LOTAR International Project Status to the Sponsoring associations

3rd of December, 2019

Rick ZURAY – LOTAR International Co-chair: AIA, Americas
Jean-Yves DELAUNAY – LOTAR International Co-chair: ASD, Europe
We are looking for support of more A&D Manufacturers in LOTAR WGs
  - Importance of support of the AIA and ASD

FAA representatives may participate to the LOTAR offsites in USA in 2020
  - In 2020 the LOTAR leadership plans to invite EASA representatives to attend a LOTAR offsite.

Change in the scheduling of the quarterly LOTAR offsites in 2020, in order to strengthen the collaboration with the different Interoperability Forums

Plan to deliver new standards for ballots in 2020
  - Composite: Part 300, 320,
  - Structural Analysis: Parts 600, 620
LOTAR 5 years plan anticipates extensions to support LTA of the digital thread between MB Engineering & Advanced MB Manufacturing (Digital transformation).

The successful implementation of LOTAR by the US & EU A&D industries relies on the governance through the time of open international product data standards:

- ISO 10303: AP242 e2, AP243 MoSSEC, AP209 e2, AP239 e3 PLCS, AP238 e2, etc.,
- completed by other standards such as QIF, SysML, FMI, AADL, etc.

Need to prepare 5 years roadmap of these standards and the associated portfolio management.

Importance of the support of PDES, Inc., AFNeT and prostep ivip.
- Support of the Interoperability Forums: CAx IF, EWIS IF, CAE IF, PDM IF, etc.

Proposal to organize a yearly coordination confcal with the sponsoring associations
- Target date: end of Nov., beg. Of Dec. for 2020: ?
Agenda

- Overview LOTAR project (goals, members, WBS, )  
  5’

- List of NAS / EN 9300 LOTAR parts (released, ballot in 2020, 5 years planning)  
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- Summary of LOTAR 2019 activities and planned activities for 2020  
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- Overview of AIA and ASD SSG recommendations to use LOTAR standards  
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- Main interdependencies of LOTAR standards with “information model” standards  
  10’

- Contributions of LOTAR projects to Interoperability Forums  
  10’

- Summary – Questions & Answers  
  15’
LOTAR Project 4 Square

**Problem:** With the emergence of digital data based processes, including model based definition, requirements were identified which predicate the need for a long term data retention solution(s) to meet the regulatory and business requirements. Traditional legacy retention and retrieval methods do not support complex digital product definition data.

**Opportunity:** Develop, publish and maintain standards designed to provide the capability to archive and retrieve digital product and technical information in a standard neutral form that can be read and reused throughout the product lifecycle.

**Participation**

- **Leadership Team:** R. Zuray (Boeing), J. Holmlund (L-Martin), JY Delaunay (Airbus), S. Rulhoff (PROSTEP AG), M. Jahadi (L-Martin)
- **3D Mech/PMI WG:** Rick Zuray (Boeing), Pierre Duchier (Airbus)
- **PDM WG:** Jeff Klein (Boeing), Frederic Darre (Airbus)
- **Composite/Adv Mfg. WG:** Rick Zuray (Boeing), Pierre Duchier (Airbus)
- **Electrical WH WG:** Dan Ganser (Gulfstream), Sophie Herail (Airbus)
- **MBSE WG:** Mark Williams (Boeing), Adrian Murton (Airbus)
- **Eng. Analysis & Sim WG:** TBD, Albert Levy (obo Airbus)

**LOTAR Mission**

**Past**

- EN/NAS 9300-xxx LOTAR Stds

**Future**

- Code of Federal Regulations
- FAA Order 8000.79
- AC21-48

**Benefits**

- Support Increasing Product Complexity
- Built on open standards
- Preservation of Digital Design Intent for long term
- Provide data security
- Protect intellectual property
- Independent of process
- Independent of tools
- Independent of language
Highlights and Challenges
LOTAR Project - 2019

