Overview of the LOTAR project and LOTAR standards, Status of implementation in Europe

Digital Preservation Coalition workshop
27th of July 2013, Bath

Presented by Sophie Herail: Airbus Cimpa
Prepared with Jean-Yves Delaunay: EADS Airbus
AIA - ASD Stan LOTAR co project leader
Introduction – objective

- Overview of the LOTAR project
- Overview of the LOTAR standards
- Summary of implementation of LOTAR standards in Europe
- Summary – next actions
• **End of the 1990ies:** different initiatives are launched in USA and in Europe for L-T Preservation of Aerospace and Defence Definition Dossier based on CAD 3D and PDM information

• **2005:** convergence of the US PDES Inc - AIA LTDR project and of the ASD Stan - ProSTEP iViP LOTAR project, under the IAQG
  
  • IAQG: International Aerospace Quality Group

• **2008:** creation of the LOTAR International project

• **2012:** publication of the NAS9300 / EN9300 standards: 2-ed2, 5, 7, 100, 110, 115, and sending for ballot of the part 120: foundation for LT Preservation of CAD 3D PMI “graphic presentation”

• **2012-2015:** preparation of the standards for L-T Preservation of:
  
  • CAD 3D PMI “semantic representation” and 3D light visualization,
  • CAD 3D composite design,
  • PDM information (priority 1: “As design” product structure),
  • CAD 3D Electrical harness
Objectives of this presentation

- To provide an **overview of the LOTAR project**
- To provide a **status of the LOTAR standards**
- To focus on LOTAR parts for LT archiving and retrieval of CAD information
  - CAD 3D PMI (“Product and Manufacturing Information”)
  - CAD 3D composite design
  - CAD electrical harness
  - 3D visualization
Introduction – objective

- Overview of the LOTAR project

- Overview of the LOTAR standards

- Summary of implementation of LOTAR standards in Europe

- Summary – next actions
Why Lotar?
- Mission, Objectives & Scope
- Hosting Organizations
- Legal & Business Motivation

LOTAR organization
- External View
- Internal View
- Working together

LOTAR Workgroups
- 3D CAD with PMI
- PDM
- Composite
- Electrical Harness
- 3D visualization
- (Meta data for archive packages)

Communication
- Public presentations
- Progress Reports
- Dates

LOTAR standards
- Overview on parts
- Industry use
- Next steps

News
Links
Contact

http://www.lotar-international.org/home.html
LOTAR International project
A&D companies members in 2013

Members (Americas)
- BAE Systems
- Boeing
- Bombardier
- Embraer
- General Dynamics
- General Electric
- Goodrich
- Honeywell
- Lockheed Martin
- Sandia National Labs
- Spirit Aero

Potential Members (Americas)
- Cessna

Members (Europe)
- Airbus
- CASSIDIAN
- Dassault Aviation
- Eurocopter
- IAI (Israel Aerospace Industries)
- SAFRAN Labinal

Potential Members (Europe)
- Thales
LOTAR International project and external relationships
2013 status of the SSG « Radar screen »

: EN9300 standard « adopted »

http://www.asd-ssg.org/radar-chart
EN9300 standard summary of the ASD SSG and associated recommendations

Abstract
The LOTAR project is designed to provide a capability to preserve digital aerospace and defense product information in a standard neutral form that can be read and reused throughout its lifecycle, independent of changes in the IT application environment originally used to create it. The multi-process joint process will share LOTAR, suitable for AIA, under the Group LOTAR, such as PDM (PDM).

ASD adoption statement
ASD recommends the use of EN9300 LOTAR standards by the European aerospace and defense industries for projects for LT Archiving and Retrieval of CAD 3D geometry and CAD assembly structure, with effect from March 2010.

ASD recommendation
The SSG recommends European aerospace and defence OEM to participate in the LOTAR international project, in order to speed up the development of the different parts according to their business priorities.

Link to a standards host site
http://www.lotar-international.org/
WP1: Development of Basic Parts

WP2: Development of Common Process Parts

WP3: Development of Data Domain Specific Parts

WP4: Implementation of Pilot Projects

WP5: Development of L-T Archiving Rec. Practices


WP7: Communication (FAA, EASA, … IT Vendors, Standardization)

WP0: Project Management
Overview of NAS / EN 9300 LOTAR standards
An architecture for extensions according to business needs

Preparation of the creation of a new WG in 2014
Not planned
Active participation of A&D manufacturers, and coordination with standardization associations

