Agenda

- Project Overview
  - Goals, Motivation, Background
  - Organization, Members, Industry Use

- Workgroups
  - Domains and current Scope
  - Interaction with other Activities

- Outlook
Information Lifecycle Planning
Driving Questions

What data should we archive?

Why are we archiving the data?

What is the final format the data is to be archived in?

What is the retention period of the data?

What is the current data format?

How frequent do we access the data?
The project goal is to develop, publish and maintain standards designed to provide the capability to archive and retrieve digital product and technical information, including 3D CAD and PDM data, in a standard neutral form that can be read and reused throughout the product lifecycle, independent of changes in the IT application environment originally used for creation.

The standards are published as EN/NAS\(^*\) 9300 and cover both the information content and the processes required to ingest, store, administer, manage and access the information.

The LOTAR International Project is a working group supported by the AIA and PDES, Inc. in the US, and ASD-STAN and the ProSTEP iViP Association in Europe.

\(^*\): EN – European Standard (Norm); NAS – National Aerospace Standard
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 defense system (nuclear missile...)

The LOTAR project: Supporting the longevity of Aerospace & Defense 3D model based definitions

Preservation Planning

Ingest

Administration

Retrieval
Motivation for LOTAR

- Meeting the legal and business requirements of the aerospace and defense industry:

- EN/NAS 9300 considers requirements coming from:
  - Legal and certification rules
  - Regulations on long term archiving of technical documentation
  - Reuse
  - Support in operation

- In addition to legal demands, there are industry established standards, and company specific rules and recommendations.

- The standard defines architecture, processes and data formats to fulfill these requirements.
Objectives & Benefits of LOTAR

Objectives include:

- Developing a standard for the archiving and retrieval of product data
- Providing methods, process modules and data model(s), to enable long term archiving of CAD, PDM and additional technical data
- Developing recommendations for practical introduction of long term archiving of product data, such as 3D CAD and PDM data, in the industry

Benefits include:

- Process security achieved through implementation of archival systems compliant to international accepted standards
- Aerospace and Defense authorities accept workflow due to intense collaboration during standards creation
- Applicable archiving workflow supported by STEP interfaces & functionalities
- By solving the challenges of long term data retention issues of data exchange are addressed
LOTAR Member Companies 2015

Europe
- Airbus Commercial Aircraft
- Airbus Defence & Space
- Airbus Helicopter
- AFNeT
- IAI Israel Aerospace Industries
- SAFRAN

Americas
- BAE Systems
- Boeing
- Embraer
- GE
- Goodrich
- Gulfstream
- Honeywell
- Lockheed Martin
- Sandia National Labs
LOTAR Timeline

Late 1990s:

2000
- Start of the PDES, Inc. LTDR Project (US) coord w/AIA LTDR

2002
- Start of the ASD Stan – ProSTEP iViP LOTAR Project (Europe)
- IAQG* approved charter for AIA/ASD Stan Joint Project
- AIA LTDR Published ARP9034

2003
- First joint team meeting of the international AIA - ASD-Stan LOTAR effort under the mgt of the IAQG* (MoU: AIA/ASD-Stan)

2004
- Launch of the 3D CAD and PDM Workgroups

2005
- First Publication of LOTAR Basic Parts

2006
- First Publication of LOTAR Common Process Parts

2009
- Creation of the joint LOTAR International consortium (AIA / ASD-Stan / PDES, Inc. / ProSTEP iViP)
- Launch of the Composites WG

2012
- First Publication of LOTAR Domain Specific Parts (3D CAD)
- Launch of the Workgroups for Electric Harness, Meta Data for Archive Packages, and 3D Visualization

2014
- Launched LOTAR Eng Analysis & Simulation WG

* IAQG: International Aerospace Quality Group
### Status of use of NAS/EN 9300 by LOTAR members

