

# Agenda



# LOTAR

LONG TERM ARCHIVING AND RETRIEVAL

- 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  
current data  
format?

How frequent  
do we access  
the data?

What is the  
retention period  
of the data?

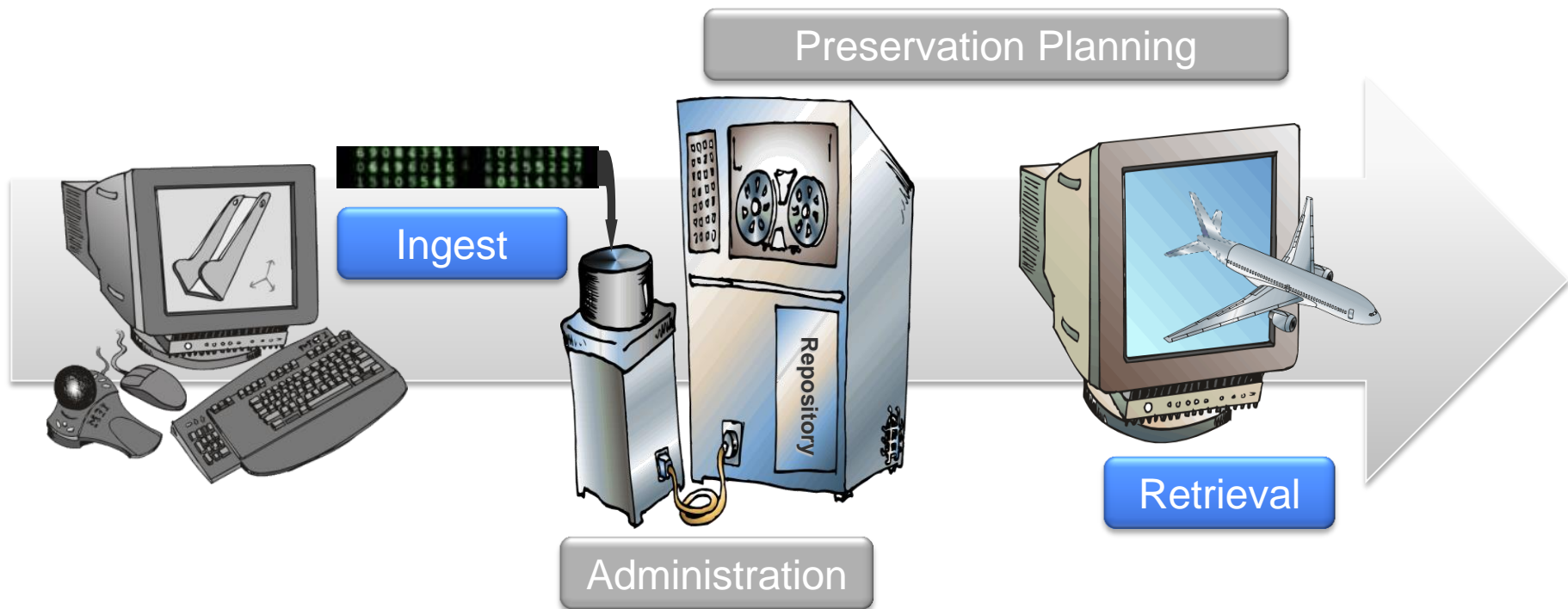
What is the final  
format the data is  
to be archived in?

- 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<sup>(\*)</sup> 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*

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

- 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...)