Highlights and Updates
• Mechanical /PMI WG started the development of P132 “Installation with Holes & Fasteners”
• Engineering Analysis and Simulation WG has a working relationship with NAFEMS consortium and signed a MOU with them.
• Q3 LOTAR Offsite was held the 9 - 13 September 2019
• Next LOTAR Offsite will be held the 9-13 December 2019

Key Project Milestones for 2020
• Standing up test case models repository for Domain specific test cases, including the Boeing Stratoliner models.
• Implementing a new set of Interoperability Forums and associated User Groups to support various product domains: MBx-IF, PDM-IF, CAx-IF, EWIS-IF, CAE-IF, MBSE-IF, etc.
• Working closely with AIA and ASD Stan to ballot and review NAS / EN 9300-xxx series standards more efficiently.
• Training and Mentoring new talent to continue this work.

Status
• Supporting STEP AP209, AP238, AP239, AP242, AP243 MoSSEC projects.
• LOTAR MBSE is working on developing NAS/EN9300-5XX series of standards, working with MoSSEC, Incose, OMG.
• The EAS WG has drafted Parts 600 & 620 “Struct. Analysis” : ready for internal ballot,
• The Basic & Common Parts WG is reviewing parts 001-021 for content and updates in 2019 and 2020.

Challenges/Help Needed
• Need additional company resources to support the WG activities.
• All WGs need active support.
• Need Subject Matter Experts (SME) in the area of Composites/Adv Mfg., MBSE, PDM/PLCS, and Engineering Analysis and Simulation.
• Need to find leaders / co-leaders for Composite, Basic & Common Parts and EAS WGs
• Need to recruit more resources from Sponsoring Orgs.
LOTAR Organization: External view

**Americas Sector Chair**
- **Boeing**: Rick Zuray
- Hosting organization: PDES, Inc.
- TAC: Technical Advisory Committee

**European Sector Chair**
- **Airbus**: Jean-Yves Delaunay
- Hosting organization: prostep ivip
- AFNet: Technical Steering Committee

**LOTAR International Project Group**
- Voting Members
- Associated Members
- Contributing Members

**Certification Authority**
- FAA

**Regulatory Authority**
- DoD

**Users & Implementers**
- CAx-IF
- CAE-IF
- EWIS-IF
- PDM-IF
- MBSE-IF (In preparation)

**Standardization**
- ISO, OASIS
- EN, NAS

**Hosting Organizations**
- AIA
- AIA-EMC
- ASD-STAN
- ASD-SSG
- prostep ivip
- AFNet

**Technical Steering Committee**
- TSC
LOTAR Member Companies 2019

- Europe
  - AFNeT
  - Airbus
  - Airbus Helicopter
  - Airbus Defense & Space
  - SAFRAN Engine

- Americas
  - BAE Systems
  - Boeing
  - Embraer
  - General Electric
  - Gulfstream
  - Lockheed Martin
  - Sandia National Labs
  - UTC: in progress (Pratt Whitney, Collins Aerospace, Goodrich, Raytheon)
## LOTAR project management team

<table>
<thead>
<tr>
<th></th>
<th>AIA (America)</th>
<th>ASD (Europe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTAR project leader</td>
<td>R. ZURAY</td>
<td>JY DELAUNAY</td>
</tr>
<tr>
<td>Basic Parts coordination</td>
<td>R. ZURAY</td>
<td>T. MUELLER</td>
</tr>
<tr>
<td>P1XX Mechanical and PMI WG</td>
<td>R. ZURAY</td>
<td>P. DUCHIER</td>
</tr>
<tr>
<td>P2XX Product Data Management WG</td>
<td>J. KLEIN</td>
<td>F. DARRE</td>
</tr>
<tr>
<td>P3XX “Advanced Manufacturing” WG</td>
<td>R. ZURAY</td>
<td>P. DUCHIER</td>
</tr>
<tr>
<td>P4XX “Electrical Wiring Harness” WG</td>
<td>D. GANSER</td>
<td>S. HERAIL</td>
</tr>
<tr>
<td>P5XX “Model Based Systems Engineering” WG</td>
<td>M. WILLIAMS</td>
<td>A. MURTON</td>
</tr>
<tr>
<td>P6XX “Engineering Analysis &amp; Simulation” WG</td>
<td>X</td>
<td>A. LEVY</td>
</tr>
</tbody>
</table>