- 4 international LOTAR workshops of 3 days:
  - 11th – 13th of March 2013  USA, NIST (parallel to the PDES Offsite)
  - 11th – 13th of June 2013  Europe, Toulouse, Cimpa
  - 23th – 25th of Sept. 2013  USA, PDES Inc (parallel to the PDES Offsite)
  - 3th – 5th of Dec. 2013  Europe, Darmstadt, ProSTEP iViP

- Weekly teleconferences of the main Working Groups:
  - PDM WG, CAD 3D PMI WG, CAD 3D composite WG,
  - Coordination team
  - Bi weekly teleconferences:
    - Elec. Harness WG, 3D visualization, WG, Meta data for Archive Pack. WG

- Coordination with A&D and PLM standardization associations
  - Aerospace and Defence manufacturers associations: AIA and ASD
  - PLM Standardization associations: PDES Inc and ProSTEP iViP
- Introduction – objective
- Overview of the LOTAR project
- Overview of the LOTAR standards
- Summary of implementation of LOTAR standards in Europe
- Overview of the Airbus project for Long Term Archiving and Retrieval of the A350 3D electrical harness installation
- Summary – next actions
Rates of Change of technologies versus the longevity of an aerospace product

- Life of Operating System: 18 months
- Life of Computer: 3 years
- Time between CAD Versions: 6 months
- Life of CAD System: 10 years
- Life of aerospace Product: 70 years +
A Brief History of CAD

- **Manual Drawing**
- **Computer as Electronic pencil**
  - Part shape is modelled to produce drawings more easily
  - Automated redrawing after small changes
- **Geometry Modelling**
  - Part model includes shape, materials, tolerances
- **Product Modelling**
What is the master?

- Manual Drawing
- Computer as Electronic pencil
- Geometry Modelling
- Model is the master
- Product Modelling

Drawing is the master
Model Verification

For model as master, we need to prove we have retained the master.
The LOTAR project: To support the **longevity** of Aerospace & Defense 3 D Model based definition

- CAD S/W versions change every **6 to 12 months**, CAD generations change every **10 years**.
- Aircraft lifecycle of **70+ years**
- The Lifecycle of software & hardware is short compared to the lifecycle of an aircraft or a defence system (nuclear missile, ...)

---

**Ingest**

**Preservation Planning**

**Repository**

**Administration**

**Retrieve**
001: Common Overview
   - Objective, structures of the EN9300 parts

002: Requirements
   - Business Requirements (Acceptance, legal, security, certification)
   - Functional Requirements based on the OAIS reference model

003: Fundamentals and concepts
   - Product model, OAIS ISO, ISO Open product data standards (STEP),
     representation - presentation, validation / verification, key characteristics

004: Methods (description)
   - Scope/ scenario, Use Case diagram, process, data, system architecture

005: Authentication and Verification
   - Electronic Keys, Electronic signature, Hash Code, Authentication, Verification, electronic time signatures

006: Architecture Framework (new)
   - Identification of sub-systems with associated functions

007 Terms and References (new)
   - Common to all parts of EN9300 (updated with new parts)
Status of NAS/EN 9300
Common Process Parts

010: Overview Data Flow
011: Data Preparation
012: Ingest
013: Archival Storage
014: Retrieval
015: Removal
016: Test Suites

020: Governance and planning

Ballot
S2 2013

02X: Audit (of the LT Archiving and retrieval system) > 2014
02X: Security (of the LT Archiving and retrieval system) > 2014
NAS/EN 9300 Fundamentals and concepts N°1: Use of ISO OAIS (Open Archive Information Model)
NAS/EN 9300 Fundamentals and concepts N°2: L.-T. Preservation based on open standards

Process to **demonstrate the equivalence of the product aerospace models, based on preservation of Key Characteristics**, with validation & verification rules

- **Δ1** Release of CAD native data
- **Δ2** Migration 1 of CAD native data
- **Δ3** Migration 2 of CAD native data
- **Δ4** Migration 3 of CAD native data
- **Δ5** Migration 4 of CAD native data
- **Δ1’** Conversion 1 in open standard format
- **Δ2’** Conversion 2 in open standard format

For preservation of the archived 3D Reference Models through the change of generations of CAD applications

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NAS/EN 9300 Fundamentals and concepts N°2: Use of the suite of ISO STEP standards and related 3D light visualization standards

LOTAR standards references to ISO Standards for information models

PLM information
STEP AP 209, AP 242*, AP 238, AP 239, AP 233,*: convergence of AP203/AP214
3D light Visualization: JT, PRC, U3D, …

Managed Digital Model Based Definition throughout the Enterprise

2007

2015 +

LOTAR
LONG TERM ARCHIVING AND RETRIEVAL
Overview of LOTAR standards & relationships with ISO 10303 STEP Application Protocols