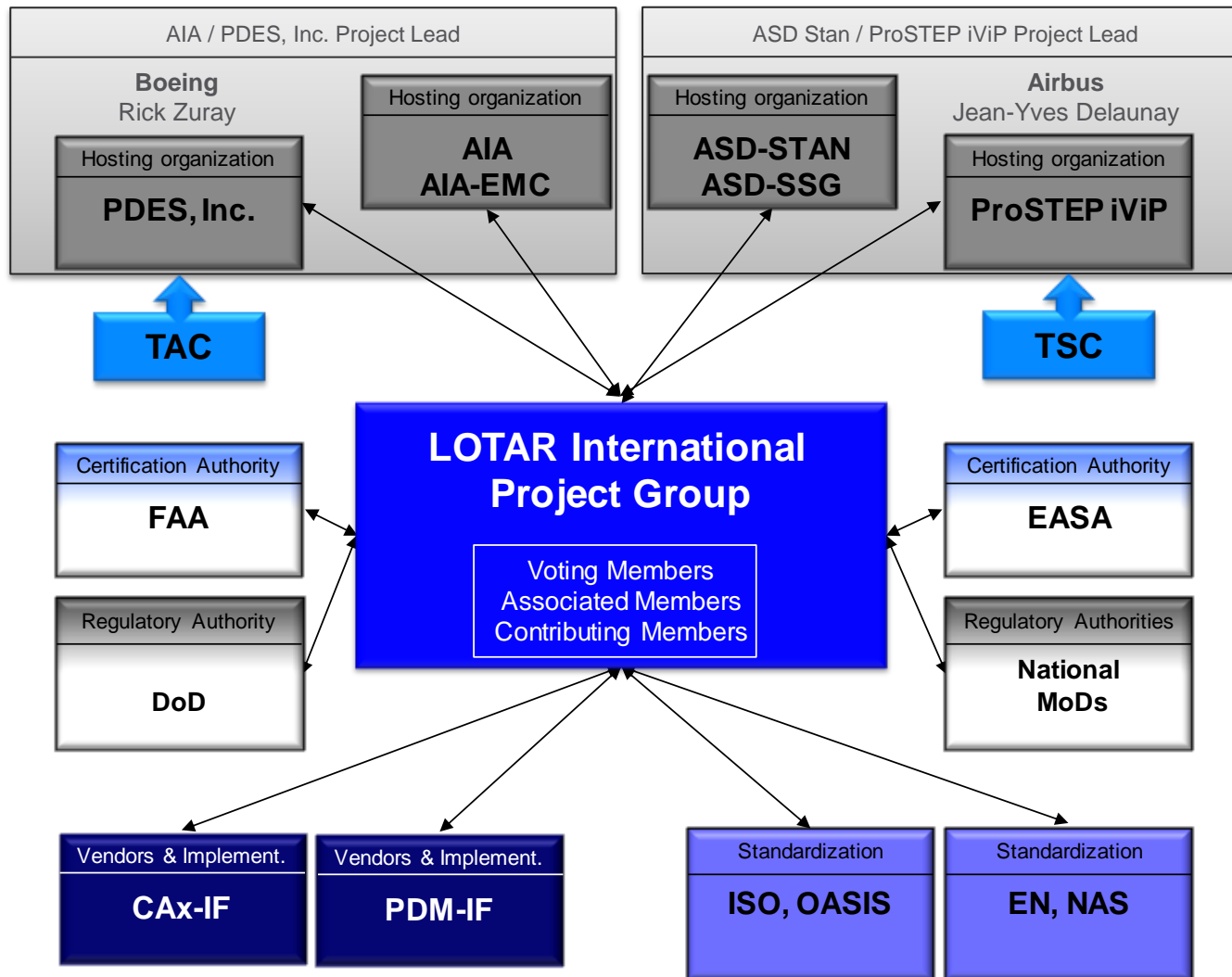
- Meeting the legal and business requirements of the aerospace and defense industry:



- 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 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 Organization – External View



