fit for purpose) limitations        |
| 05             |    | Manufacturers' recom...    | 4.0.1 System Code            | Scheduled/unscheduled maintenance               |
| 00             |    |                            | 4.0.1 Sub System Code ...    | Scheduled/unscheduled maintenance - General     |
| 00             |    |                            | 4.0.1 Assembly Code          | Scheduled/unscheduled maintenance - General     |
| ICN-PTI        |    |                            | Model Based Informatio...    |   |
| 00             |    |                            | 4.0.1 Disassembly Code       | Scheduled/unscheduled maintenance - General     |
| A              |    |                            | 4.0.1 Disassembly Code ...   | Scheduled/unscheduled maintenance - General     |
| 10             |    | Those manufacturer re...   | 4.0.1 Sub System Code ...    | Time limits                                     |
| 20             |    | A list of the manufactu... | 4.0.1 Sub System Code ...    | Scheduled maintenance checks lists              |
| 40             |    | Those manufacturer re...   | 4.0.1 Sub System Code ...    | Scheduled maintenance checks                    |
| 50             |    | Those maintenance ch...    | 4.0.1 Sub System Code ...    | Unscheduled maintenance checks                  |
| 60             |    | Those current status...    | 4.0.1 Sub System Code ...    | Acceptance and functional check usage           |
| 06             |    | Those illustrations and... | 4.0.1 System Code            | Dimensions and areas                            |
| 07             |    | Shall include all neces... | 4.0.1 System Code            | Lifting, shoring, recovering and transporting   |
| 08             |    | This System includes t...  | 4.0.1 System Code            | Leveling and weighing                           |
| 09             |    | Those instructions nec...  | 4.0.1 System Code            | Handling and maneuvering                        |
| 10             |    | This System is to cont...  | 4.0.1 System Code            | Parking, mooring, storing and return to service |
| 11             |    | All procurable placard...  | 4.0.1 System Code            | Placards and markings                           |
| 12             |    | Those instructions for ... | 4.0.1 System Code            | Servicing                                       |
| 14             |    | This System contains t...  | 4.0.1 System Code            | Product loading and offloading                  |
| 15             |    | This System provide a...   | 4.0.1 System Code            | Crew information                                |
| 16             |    | Those instructions nec...  | 4.0.1 System Code            | Change of role                                  |
| 18             |    | This System provides t...  | 4.0.1 System Code            | Vibration and noise analysis and attenuation    |
| 20             |    | This System contains t...  | 4.0.1 System Code            | Standard practices - Airframe systems           |
| 21             |    | Those units and comp...    | 4.0.1 System Code            | Environmental control                           |
| 22             |    | Those units and comp...    | 4.0.1 System Code            | Auto flight                                     |
| 23             |    | Those units and comp...    | 4.0.1 System Code            | Communications                                  |
| 24             |    | Those electrical units ... | 4.0.1 System Code            | Electrical power                                |
| 25             |    | Those removable item...    | 4.0.1 System Code            | Equipment/furnishings                           |