<table>
<thead>
<tr>
<th>Process &amp; use cases</th>
<th>Information</th>
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</table>

### Basic Parts
(Overview, Requirements, Fundamentals, Methods, ...)

### Common Process Parts
(Common Process, Data Preparation, Ingest, Archival Storage, Retrieval, ...)

### Data Domain Specific Parts
- CAD Mechanical 3D Geometry & Assembly with PMI
- Product Management
- Data
- Composite Design
- Electrical Harness
- Systems Engineering (not yet started)
- Engineering Analysis (not yet started)

#### Applicable Data Models (ISO 10303 STEP)
- AP203e2
- AP214e3
- AP242e1
- AP239
- AP203e2
- AP242e1
- AP242e2 (target)
- AP233 (target)
- AP209e2 (target)
- AP2xx
**Method Generation 1**
(2D drawing only)

- Left view
- Scale: 1:1

**Method Generation 2**
(2D & 3D)

- Left view
- Scale: 1:1

**Method Generation 3**
(3D with GD&T as master)
### Overview of the NAS/ EN9300-100

Illustration of different CAD data functionalities for mechanical design, and the related generation

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<td>3D Explicit Solid Geometry with GD&amp;T &amp; machining Form Features</td>
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<td>3D parametric Geometry with Construction History</td>
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- **3D surfaces**
- **3D Explicit Solid**
- **3D Explicit Solid Geometry with GD&T (Geometric Dimensions & Tolerances)**
- **3D Explicit Solid Geometry with GD&T & machining Form Features**
- **3D parametric Geometry with Construction History**

- + Dimensions & Tolerances
- Hole
  - General pocket
  - General_outside_profile
- Capability to update the part using construction history / parametric
**Document structure of EN9300-1XX family**

<table>
<thead>
<tr>
<th>Document Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>9300-100</td>
<td>Common concepts for LT Archiving of CAD 3D mechanical information</td>
</tr>
<tr>
<td>9300-110</td>
<td>Long Term Archiving of CAD 3D Explicit Geometry</td>
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<tr>
<td>9300-115</td>
<td>Long Term Archiving of CAD Explicit Assembly Structure</td>
</tr>
<tr>
<td>9300-120</td>
<td>Long Term Archiving of CAD 3D Explicit Geometry with 3D Product and Manufacturing Information (PMI)</td>
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<tr>
<td>9300-125</td>
<td>Long Term Archiving of CAD Explicit Assembly Structure with 3D Product and Manufacturing Information (PMI)</td>
</tr>
<tr>
<td>9300-130</td>
<td>Long Term Archiving of CAD 3D parametric geometry</td>
</tr>
<tr>
<td>9300-135</td>
<td>Long Term Archiving of CAD parametric Assembly Structure</td>
</tr>
</tbody>
</table>
Template for the table of contents of a part of the family EN9300-1xx.

1 - Scope
2 - Normative references
3 - Terms, definitions and abbreviations
4 - Applicability
5 - Fundamental concepts (if requested)
5 - Business specifications
6 - Essential information
7 - Definition of the core model
8 - Verification rules
9 - Validation rules
PART 100: Common concepts for Long term archiving and retrieval of CAD 3D mechanical information

Business requirements

- Certification
- Product Liability
- Support in operation
- Reuse

Functions to be supported after retrieval

Risk management

Validation properties

Verification rules

Essential information to be preserved

Set of Essential information N°1

Set of Essential information N°2

Set of Essential information N°3

Part 1xx

Part 1yy

Part 1zz

UC1 UC2 UC3 UC4 UC4 ... UC n

Use Cases

: Business requirements & use cases
PART 100: Common concepts for Long term archiving and retrieval of CAD 3D mechanical information

The 2 parts are different to some minor geometry shapes, but are in the tolerance for its Key Characteristics.

Manufacturing

Design
“Definition Dossier”

Definition of Key Characteristics of the part, with tolerances

Control based on predefined Key Characteristic (with tolerances)

Physical Part No. 1
Physical Part No. 2

Manufacturing

Long Term Archiving System

3D Geometric Model for LT preservation

3D Geometric essential information is preserved, with the associated tolerance

Information semantic integrity is controlled, based on definition of essential information, and tolerances

For Support in operation, Product Liability, Certification

2000

2030
Part 110: Long Term Archiving and Retrieval of CAD mechanical 3D Explicit geometry information

- **Scope:** The archiving of 3D Explicit geometry
  
  Out of scope:
  - Implicit or parametric geometry (planned in part 130)
  - Drawing
  - Annotation (see part 120)
  - Assembly structures. (see part 115)

- **Use cases**
  - Documentation of Aerospace & Defense product design for regulatory and contractual compliance
  - Aerospace & Defense Industry incident investigation
  - Design re-use – product modification
  - Product lifecycle & supply chain support and disposal.