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Airbus</td>
<td>A350 3D electrical harness installation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>AP 214 ed3 (*) + AP 242 ed1</td>
<td>PROD</td>
</tr>
<tr>
<td>EADS</td>
<td>&quot;Full 3D&quot; model based</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>AP 242 ed1</td>
<td>PROD</td>
</tr>
<tr>
<td>Dassault-Aviation</td>
<td>Falcon 7X complete definition of the aircraft (airframe, brackets, pipes, harness)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>AP 214 ed3 (*)</td>
<td>PROD</td>
</tr>
<tr>
<td>Sncema</td>
<td>New parts of engines 3D definition with PMI of new mechanical part</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>AP 214 ed3 (*)</td>
<td>PROD</td>
</tr>
<tr>
<td>Boeing</td>
<td>787 3D definition with PMI with assemblies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>AP 203 ed2 (*) + U3D PDF</td>
<td>DEV</td>
</tr>
<tr>
<td>Gulfstream</td>
<td>G650 3D mBD mechanical, electrical and composite</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
<td>AP 203 ed2 (*)</td>
<td>PROD</td>
</tr>
<tr>
<td>Lockheed-Martin</td>
<td>F35 3D mBD mechanical, electrical and composite</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>AP 203 ed2 + AP242 ed1</td>
<td>DEV</td>
</tr>
<tr>
<td>EMBRAER</td>
<td>Legacy 450 &amp; Legacy 500 complete definition of the aircraft</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>AP 242 ed1</td>
<td>PROD</td>
</tr>
</tbody>
</table>

- **PLANNED**: project planned
- **DEV**: project in development
- **PROD**: project on production

(*): Plan to migrate to STEP AP 242 ed1 when possible
- “Open Archive Information System“ (OAIS) Reference Model is basis for LOTAR processes
- Developed by Aerospace and Defense Industry
- Extended to meet the specific requirements of LOTAR

- As a neutral data format for the archives, ISO 10303 (STEP) has been chosen since it is the most advanced open format.
LOTAR Domains and related ISO Information Models

Processes & Use Cases

- 3D CAD Mechanical Geometry & Assembly incl. PMI
- Product Management Data & Conf. Product Structure
- Composite Design & Advanced Manufacturing
- Wiring Harness
- Systems Engineering (not started)
- Engineering Analysis and Simulation
- Electronics (not started)

Applicable Information Models (ISO 10303 STEP)

- AP203e2
- AP214e3
- AP242e1
- AP239
- AP203e2
- AP242e1
- AP242e2 (target)
- AP233 (target)
- AP209e2 (target)
- AP210e2 (target)
"V cycle" for development and validation of LOTAR standards

LOTAR Members → Business Needs / Use Cases → Operational Solutions for the Industry

ISO TC184 / SC4

LOTAR Standard
development

Proof of Concept

LOTAR
Standard
validation

Interoperability Testing

Recommended Practices Development

Operational Solutions for the Industry → Implementor Forums

ISO Information Model Selection

LOTAR Members

Recommended Practices Development

Implementor Forums

Proof of Concept

LOTAR Members

LOTAR Members

LOTAR Members

LOTAR Members

LOTAR Members

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LOTAR Members
LOTAR WG: 3D CAD with PMI (EN/NAS 9300-1xx)

- **Scope:**
  - Exchange and archiving of 3D Geometry via STEP
  - Provision of Validation Properties and User Defined Attributes
  - Transfer of PMI (Product & Manufacturing Information) as:
    - Representation (machine-readable, reusable)
    - Graphic Presentation (human-readable)

- **Deliverables (\(^*\)):**
  - **Parts:**
    - 100 (Common Concepts)
    - 110 (Explicit 3D Geometry),
    - 115 (CAD Assembly Structure),
    - 120 (PMI Graphic Presentation),
    - 121 (PMI Semantic Representation),
    - 122 (Machining Features),
    - 125 (Assembly PMI Graphic Pres.)
  - Comprehensive suite of test models
  - Numerous pilot projects in cooperation with the CAx-IF
  - Support of STEP AP242 development and associated Recommended Practices

\(^*\): Accomplished or in work; more planned
LOTAR WG: PDM (EN/NAS 9300-2xx)

- **Scope:**
  - Archive and retrieve Product Data Management information in a standard neutral form that can be read and reused throughout the product lifecycle.
  - Preservation of digital PDM information along the product lifecycle: in development, as designed, as planned, as delivered and as maintained.