Persons of the standardization associations supporting the LOTAR project

AFNet: JM Crepel
PDES Inc: P. Rosche
prostep ivip: S. Rulhoff & J. Boy
LOTAR International Quarterly Offsites in 2019

- 1st meeting: (10) 11th – 14th of March, Asheville – NC, USA: done
- 2nd meeting: (20) 21st – 23rd of May, Toulouse, France: done
- 3rd meeting: (8) 9th – 12th of September, Atlanta, USA: done
- 4th meeting: (9) 10th – 12th of December, Darmstadt, Germany

Access to LOTAR meeting summary on LOTAR public web site
http://www.lotar-international.org/communication/progress-reports.html
LOTAR Technical Working Groups

**Mechanical 3D CAD with Product and Manufacturing Information (PMI)**
EN/NAS 9300-1xx series
STEP AP203 ed2
STEP AP234 ed3
STEP AP242 ed1 & ed2
2004 launch

**Wiring Harness**
EN/NAS 9300-4xx series
STEP AP242 ed2
2012 launch

**Product Data Management (PDM)**
EN/NAS 9300-2xx series
STEP AP239
STEP AP242 ed1 & ed2
2004 launch

**Meta Data for Archive Packages**
EN/NAS 9300-21
STEP AP239 ed3
STEP AP 242 ed2
2012 launch

**Composites and Advanced Manufacturing**
EN/NAS 9300-3xx series
STEP AP203 ed2
STEP AP242 ed1 & ed2
2009 launch

**Engineering Analysis and Simulation**
EN/NAS 9300-6xx series
ISO STEP AP209 ed2
2014 launch

**Model-Based System Engineering**
EN/NAS 9300-5xx series
STEP AP233 ed2
STEP AP239 ed3
STEP AP243 ed1, FMI, SysML, etc.
2018 launch

**Basic & Common Parts**
EN/NAS 9300-001-099 series
2004 launch

**Electronics (PCB, etc.)**
EN/NAS 9300-700 series
Launch TBD

**Mechanical Transport Elements**
(Tubing, Mech/Hyd., HVAC, etc.)
EN/NAS 9300-800 series
Launch TBD

**3D Visualization**
Requirements and Compliance Documents
2012 launch
2017 Complete

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LOTAR Technical Working Groups

- 3D Mechanical / PMI WG
- PDM – Conf. Management data WG
- Advanced Mfg. - Composite WG
- Electrical Wiring Systems WG
- 3D Visualization WG
- Meta data for archive packages
- Model Based System Engineering WG
- Engineering Analysis & Simulation WG

Description of a LOTAR WG web page

- Goals and Objectives
- Associated LOTAR use cases
- LOTAR Family of Standards
- Associated ISO 10303 Information Models
- Meetings & teleconferences
- Accomplishments
- Related standardization projects

http://www.lotar-international.org/lotar-workgroups.htm
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3 parts send for publication to ASD Stan and AIA: P120 ed2, part 121, part 125.
## LOTAR Tier 0 Five Year Roadmap

### 2019
- Review and Update Basic Parts (001-009)
- Review and Update Common Parts (010-099)
- Dev and Update Mech/PMI Parts (115e2, 126e1 Assembly PMI)
- Dev and Update Mech/Mfg. Parts (130-132 - Mach Features, Holes/Fasteners)
- Dev and Update Mech/QIF Parts (140-145 Quality V&V, Measurement)
- Dev and Update PDM/PLM Parts (200e2, 210e1. 220e1 As-Designed, As-Built)
- Dev and Update Composite Parts (300e1, 310e1 – Supporting AP209e2, AP242e2/e3)
- Dev and Update Advanced Mfg. Parts (350e1, 360e1 – Supporting AP242e2/e3)
- Dev and Update Electrical WH Parts (400e1, 410e1, 420e1 – Supporting AP242e2/e3)
- Dev and Update MBSE Parts (500e1, 510e1, 520e1 – Supporting AP233e2/AP243e1)
- Dev and Update Eng. Sim & Analysis Parts (600e1, 610e1, 620e1 – Supporting AP209e2, AP209e3/e4 dev.)