- **Essential information:** The 3D exact shape

- **Core model:** ISO 10303-514 (Advanced boundary representation) used by STEP AP203 and AP 214
Part 110: Long Term Archiving and Retrieval of CAD mechanical 3D Explicit geometry information

- **Validation:**
  - Validation properties level 1: Volume, centroid and area
  
  - Volume: 344714.254 mm³
  - Centroid: X = 115.498 mm, Y = 0.002 mm, Z = 8.353 mm
  
  - Area: 156872.419 mm²

- Validation properties level 2: Optional: Clouds Of Points
**PART 115: explicit CAD assembly structure**

- **Scope:** CAD assembly structure
  Out of scope: geometric model (see part 110)

- **Essential information:** Nodes + basic attributes + relationship

- **Use cases:** full archiving & incremental archiving

- **Core model** (ISO 10303 STEP AP 203 and AP 214):
  - Based on the PDM schema and the associated usage guide
  - CAX-IF recommended practices
PART 115: explicit CAD assembly structure

- **Verification**
  - Some simple rules like no acyclic assembly structure

- **Validation**:
  - Geometric validation properties: volume, centroid and area
  - Assembly validation properties
Part 12x family: 3D with PMI and machining form feature (PMI = «Product and Manufacturing Information»)

- **Part 120: PMI Graphic Presentation**
  - Balloted; planned publication in Sept. 2013

- **Part 121: Semantic PMI Representation**
  - Draft available
  - Planned ballot in 2014

- **Part 122: Machining Form Features**
  - Start in 2014
  - Planned ballot in 2015 – 2016

Nota: new numbering of LOTAR parts 12x agreed during the June 2013 LOTAR workshop
Main categories of CAD information of a Definition Dossier based on 3D with PMI
(PMI = « Product and Manufacturing Information »)

Illustration of the main types of information of 3D PMI:

3D exact shape

3D simplified – facettized ("context")

Assembly structure and associated meta data

3D dimensioning & tolerancing (GD&T)

3D annotations

3D symbols (E.g. welding, fasteners, ...)

Specific properties associated to 3D geometry (UDA)
LOTAR Part 120 “3D PMI presentation
STEP with 3D PMI “polyline presentation”

• Example of LOTAR pilot set up in 2009 to demonstrate the feasibility of
  the interoperability between different CAD systems.

• The following figures shows example of conversion
  with STEP 3D PMI “presentation as polyline”

• Dassaul Systems solution:
  Catia V5-R19 GA SP2 (Q1 2009)
LOTAR part 121 “3D PMI representation”
Types of ISO GD&T to take into account
(GD&T: Geometric Dimensioning and Tolerances)

Geometric tolerance

- Tolerance zone
- Multiple feature
- Reference system
  - A
  - B

Run-out

Form tolerance

Orientation tolerance

Local tolerance

- Requirement, condition,…
- Indications of a compound / restricted tol. feature

Datum

Intersection plane

General modifier

- /Length
- ACS
- CT
- SCS

- Number ×

Surface texture

- milled
- Ra 0,7
- Rz1 3,1

Text annotations
LOTAR part 122
“3D PMI with Machining Form Features”

Illustration of types of machining form features to take into account

Planned start of the part 122 in 2014
LOTAR Composite WG
(status June 2013)

Project Description/Purpose:
- A Lack of Functionality – support advanced, multi-function structures in a model based environment.
- Product vs Part Representations and explicit representations of advanced composites.
- Support for Neutral Exchange Formats– STEP AP203e2 and then AP242e1. Future explicit MBDs will be focused on tessellated representations linked to meta-data such as material, orientation and rosette reference.
- Support the production of LOTAR parts 300/310

Achievements during workshop:
- Telecon with Dassault on Status
- Telecon with Siemens/Fibersim Status
- Work on Validation Properties
- Work on Recommended Practices V2
- Review of Websites – Lotar and AP242
- Workshop with Dassault on Explicit confirmed
- Definition of 4 Rosette Transformation types defined
- Meeting with Dassault Developer in Toulouse
- Composite Glossary refined – reduced 70%
- External Element Reference and BO Model discussion

Deliverables:
- Additional Test cases and Use cases
- Generate Validation properties
- LOTAR standards – Parts 300 & 310
- Updated STEP Composite Recommended Practices
- Enhancement of STEP standard
  - Contributions to 3D tessellated geometry pilot
  - Contributions to “External element reference” pilot
- Summary page for LOTAR website
- Glossary for Composite terms for Parts 300 & 310
- Develop implementation approaches for more complex rosettes