- **Deliverables\(^{(*)}\):**
  - Part 200 fundamentals and concepts
  - Part 210 as designed (ed. 2 incl. effectivities)
  - Part 220 as planned (cancelled)
  - Part 230 as built (dependency on Part 210)
  - Part 240 Product Management Data In-development (including preliminary design review, critical design review, FAI, etc.),
  - Part 250 Change documentation

\(^{(*)}\): Accomplished or in work; more planned
Scope:

- Define processes, UCs and standard information model to manage meta-data for:
  - Submission Information Package
  - Archival Information Package
  - Dissemination Information Package
- Define processes, UCs and standard information model to manage meta-data for:
- Define the information model and the corresponding STEP AP 239 PLCS subset

Deliverables(*):

- Part 021 (Meta-data for Archiving),
- Processes, use cases and test cases
- STEP AP 239 information model subset
- STEP AP 239 LOTAR DEX / Rec. Practices for meta data for AP
- Test round reports and prototypes of PLM vendors

(*): Accomplished or in work; more planned
LOTAR WG: Advanced Manufacturing (EN/NAS 9300-3xx)

- **Scope:**
  - Preservation of New information required in STEP data model for Composite design and Additive manufacturing:
  - **Organic Shapes and Surface Models**
    - Design Tools –
    - Representation Formats
    - Preservation of CAD 3D tessellated solids
    - 3D composite structures information such as Sequences, Plies, Cores, Material properties, Rosette, Orientation…
    - Preservation of CAD 3D tessellated solids
  - **Deliverables(*):**
    - Part 300 (Common Concepts)
    - Part 310 Ed.1 (“exact implicit” – Ply Definition)
    - Part 310 Ed.2 (“approximate explicit” – 3D Tess. Solid)
    - Support of STEP AP242 Development and associated Recommended Practices
    - Prototype parts developed to support proof of concepts for future structures

(*) Accomplished or in work; more planned
LOTAR WG: Wiring Harness
(EN/NAS 9300-4xx)

Scope:
- Preservation of digital electrical harness models for
  - Design
  - Certification
  - Manufacturing
  - Support

Deliverables(*):
- Part 400 (Common Concepts),
- Part 410 (Physical harness definition for design & construction)
- Preparation of test cases for physical electrical harness definition
- Preparation of business requirements and use cases for extension of STEP AP 242 ED2 to include Electrical Harness Data
- Coordination with other standardization projects related to electrical harness (STEP AP 210, AP239, VDA VEC specification, ...)

(*) Accomplished or in work; more planned
Start of the LOTAR working group for “Engineering Analysis and Simulation” in 2014

- Scope: Preservation of Simulation and Analysis information
- Deliverables(*):
  - Part 600 (Fund. & Concepts),
  - Part 610 (Simulation Data Management)
  - Part 620 (Structural Analysis information)
- Coordination with other standardization projects related to S & A (ISO STEP AP209) → http://www.ap209.org/

Scope of ISO STEP AP 209e2 “Multi-Disciplinary Analysis and Design”

- Structural analysis
- Computational Fluid Dynamic

Preparation of the launch of a “CAE IF” as part of the CAx Implementer Forum

Regular coordination with NAFEMS (USA, Europe)

(*) Accomplished or in work; more planned
Scope:

- Define common recommendations for LT Archiving and Retrieval of 3D Visualization information being consistent with LT Archiving and Retrieval of information concerning CAD models and related information, throughout the full product life cycle.

Goals and Objectives:

- Define the characteristics of the Visualization information to be archived.
- Prepare recommended practices for implementing available 3D Visualization standards by the LOTAR community.
- Describe recommended processes to ensure the consistency between the archived CAD 3D (authoring) data and the archived 3D Visualization (derived) data.
The Aerospace & Defense industry is currently supporting a number of interoperability projects.