DATA CENTRIC

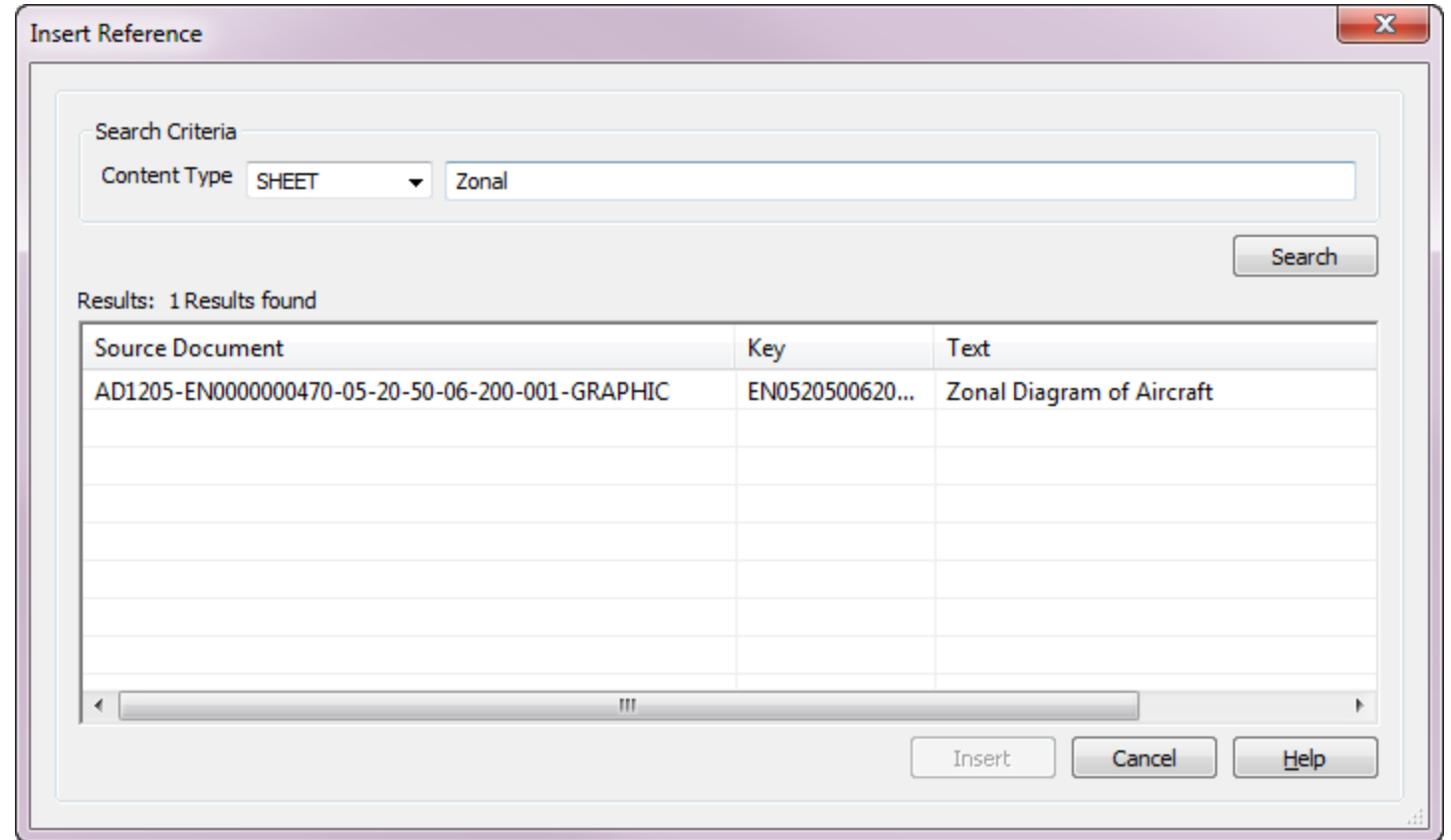
| Name  | Cl |
|---|----|
| AMM   |    |
| Front Matter                                    |    |
| Temporary Revision List                         |    |
| Introduction                                    |    |
| Effectivity Cross Reference Table               |    |
| Letter of Transmittal                           |    |
| TIME LIMITS/MAINTENANCE CHECKS                  |    |
| General   |    |
| Time Limits                                     |    |
| Scheduled Maintenance Checks                    |    |
| Zonal Inspection                                |    |
| Inspection/Check                                |    |
| AD1205-EN0000000470-05-20-50-06-200-001-TASK    |    |
| AD1205-EN0000000470-05-20-50-06-200-001-GRAPHIC |    |
| Unscheduled Maintenance Checks                  |    |
| DIMENSIONS AND AREAS                            |    |
| LIFTING & SHORING                               |    |
| General   |    |
| Jacking   |    |
| Jacking Procedures                              |    |
| Servicing                                       |    |
| Shoring   |    |
| LEVELING & WEIGHING                             |    |
| TOWING & TAXIING                                |    |
| PARKING, MOORING, STORAGE & RETURN TO SERVICE   |    |
| PLACARDS AND MARKINGS                           |    |
| SERVICING                                       |    |
| VIBRATION AND NOISE ANALYSIS (HELICOPTER ONLY)  |    |
| STANDARD PRACTICES - AIRFRAME                   |    |
| AIR CONDITIONING                                |    |