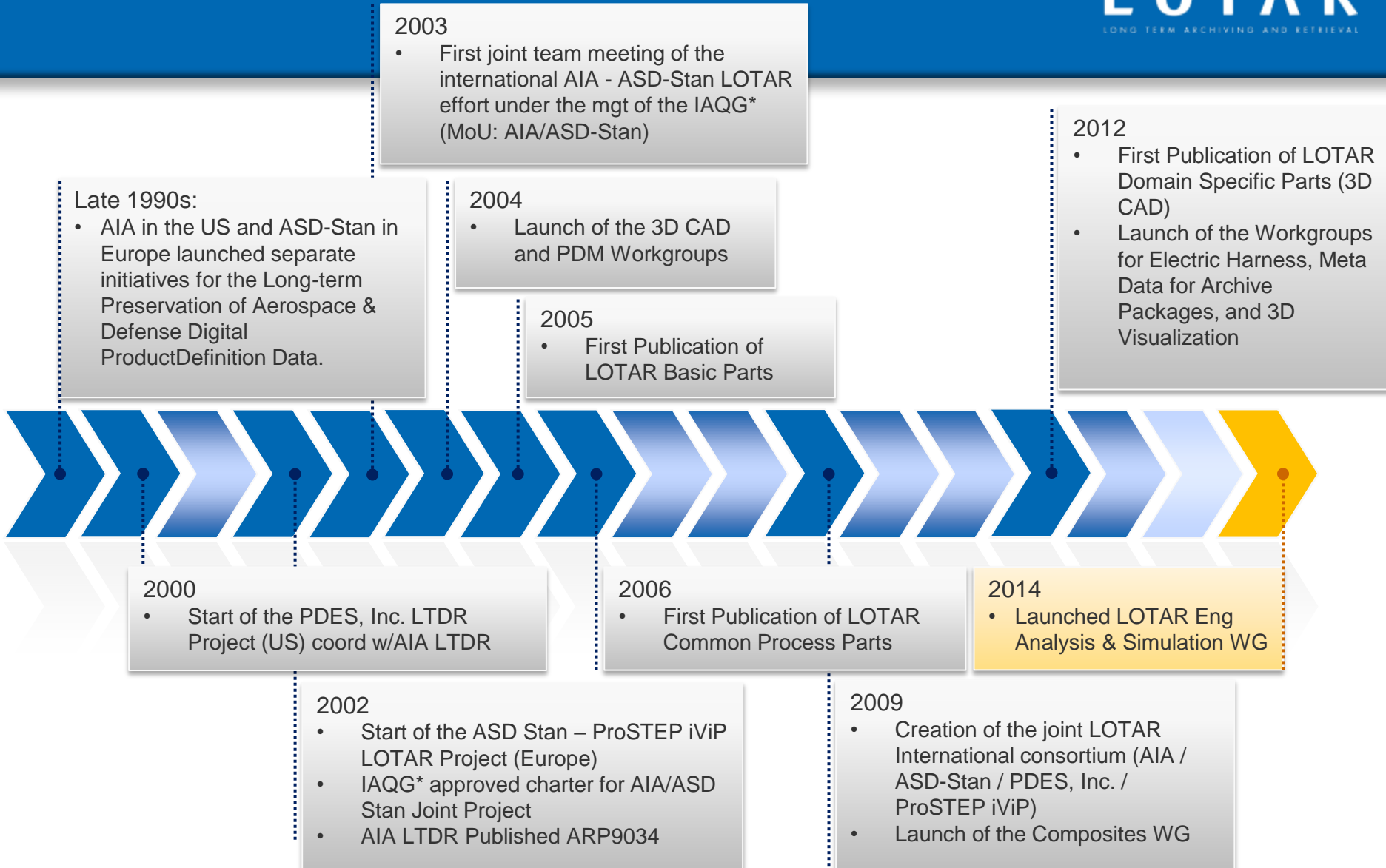
## Europe

- 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



\* IAQG: International Aerospace Quality Group

# Status of use of NAS/EN 9300 by LOTAR members

A&D company	Area of application	Scope	NAS / EN 9300 LOTAR parts (CAD)				ISO formats	Project status
			CAD 3D exact geometry	CAD 3D tessellated geometry	CAD 3D PMI	CAD Assembly structure		
			Part 110	Part 100	Part 120	Part P115	ISO 10303 "STEP"	
Airbus	A350	3D electrical harness installation	Yes	Yes	Yes	Yes	AP 214 ed3 (*) + AP 242 ed1	PROD
EADS		"Full 3D" model based	Yes	Yes	Yes	Yes	AP 242 ed1	PROD
Dassault-Aviation	Falcon 7X	complete definition of the aircraft (airframe, brackets, pipes, harness)	Yes	No	Yes	Yes	AP 214 ed3 (*)	PROD
Snecma	New parts of engines	3D definition with PMI of new mechanical part	Yes	No	Yes	No	AP 214 ed3 (*)	PROD
Boeing	787	3D definition with PMI with assemblies	Yes	Yes	Yes	Yes	AP 203 ed2 (*) + U3D PDF	DEV
Gulfstream	G650	3D mBD mechanical, electrical and composite	Yes	No	Yes		AP 203 ed2 (*)	PROD
Lockheed-Martin	F35	3D mBD mechanical, electrical and composite	Yes	No	Yes	Yes	AP 203 ed2 + AP242 ed1	DEV
EMBRAER	Legacy 450 & Legacy 500	complete definition of the aircraft	Yes	No	Yes	Yes	AP 242 ed1	PROD