### 2020

### 2021

### 2022

### 2023

- Supporting AP242e2 and e3
- Supporting AP239e3 and AP242 ed2

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LOTAR International Planned Member Companies for 2020

EUROPE:
- AFNeT
- Airbus
- Airbus Helicopter
- Airbus Defense & Space
- SAFRAN Engine

AMERICAS:
- BAE Systems
- Boeing
- Embraer
- General Electric
- Gulfstream
- Lockheed Martin
- Sandia National Labs
- UTC: in progress (Pratt Whitney, Collins Aerospace, Goodrich, Raytheon)
LOTAR International Quarterly Offsites for 2020

- 1\textsuperscript{st} meeting: (16) 17 - 19 March, Toulouse, France, hosted by AFNeT
- 2\textsuperscript{nd} meeting: (14) 15 - 17 June, USA, hosted by PDES Inc
- 3\textsuperscript{rd} meeting: (7) 8 -11 Sept., Darmstadt hosted by prostep ivip
  - GPDIS 2020: 14\textsuperscript{th} – 18\textsuperscript{th} of September, USA
- 4\textsuperscript{th} meeting: (6) 7 - 9 Dec., USA, hosted by PDES Inc

The Leadership Team in conjunction with AFNet, PDES, Inc. and prostep ivip, decided to alternate meeting locations bi-yearly in order to strengthen the collaboration between Interoperability Forums and associated User Groups.
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Overview of AIA and ASD SSG recommendations to use LOTAR standards: ASD SSG recommendations

http://www.asd-ssg.org/web/asd-ssg/radar-chart

Standards component summary for
- EN9300 1XX
- EN9300 2XX
- EN9300 3XX
- EN9300 4XX
- EN9300 5XX
- EN9300 6XX
and related ASD recommendations
### Overview of AIA and ASD SSG recommendations to use LOTAR standards: ASD SSG recommendations

<table>
<thead>
<tr>
<th>EN9300_1xx (Long-Term Archiving and Retrieval of 3D Geometry, CAD structure and Product Manufacturing Information)</th>
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<th>ASD development</th>
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<tr>
<td>EN9300_2xx (Long-Term Archiving and Retrieval of Product Management Data &amp; Configured Mechanical Product Structure)</td>
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<td>Track</td>
<td>ASD development</td>
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<tr>
<td>EN9300_6xx (Long-Term Archiving and Retrieval of Engineering Analysis and Simulation information)</td>
<td>OK</td>
<td>Track</td>
<td>ASD development</td>
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</table>

#### EN9300 LOTAR 1xx

ASD recommends the use of EN9300 LOTAR standards parts 100, 110, 115 and 120 by the European aerospace and defense industries for long-term archiving and retrieval of CAD 3D explicit geometry, 3D Product Manufacturing Information and CAD assembly structure, with effect from July 2012.

The SSG recommends European aerospace and defence OEM to participate in the LOTAR PDM working group in order to speed up the development of the different parts according to their business priorities.

Recommendation formally agreed by ASD SSG on 5th of October 2012.

Related topic: EN9300 LOTAR 3D-FMI


[http://www.asd-ssg.org/recommendations](http://www.asd-ssg.org/recommendations)
Regulatory requirements for LOTAR aircraft certification and safety

Document & Data Archiving is a legal obligation defined by external requirements and by internal company policies.