( 89 objects )

PUB CENTRIC

# LINK OBJECTS

- ATA references are internal to the manual
- Searches are based on the content type (e.g. Tasks, Process Lists, Sheets etc.)
- Only searches within the current manual





# LINK OBJECTS

- S1000D robust support for internal and external references
- References can be manual specific when reusing a data module (internal in some cases; external in others)

**Browse Data modules**

Data module

Model Identification Code Equals

System Difference Code Equals

System Code Equals 32

Sub System Code \_Sub Sub System Code Equals

Assembly Code Equals

Disassembly Code Equals

Disassembly Code Variant Equals

Information Code Equals

Information Code Variant Equals

Item Location Code Equals

Clear Search

| Name                             | Title  | Issue Number | In Work |
|----------------------------------|--|--------------|---------|
| DMC-PTCUAV-A-32-00-00-00A-034A-D | Landing gear - General - Technical data (physical breakdo...   | 000          | 01      |
| DMC-PTCUAV-A-32-00-00-00A-040A-D | Landing gear - General - Description of how it is made an...   | 000          | 01      |
| DMC-PTCUAV-A-32-10-00-01A-365A-D | Main gear and doors - Continuity check                         | 000          | 01      |
| DMC-PTCUAV-A-32-10-00-01A-941A-D | Main gear and doors - IPD                                      | 000          | 01      |
| DMC-PTCUAV-A-32-10-00-01A-941A-D | Main gear and doors - IPD                                      | 001          | 00      |
| DMC-PTCUAV-A-32-10-00-01A-941A-D | Main gear and doors - IPD                                      | 001          | 01      |
| DMC-PTCUAV-A-32-20-00-00A-040A-D | Nose/tail gear and doors - General - Description of how it ... | 000          | 01      |
| DMC-PTCUAV-A-32-20-00-00A-365A-D | Nose/tail gear and doors - General - Continuity check          | 000          | 01      |
| DMC-PTCUAV-A-32-20-00-00A-365B-D | Nose/tail gear and doors - General - Continuity check          | 000          | 01      |
| DMC-PTCUAV-A-32-20-00-00A-941A-D | Nose/tail gear and doors - General - IPD                       | 000          | 01      |

17 items found.  Use Issue Information OK Cancel Help

# GRAPHIC RE USE/GRAPHIC NAMING

- S1000D

**S1000D**

\* Model Identification Code: PTCUAV

\* System Difference Code: A

\* System Code: 05

\* Sub System Code: 0

\* Sub Sub System Code: 0

\* Assembly Code: 00

\* Originator: OK0D7 - PTC

\* Responsible Partner Company Code: P

\* Variant Code: A

\* Security Classification: 01 - Unclassified

- ATA

Create Information Control Number

Type: Information Control Number - ATA

File Path: D:\Users\... \P Browse

Title: Zone Map of Aircraft

|                             |        |
|-----------------------------|--------|
| Model                       | AD1205 |
| Chapter                     | 05     |
| Section                     | 20     |
| Subject                     | 50     |
| Originator                  | OK0D7  |
| Responsible Partner Company | OK0D7  |

Create Close

# DMRL VS IEL

- S1000D DMRL

| Name ▲                            | Issue Number | In Work | Issue Type | State           |
|-----------------------------------|--------------|---------|------------|-----------------|
| DDN-PTCUAV-0K0D7-0K0D7-2016-00001 |              |         |            | Work In Progre. |
| DMC-PTCUAV-A-00-00-00-00A-00PA-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-00-00-00-00A-00QA-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-00-00-00-00A-00WA-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-00-00-00-00A-018A-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-00-00-00-00A-022A-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-00-00-00-00A-941A-D  | 000          | 01      | new        | Pending         |
| DMC-PTCUAV-A-00-00-00-01A-941A-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-00-20-00-00A-012A-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-04-00-00-00A-040A-D  | 001          | 00      | new        | Issued          |
| DMC-PTCUAV-A-05-00-00-00A-200A-D  | 000          | 01      | new        | Work In Progre. |
| DMC-PTCUAV-A-07-10-00-00A-912A-D  | 000          | 01      | new        | Work In Progre. |