Overall Schedule:

Performance: Schedule: Technical
Overview and illustration of capabilities

Examples of associated use cases

Dependencies / related standards

Status of availability of COTS solutions

Status of rec. practices / implementers forums

Examples of associated use cases
- Interoperability between different systems
  - CAD-CAD: CAD 3D composite design exchange with the supply chain
  - CAD-CAE: CAD 3D composite design to Engineering Analysis
  - CAD-CAM: CAD 3D composite design to Manufacturing

- Long Term Archiving and retrieval (LTA&R)
  - LTA&R of CAD 3D composite design for certification
  - LTA&R of CAD 3D composite design for manufacturing and repairs
  - Visualization of archived CAD 3D composite design information

List not exhaustive, for more information refer to the CAX IF use cases and the STEP AP 242 use cases described by the respective industry associations.

Dependencies / related standards

The data model of AP 242 for CAD 3D composite design is based on STEP AP 203 and STEP AP209.

Status of availability of COTS solutions

Beta version interfaces for CAD composite design are in test for different systems.
More information to be published in 2014.

Related recommended practices

STEP recommended practices for CAD 3D Composite design; draft available: [link](#)

Associated CAX Implementer Forum for Composite design; planned to start in 2014.
LOTAR “Electrical Harness” WG  
(status 11th of June 2013)

**Project Description/Purpose:**

- Development of LOTAR parts for Long term archiving and retrieval of electrical harnesses
  - P400: “fund. and concepts for LOTAR of elec. harness”
  - P410 “LOTAR of phys. elec harness design & construction”
  - P420 “LOTAR of CAD 3D elec. harness installation”,
- To support the development of the STEP AP 242 ed2 standard for LOTAR and interoperability of electrical harness
- To set up pilots / prototypes demonstrating the feasibility of the new concepts specified by the P4XX standards
- To ensure the appropriate coordination with the CAX IF and the other related standardization projects

**Deliverables:**

- New LOTAR parts of the family 4XX
- Processes, use cases and test cases
- Essential information and associated Validation Properties / verif.
- Test round reports and prototypes of PLM vendors
- Support to the prep. of STEP AP 242 ed2 for Electrical Harness
- Communication actions (LOTAR public web page, …)

**Dependencies / Issues / Actions**

- VDA VEC / KBL recommendations (AP 212), STEP AP 210 , AP239
- Preparation of STEP AP 242 ed2 for the Sept. 2012 workshop

**Performance:**

- Schedule: G
- Technical: G

**Achievements since the previous workshop:**

- 3 teleconferences since the March. LOTAR workshop
- Enhancement of Harness test cases for design & construct.
- Continuation of identification of essential info. of harness definition for design & construct. (reference designator, …)

**Next Steps until the Sept. Workshop:**

- Review of use cases and test cases for LOTAR of Physical electrical Harness design and construction. For: 1) certification, 2) reuse, and 3) exchange in the EE
- Same for CAD 3D electrical Harness installation
- VDA VEC KBL tutorial as input for prep of STEP AP 242 ed2
- Participation to the workshop for STEP AP 242 ed2 white paper for extension to electrical harness

**Overall Schedule:**

[Diagram of schedule with key dates and milestones]
Overall planning and link with the development of AP 242 ed2

**LOTAR**
- parts 4XX for CAD 3D Elec Harness
- Data model based on

**STEP**
- AP 242 ed2 with CAD 3D Elec. Harness
- Qualified by

**AP 242 Elect. Harness IF**
- ECAD IF and Rec. Practices

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<thead>
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<th>Year</th>
<th>Event</th>
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<td>2011</td>
<td>NWI</td>
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<td>2011</td>
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<td>Scope P410 V1</td>
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<td>2012</td>
<td>Essential information + glossary</td>
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<td>2012</td>
<td>Pilot V1</td>
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<td>2015</td>
<td>Part 400 &amp; 410 V1</td>
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<td>2016</td>
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<td>Sept. 2011</td>
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<td>Preparation</td>
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<td>June 2014</td>
<td>Start</td>
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<td>Dec. 2016</td>
<td>sent for ballot</td>
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Test case illustration – Example of essential information to preserve

- Connector with 90° backshell
- Connector with "Straight" backshell
- Marker
- Branch with 2 protections
- Bonding
- Similar to a lug:
  A terminal without a connector with a reference designator
- Derivation
- Grommet
  Different types of grommets:
  - chafing,
  - seal pressure,
  - vibration
- Fixing
- Splice
- PVC diameter 15mm
LOTAR “Visualization” WG
(status June 2013)

Project Description/Purpose:
define common aerospace recommendations for LT Archiving and Retrieval of 3D light visualization information, consistent with LT Archiving and Retrieval of CAD 3D product models, throughout the full product life cycle.