- LOTAR supports these activities in accordance with each workgroup’s scope and planning

Supported activities:

- **STEP AP242 2nd Edition**
  - Scope extension to support LOTAR of Electric Harness data
  - Extensions and enhancements of existing capabilities

- **STEP AP239 3rd Edition**
  - Enhancement of through-lifecycle support
  - Further harmonization with AP242 for PDM

- **CAx and PDM Implementor Forums**
  - Creation of PDM Recommended Practices for AP242 BO Model XML
  - Creation of CAx Recommended Practices for AP242 AIM Part21
  - CAx and PDM Interoperability Testing of LOTAR-specific capabilities
LOTAR Involvement in the development of ISO 10303-242

**PDM**
- Part Identification, Physical Part Characteristics, Document Management
- General management information
- Activity and work management
- Effectivity, Specification, Breakdown and Configuration

**AP242 Domain Support**

- Process Plans
- Requirements
- Design Rules

**Electrical Wire Harness**

**Presentation**

**3D Machining**
- Form Features

**3D PMI**
- (Product & Manufacturing Information)

**3D Assembly Constraints**

**3D Kinematics**

**3D Shape (Explicit and Parametric)**
- 3D Exact/Explicit Geometry
- 3D Tessellated Geometry
- 3D Parametric & contr. history

**3D Composite Design**
Basic and Common Process Parts

- Leverage work from related initiatives and adapt to LOTAR requirements to cover topics such as Functional Architecture (Part 006), Security (Part 008) or Audit (Part 009). For instance:
  - RASSC Project (Retention and Access Services in Supply Chains)
  - TSCP (Transglobal Secure Collaboration Program)
  - CCSDS (Consultative Committee for Space Data Systems)

Meta Data for Archiving (Part 021)

- Review list of metadata, cross-check with AP239 to ensure completeness

3D CAD with PMI WG (Parts 1xx)

- Complete first edition of Part 121 (Semantic PMI) and Part 125 (Assembly PMI Presentation)
- Support development of new capabilities in AP242 2nd Edition by conduction dedicated pilot projects

PDM WG (Parts 2xx)

- Publication of Part 200 (PDM Fundamentals & Concepts)
- Internal draft of Part 210 (“as designed”) product structures including configuration and variants
Composites and Advanced Manufacturing WG (Parts 3xx)
- Complete technical work on Part 300 (Composite Fundamentals & Concepts)
- Continue on Part 310 (CAD 3D Composite Design) with related pilots for different (implicit / explicit) design representations

Wiring Harness WG (Parts 4xx)
- Continue work on Part 400 (Electric Systems: Fundamentals & Concepts) and Part 410 (Physical Electrical Harness for Design and Construction)
- Support for development of related new AP242e2 capabilities, by mapping of essential information, preparation of test cases and support of dedicated pilot projects
- Definition of electrical harness validation properties

Engineering Analysis and Simulation WG (Parts 6xx)
- First draft of Part 600 (Engineering Analysis and Simulation Fundamentals and Concepts)
- Update Recommended Practices for STEP AP209e2 (Multi-Disciplinary Analysis & Design)
- Complete definition of LOTAR EAS test model
- Establish contact with CAE vendors for proof of concept testing, and to prepare extension of the Cax Implementor Forum into the EAS domain
LOTAR Homepage: www.lotar-international.org

Why LOTAR?
- Mission, Objectives & Scope
- Legal & Business Motivation
- Technical & IT Background
- Goals & Benefits

LOTAR Organization
- External View
- Internal View
- Working Together
- Fundamentals & Processes
- Member Companies

LOTAR Workgroups
- 3D CAD with PMI
- PDM
- Composites
- Electrical Harness
- 3D Visualization
- Meta Data for Archiving
- Engineering Analysis & Sim.

Communication & Dates
- Public Presentation
- Progress Reports

LOTAR Standard
- Overview on Parts
- Related Documents
- Industry Use
- Next Steps

News
Links
Contact

LOTAR International is a project being conducted by leading OEMs and suppliers in the aerospace and defense industry under the joint auspices of ASD-STAN, AIA, PDx Inc. and the ProSTEP IVIP Association.

Close cooperation with the PDx, Inc. / ProSTEP IVIP CAX Implementor Forum ensures implementation reliability.

The LOTAR project consortium consists of user companies from around the world. Member companies include Airbus, BAE Systems, Boeing, Dassault Aviation, EADS, Eurocopter, General Dynamics, Goodrich, IA, Lockheed Martin, SAFRAN, Sandia, and Spirit.

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