- ATA IEL (burst assets)

| Information Structure |   | Information Element List |                                   | Attributes |  |
|-----------------------|---|--------------------------|-----------------------------------|------------|--|
| Number                | Name ▲  | Version                  | Title                             | Sta        |  |
| 0000000010            | AD1205-EN0000000470-05-20-50-06-200-001-GRAPHIC | A.1                      | Diagram of Inspection Zones       | In V       |  |
| 0000000009            | AD1205-EN0000000470-05-20-50-06-200-001-TASK    | A.1                      | Zonal Inspections                 | In V       |  |
| 0000000011            | AD1205-EN0000000470-07-10-30-04-PRCLIST1        | A.1                      |                                   | In V       |  |
| 0000000007            | Effectivity Cross Reference Table               | A.1                      | Effectivity Cross Reference Table | In V       |  |
| 0000000006            | Introduction                                    | A.1                      | Introduction                      | In V       |  |
| 0000000008            | Letter of Transmittal                           | A.1                      | Letter of Transmittal             | In V       |  |
| 0000000005            | Temporary Revision List                         | A.1                      |                                   | In V       |  |

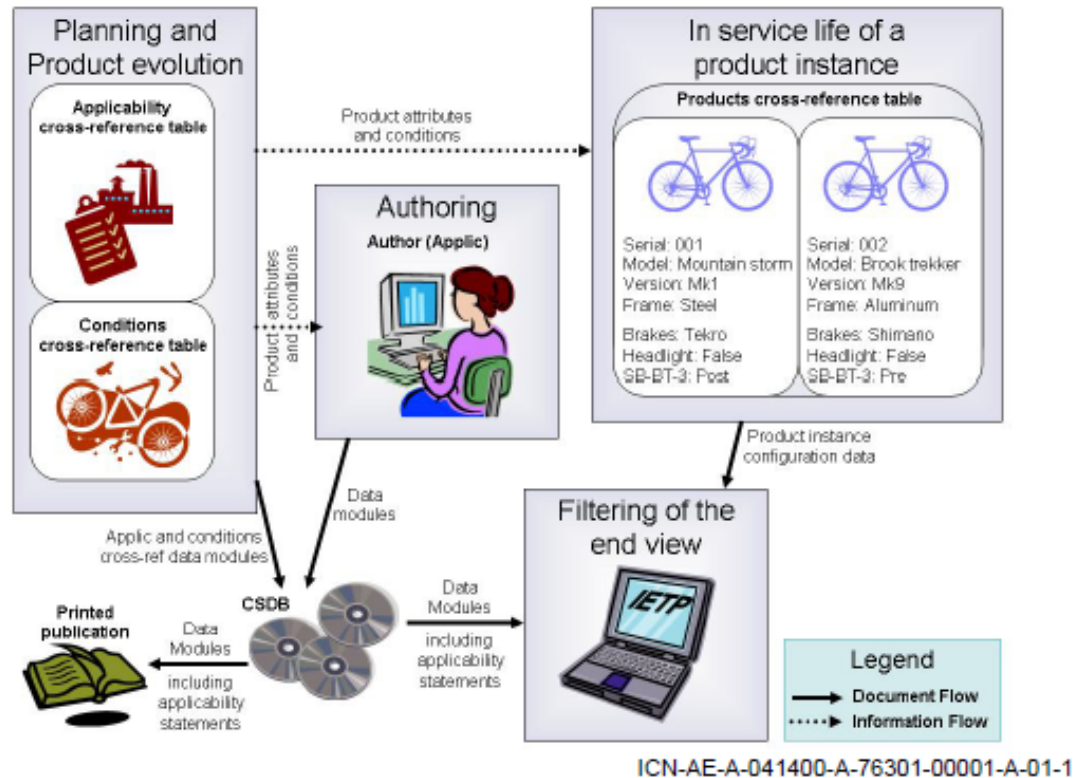
# INCLUSIONS/EXCLUSIONS

- Allows for non uniform instances
- Creates conversion/standardization challenges

The plus sign after the content model followed by one or more elements within parentheses declares an "inclusion". An inclusion indicates that the elements can appear anywhere in the element to which they are attached and in any of its subelements.