Achievements since the previous workshop:
• 5 bi-weekly teleconference
• Use cases development
• Start the requirements definition

Workshop achievement:
• Continue the use cases development
• Continue the requirements identification
• Initiate the Trade study discussion

Next Steps until the September Workshop:
• Requirements finalized
• Use cases description released
• Trade study development

Deliverables:
• Requirements Diagram and Document
• Use Cases for Verification of Requirements
• Best Practices / Processes for the LTA of Viz Data
• Trade Studies and Compliance Matrix for generally accepted formats
• Viz Data for Testing and Public Display
• Glossary of Terms

Dependencies / Issues / Actions
• N/A

Overall Schedule:

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<tr>
<td>▪ Introduction – objective</td>
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<tr>
<td>▪ Overview of the LOTAR project</td>
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<tr>
<td>▪ Overview of the LOTAR standards</td>
<td></td>
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<tr>
<td>▪ Summary of implementation of LOTAR standards in Europe</td>
<td></td>
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<tr>
<td>▪ Summary – next actions</td>
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# Summary of implementation of the LOTAR standards in Europe

<table>
<thead>
<tr>
<th>A&amp;D company</th>
<th>Area of application</th>
<th>Scope</th>
<th>CAD 3D exact geometry</th>
<th>CAD 3D tessellated geometry</th>
<th>CAD 3D PMI</th>
<th>CAD Assembly structure</th>
<th>ISO formats</th>
<th>Project status</th>
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<tbody>
<tr>
<td>Airbus</td>
<td>A350</td>
<td>3D electrical harness installation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>ISO 10303 &quot;STEP&quot;</td>
<td>AP 214 ed3 (*)</td>
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<td>+ AP 242 ed1</td>
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<tr>
<td>EADS</td>
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<td>&quot;Full 3D&quot; model based</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>AP 242 ed1</td>
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<tr>
<td>Dassault-Aviation</td>
<td>Falcon 7X</td>
<td>complete definition of the aircraft (airframe,</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>AP 214 ed3 (*)</td>
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<td>brackets, pipes,</td>
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<td>Sncema</td>
<td>New parts of engines</td>
<td>3D definition with PMI of new mechanical part</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>AP 214 ed3 (*)</td>
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<td>(TBC)</td>
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<td>Boeing</td>
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<td>3D definition with PMI with assemblies</td>
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<td>Yes</td>
<td>AP 203 ed2 (*)</td>
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<td>+ U3D PDF</td>
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<td>Lockheed-Martin</td>
<td>F35</td>
<td>3D mBD mechanical, electrical and composite</td>
<td>Yes</td>
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<td>Yes</td>
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<td>AP 203 ed2 + AP242 ed1</td>
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</tbody>
</table>

**Legend:**
- **PLANNED**: project planned
- **DEV**: project in development
- **PROD**: project on production
- (*) Plan to migrate to STEP AP 242 ed1 when possible
- Introduction – objective
- Overview of the LOTAR project
- Overview of the LOTAR standards
- Summary of implementation of LOTAR standards in Europe
- Summary – next actions
The LOTAR project and the coordination with other PLM standardization projects

- The LOTAR standards define the processes, use cases, quality control rules, for the preservation of the PLM information
- They rely on other ISO TC 184 SC4 STEP standards defining the PLM information models

=> It relies on the setting up of a coordination of the LOTAR project with other PLM standardization projects, for example:

- Funding of STEP AP 242 and STEP AP 239 “Product Life Cycle Support” harmonization for PDM information model
- Funding of the STEP CAX Implementor Forum
- Funding of the development of specific functionalities of STEP AP 242,
- Liaison to be set up with ISO TC 171 “Technical documentation” for PDF A3 / PRC
STEP AP 242 as the cornerstone for LT Archiving & retrieval of CAD information: scope of AP 242 edition 1

PDM
Part identification, Physical part characteristics, Document Management, General management information, Activity and work management, Effectivity, Specification, Breakdown and configuration

Process Plans
Requirements
Design Rules

Presentation

3D Machining
Form Features

3D shape
Data Quality

2D draughting

3D shape (explicit and parametric)

3D Composite design

Addressed by the BO model:

- PDM system
- Requirement management system
- CAD system
- Process Planning system
Structure of the web site:

- Welcome
- Why AP242?
- AP 242 standard
- AP 242 project organization
- Other related standards
- Implementer Forums
- Rec. Practices

Site map

http://www.ap242.org/
The LOTAR project has **delivered standards now used** by the US and European Aerospace and Defences manufacturers.