EU (EASA) Regulation Requirements
- EC No 748/2012 Part 21A.55: Record keeping for Type Certification
- EC No 748/2012 Part 21A.105: Record keeping for Modification

US (FAA) Regulation Requirements
- 14 CFR Part 21.31: Requirements for Type Design
- 14 CFR Part 21.41: Type Certificate (Type Design + Records of Compliance/Limitations)
- 14 CFR Part 21.49: Availability of Type Certificate to FAA or NTSB
- 14 CFR Part 21.50: Continued Airworthiness

EN9100 §4.2.4 Control of Records

The FAA and EASA have promoted efforts to harmonize the regulations, so there are many similarities between them. This may have to be updated to support digital processes and definitions.
Opportunities for Involvement of FAA and EASA representatives in the 2020

- Summary of AIA BTIC meeting on the 6th of Nov. with FAA
  - Interest raised by the FAA to participate in LOTAR meetings organized in USA in 2020

- Preparation of ASD Stan LOTAR meeting with EASA for the status of NAS / EN 9300 LOTAR standards in 2020
  - Potential participation of EASA to LOTAR meetings in Europe
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Need to ensure
• the longevity / enhancement of the international product information standards (ISO 10303 STEP and other standards such as FMI, SysML, etc), including their development infrastructure as part of the preservation plan,
• the consistency between standards.
Close dependency of LOTAR standards with product information standards and Interoperability

- Main interdependencies with technical information standards
  - ISO 10303 STEP:
    - AP242 ed1 / ed2
    - AP209 ed2,
    - AP243 MoSSEC,
    - AP239 ed3 PLCS,
    - (AP238 ed2 - future)
    - AP233 ed2, etc
  - ISO 23952 QIF (DIS adoption in progress)
  - Non ISO standards Modelica FMI, OMG SysML, etc

To be published as International Standard by ISO in Q1 2020
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Interdependancies between Business requirements, LOTAR, STEP standards and associated Implementer Forums

Industry gaps analysis & business requirements

Sub processes & use cases

- Mechanical
- Electrical
- Electrical
- Structure/Elk
- Electronic
- LOTAR

- PLM exchange (…)
- PLM linked data (…)

Operationnal solutions for the industry

Answers

Based on

STEP AP2XX Benchmark Interoperability Test Rounds (led by Manufacturers)

STEP AP2XX standard

Tutorials

Pilots

Interoperability Forums

User Group

Implementer Group

LOTAR

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- Increasing need to speed up the deployment of PLM interoperability and LT Archiving solutions based on test rounds with PLM editors and integrators

- Participations of LOTAR WGs to the User Groups of Interoperability Forums:
  - **CAx IF**: for mechanical interoperability, based on AP242
  - **EWIS IF**: for Elec. Wiring Harness interoperability, based on AP242 ed2
  - **CAE IF**: for Structural Analysis interoperability, based on AP209 ed2,
  - **PDM IF**: for PDM – CM interoperability, based on AP242
  - **Future MBSE IF (in preparation)**

- Tri lateral MoU in progress between PDES Inc, prostep ivip and Afnet for a common template of Interoperability Forum
MBx-IF Project Framework

CAx Interoperability Forum (CAx-IF)
- User Group
- Impl. Group

CAE Interoperability Forum (CAE-IF)
- User Group
- Impl. Group

EWIS* Interoperability Forum (EWIS-IF)
- User Group
- Impl. Group

Original CAx-IF scope since 1999

AP242

Extension in 2016

AP209 Ed. 2

Extension in 2019

AP242 Ed. 2

* Electrical Wiring Interconnection Systems
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Contact Information

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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 Mech/PMI 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
• Launch of the Engineering Analysis & Simulation Workgroup (EAS WG)

2015
• Launch of the Additive Mfg (AM WG)

2018
• Evaluation of Model Based System Engineering Requirements
• Kicked off MBSE WG

2019
• Re-established LOTAR Basic & Common Parts WG

* IAQG: International Aerospace Quality Group

LOTAR Project Overview