- S1000D – ACT, PCT, CCT

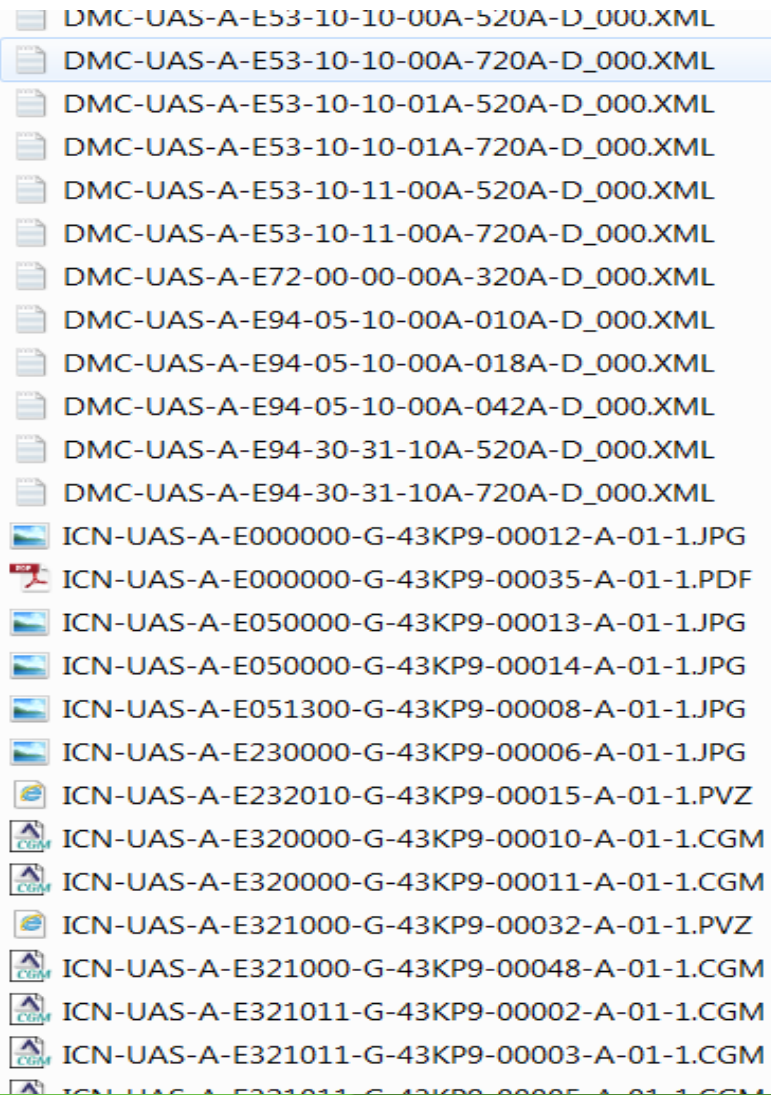
- ATA – serial number ranges



```

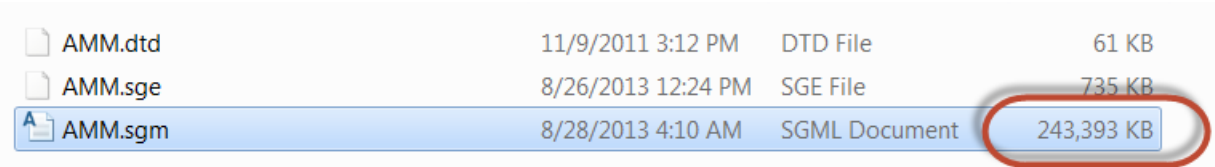
<TASK
  CHAPNBR="06"
  CHG="U"
  CONFLTR="A"
  FUNC="992"
  KEY="AMM06-41-30-992-801-A34"
  PGBLKNBR="01"
  REVDATE="20110825"
  SECTNBR="41"
  SEQ="801"
  SUBJNBR="30"
  VARNBR="34">
<EFFECT
  EFFRG="1526015260 1526315264 1526715270"
  EFFTEXT="ON A/C 15260, 15263-15264, 15267-15270">
</EFFECT>
<TITLE>Component Location Index</TITLE>
<TFMATR>
<PRETOPIC>
<TITLE>Introduction</TITLE>
<LIST1>
  