The LOTAR project **prepares new LOTAR standards** in order to extend the current capabilities:
- PDM « As design », CAD 3D composite design, CAD electrical harness
- recommandation for LT Archiving of 3D light visualization

Need of close coordinations with other initiatives in Europe, USA and Asia for long term preservation of product information, such as CAD 3D models:
- Shall rely on ISO open standards for product information models
- Unconsistent recommendations will weeken the positions of the industries and increase the cost / risk for LT preservation of PLM information, such as CAD 3D models
LOTAR business requirements
part 2 edition 2

• BUSINESS REQUIREMENTS
  • 6.2.1 ACCEPTANCE
  • 6.2.2 LEGAL REQUIREMENT
  • 6.2.3 SECURITY REQUIREMENT
  • 6.2.4 CERTIFICATION

• FUNCTIONAL REQUIREMENTS based on the OAIS reference model
  ▸ Preparation 9
  ▸ Ingesting Product Definition into Repository/Archive 5
  ▸ Archive Storage 11
  ▸ Disaster Recovery: 4
  ▸ Data Management: 42
  ▸ Administration 5
  ▸ Preservation Planning: 15
  ▸ Access 8

• SPECIFIC REQUIREMENTS per TYPES OF 3D CAD-PDM DATA to preserve
  ▸ REQUIREMENTS for LT Preservation of 3D PARTS (3D EXACT SOLID BOUNDARY REP.)
  ▸ “ “ “ LT Preservation of EXPLICIT CAD ASSEMBLY STRUCTURE
  ▸ “ “ “ LT Preservation of PDM cDMU INFORMATION OF THE A380
  ▸ “ “ “ LT Preservation of CAD 3D EXPLICIT GEOMETRY WITH GD&T
NAS/EN 9300 Part 20
“Governance and Preservation Planning”

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
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<tbody>
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<td>Introduction</td>
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<td>2</td>
<td>Scope</td>
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<tr>
<td>3</td>
<td>Normative references</td>
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<tr>
<td>4</td>
<td>Terms, definitions and abbreviations</td>
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<tr>
<td>5</td>
<td>Applicability</td>
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<tr>
<td>6</td>
<td>Responsibility Model</td>
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<tr>
<td>7</td>
<td>Business Preservation Planning</td>
</tr>
<tr>
<td>8</td>
<td>User Preservation Planning</td>
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<tr>
<td>9</td>
<td>Technical Preservation Planning</td>
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<tr>
<td>10</td>
<td>Knowledge Management</td>
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<tr>
<td>11</td>
<td>Risk Management</td>
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<td>12</td>
<td>Organizational Compliance with LOTAR</td>
</tr>
<tr>
<td>13</td>
<td>Repository Responsibilities</td>
</tr>
</tbody>
</table>

Appendix A  Relationship between OAIS and LOTAR
Appendix B  Organization Structure
• 4 levels of preservation planning: **business** level, **user** level (E.g., design office), **technical** level (E.g., Information system organization), + **archive system level**
### Overview of the LOTAR standards P2XX for Long Term Archiving and Retrieval of Product Management data