```

- S1000D – discrete file set



DMC-UAS-A-E53-10-10-00A-520A-D\_000.XML  
DMC-UAS-A-E53-10-10-00A-720A-D\_000.XML  
DMC-UAS-A-E53-10-10-01A-520A-D\_000.XML  
DMC-UAS-A-E53-10-10-01A-720A-D\_000.XML  
DMC-UAS-A-E53-10-11-00A-520A-D\_000.XML  
DMC-UAS-A-E53-10-11-00A-720A-D\_000.XML  
DMC-UAS-A-E72-00-00-00A-320A-D\_000.XML  
DMC-UAS-A-E94-05-10-00A-010A-D\_000.XML  
DMC-UAS-A-E94-05-10-00A-018A-D\_000.XML  
DMC-UAS-A-E94-05-10-00A-042A-D\_000.XML  
DMC-UAS-A-E94-30-31-10A-520A-D\_000.XML  
DMC-UAS-A-E94-30-31-10A-720A-D\_000.XML  
ICN-UAS-A-E000000-G-43KP9-00012-A-01-1.JPG  
ICN-UAS-A-E000000-G-43KP9-00035-A-01-1.PDF  
ICN-UAS-A-E050000-G-43KP9-00013-A-01-1.JPG  
ICN-UAS-A-E050000-G-43KP9-00014-A-01-1.JPG  
ICN-UAS-A-E051300-G-43KP9-00008-A-01-1.JPG  
ICN-UAS-A-E230000-G-43KP9-00006-A-01-1.JPG  
ICN-UAS-A-E232010-G-43KP9-00015-A-01-1.PVZ  
ICN-UAS-A-E320000-G-43KP9-00010-A-01-1.CGM  
ICN-UAS-A-E320000-G-43KP9-00011-A-01-1.CGM  
ICN-UAS-A-E321000-G-43KP9-00032-A-01-1.PVZ  
ICN-UAS-A-E321000-G-43KP9-00048-A-01-1.CGM  
ICN-UAS-A-E321011-G-43KP9-00002-A-01-1.CGM  
ICN-UAS-A-E321011-G-43KP9-00003-A-01-1.CGM  
ICN-UAS-A-E321011-G-43KP9-00005-A-01-1.CGM

- ATA monolithic instance of SGML



|         |                    |               |            |
|---------|--------------------|---------------|------------|
| AMM.dtd | 11/9/2011 3:12 PM  | DTD File      | 61 KB      |
| AMM.sge | 8/26/2013 12:24 PM | SGE File      | 735 KB     |
| AMM.sgm | 8/28/2013 4:10 AM  | SGML Document | 243,393 KB |

# COMMON CUSTOMIZATIONS TO THE ATA IMPLEMENTATION

- Front Matter
- Fault Isolation – Huge difference here between different OEMs
  - For faults manual Boeing are using the FIM or even FRMFIM manual which mainly lists faults and their procedures while Airbus are producing Troubleshooting manual based on the TSM which includes groups of symptoms that result in a fault and then the procedure
- Parts
  - there are differences between OEMs in parts catalog elements and their presentation and even in the AMM manuals, the numbering scheme is not always the same e.g. LITEM, L1ITEM, L2ITEM, etc are numbered A. , 1. , a. for one OEM and 1. A, i. for the other
- AMM
  - For the old aircrafts such as the 737 the AMM unit is PGBLK (containing PRCLIST) and it does not even include TASK which is the unit in all newer aircrafts

# CONCLUSIONS

1. Although S1000D and ATA have fundamental data model differences there is enough commonality that a single CMS can be used for both\*
2. Legacy data presents the biggest challenge because of customizations
3. S1000D codification practices can be applied to ATA data to improve search ability and re usability
4. Truly 100% "common" data may not be achievable in a COTS solution because of the reliance on robust business rules to map the elements and attributes, naming conventions and structures however some re use is possible

\*Conversion to XML may be required



QUESTIONS?