<table>
<thead>
<tr>
<th>Data domain specific part</th>
<th>Document Number</th>
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</thead>
<tbody>
<tr>
<td>Product Management Data in an <strong>as designed view</strong></td>
<td>NAS / EN 9300-210</td>
</tr>
<tr>
<td>Product Management Data in an <strong>as planned view</strong></td>
<td>NAS / EN 9300-220</td>
</tr>
<tr>
<td>Product Management Data in an <strong>as delivered/maintained view</strong></td>
<td>NAS / EN 9300-230</td>
</tr>
<tr>
<td>Product Management Data <strong>In-development</strong> (including prelim design review, critical design review, FAI, etc.)</td>
<td>NAS / EN 9300-240</td>
</tr>
<tr>
<td><strong>Change documentation</strong></td>
<td>NAS / EN 9300-250</td>
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<tr>
<td>Chapter</td>
<td>Title</td>
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</tr>
<tr>
<td>1</td>
<td>Preface</td>
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<tr>
<td>2</td>
<td>Scope</td>
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<tr>
<td>3</td>
<td>Normative References</td>
</tr>
<tr>
<td>4</td>
<td>General Terms, Definitions and Abbreviations</td>
</tr>
<tr>
<td>5</td>
<td>Applicability</td>
</tr>
<tr>
<td>6</td>
<td>Fundamentals and concepts for LTA of PDM data</td>
</tr>
<tr>
<td>7</td>
<td>Requirements for customization of off-the-shelf PDM systems</td>
</tr>
<tr>
<td>8</td>
<td>Methods of implementation of the given requirements</td>
</tr>
<tr>
<td>9</td>
<td>Preservation Planning for archived PDM information</td>
</tr>
<tr>
<td>10</td>
<td>Auditing in the PDM environment (specific requirements, constraints, etc.)</td>
</tr>
<tr>
<td>11</td>
<td>Administration and monitoring</td>
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<tr>
<td>12</td>
<td>Definition of Archive Information Packages for PDM Data</td>
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<tr>
<td>13</td>
<td>Conformance Classes</td>
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<tr>
<td>14</td>
<td>Annex</td>
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</tbody>
</table>
1 Introduction
2 Normative References
3 Terms, definitions and abbreviations
4 Applicability
5 Business scenarios and use cases for LTA of as designed PDM data
6 Essential information for ‘as designed’ PDM data
   6.1 PLCS information subset in the scope of EN 9300-210
   6.2 Essential information common to all use cases
   6.3 Essential Information specific for each use case
7 Core Information Model for LTA of as designed PDM data
8 Qualification methods for LTA of as designed PDM data
   8.1 Verification rules
   8.2 Validation rules
9 Conformance requirements
   9.1 Conformance classes
      9.1.1 Passive data, viewing format only (CC1)
      9.1.2 Partly re-usable Data (CC2)
      9.1.3 Allowing full re-use of data (CC3)
Appendix A : Business scenarios
Overview of Airbus A350 “LTA3D” project

Goal of the project is to provide a 3D archiving solution for the Definition Dossier

**Scope & Key Objectives of the phase 1**
- CAD 3D LT archiving for A350 XWB 3D harness installation only
- The solution shall be EN9300 LOTAR compliant
- The solution shall be fully integrated into the existing release process, and LT archiving shall be done in the existing Airbus corporate archive
- ISO 10303 STEP format shall become the used neutral format for LT archiving of CAD 3D PMI and PDM
- An external audit shall be performed on the solution implementation
- The solution shall be deployed before A350XWB type certification

**Essential information to be archived**
- CAD Assembly structure,
- CAD 3D exact geometry,
- CAD 3D annotation,
- CAD 3D tessellated geometry

**EN9300 LOTAR standards applied**

**Basic parts:**
- EN9300 part 1, 2, 3, 4, 5, 7

**Process parts**
- EN9300 parts 10, 11, 12, 13, 14, 15

**CAD 3D geometry domain parts**
- EN9300 part 100, 110, 115, 120
Background & Process of the Airbus A350 “LTA3D” project

**Full 3D definition dossier**

- **Ingest**
  - Fully integrated in release process:
    - Conversion from native into to neutral format
    - Quality control of converted data using V&V
  - Transfer to archive

- **Archive**
  - Fully integrated in corporate LT archiving solution:
    - Archival checks
    - Archival storage

- **Retrieve**
  - Launched from corporate LT archiving solution:
    - Retrieval of neutral archived format
    - Retrieval into native CAD format
    - Viewing

Usage of the “Full 3D” approach requires an implementation of a CAD 3D LT archiving solution to stay compliant with Airworthiness regulation.

Agreement with EASA has been reached on this subject for the A350 3D electrical harness installation scope.
Rick ZURAY
LOTAR International co-chair
Technical Principal
Enterprise CAD/CAM Services
The Boeing Company
Office: (425) 717-2654
Mobile: (206) 778-6730
Mail to: richard.s.zuray@boeing.com

Jean-Yves DELAUNAY
LOTAR International co-chair
CAD-PDM Information Interoperability
EMSA – Process Architect
Airbus
Office: (33) (0) 5-61-18-31-31
Mobile: (33) (0) 6-76-36-50-59
Mail to: jean-yves.delaunay@airbus.com

Jeff HOLMLUND
LOTAR International Project Coordinator Americas
CAD/CAM Enterprise Operations & Support Lead
Lockheed Martin Aeronautics Company
Office: (817) 935-4457
Mail to: jeffrey.a.holmlund@lmco.com

Barry HESS
LOTAR International Project Coordinator Americas
Senior Manager, Science & Engineering Information Systems
Sandia National Laboratories
Office: (505) 284-6000
Mobile: (505) 504-1311
Mail to: hess@sandia.gov

Jochen BOY
LOTAR International
Project Coordinator Europe
PROSTEP AG
Office: +49 6151 9287-382
Mobile: +49 178 9509-369
Mail to: Jochen.Boy@PROSTEP.com