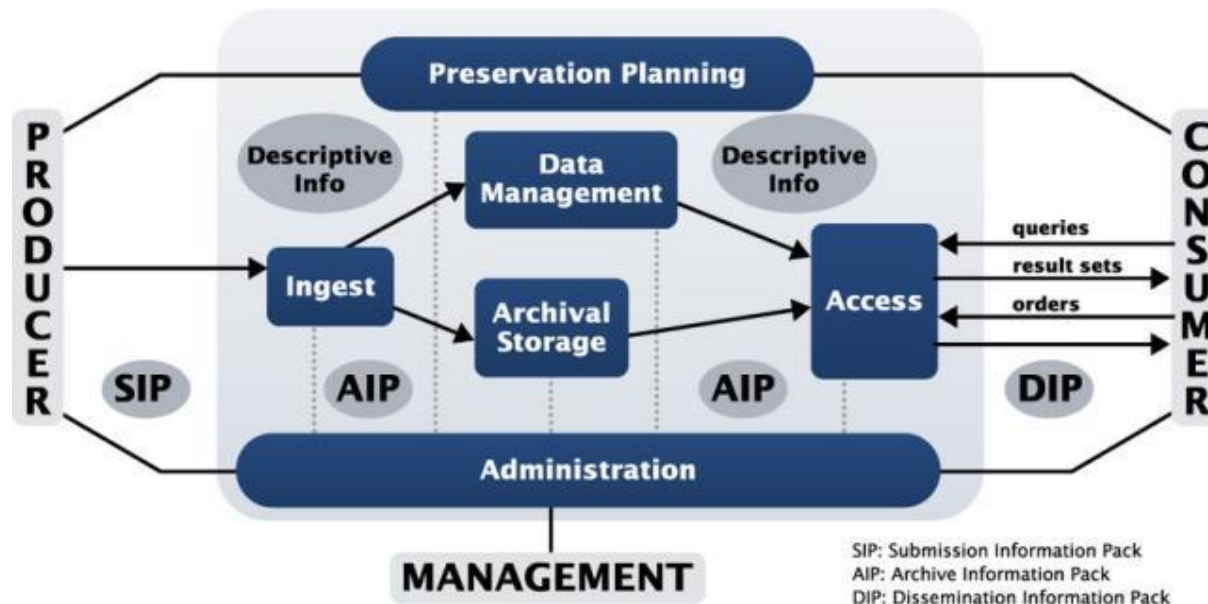
PLANNED : project planned

DEV : project in development

PROD : project on production

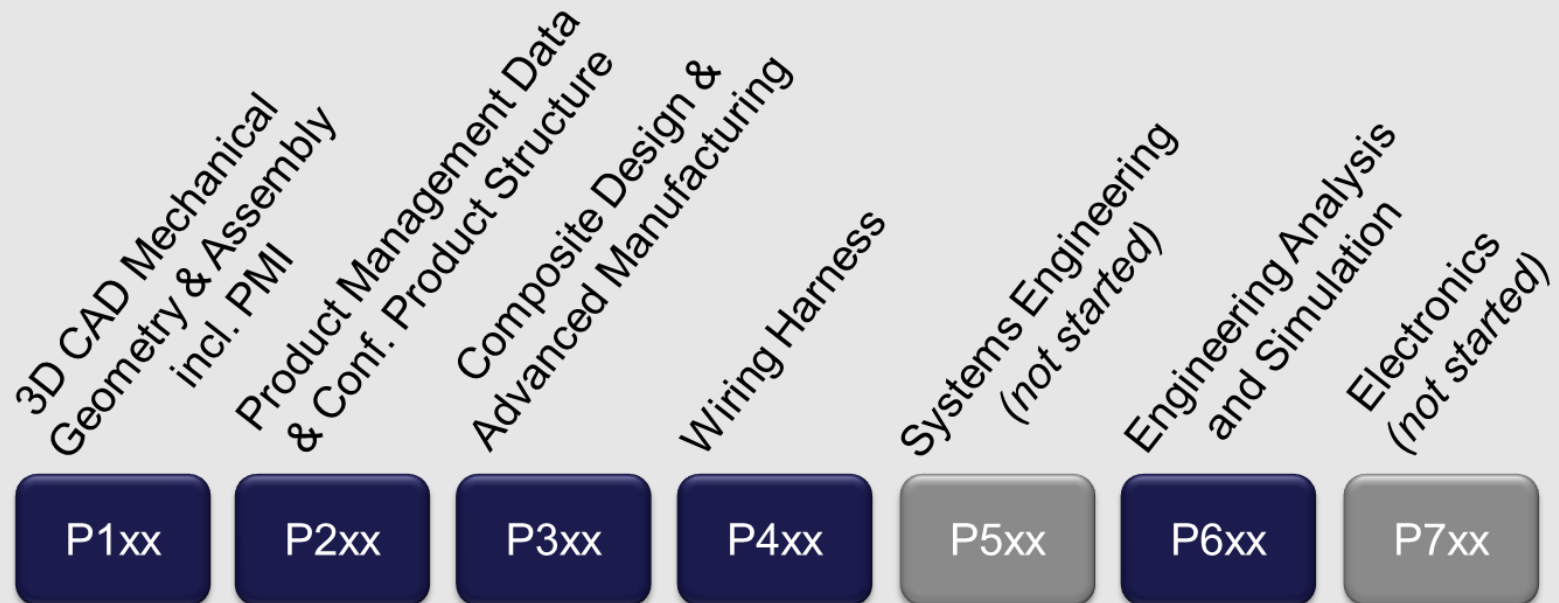
(\*): Plan to migrate to STEP AP 242 ed1 when possible

- „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.

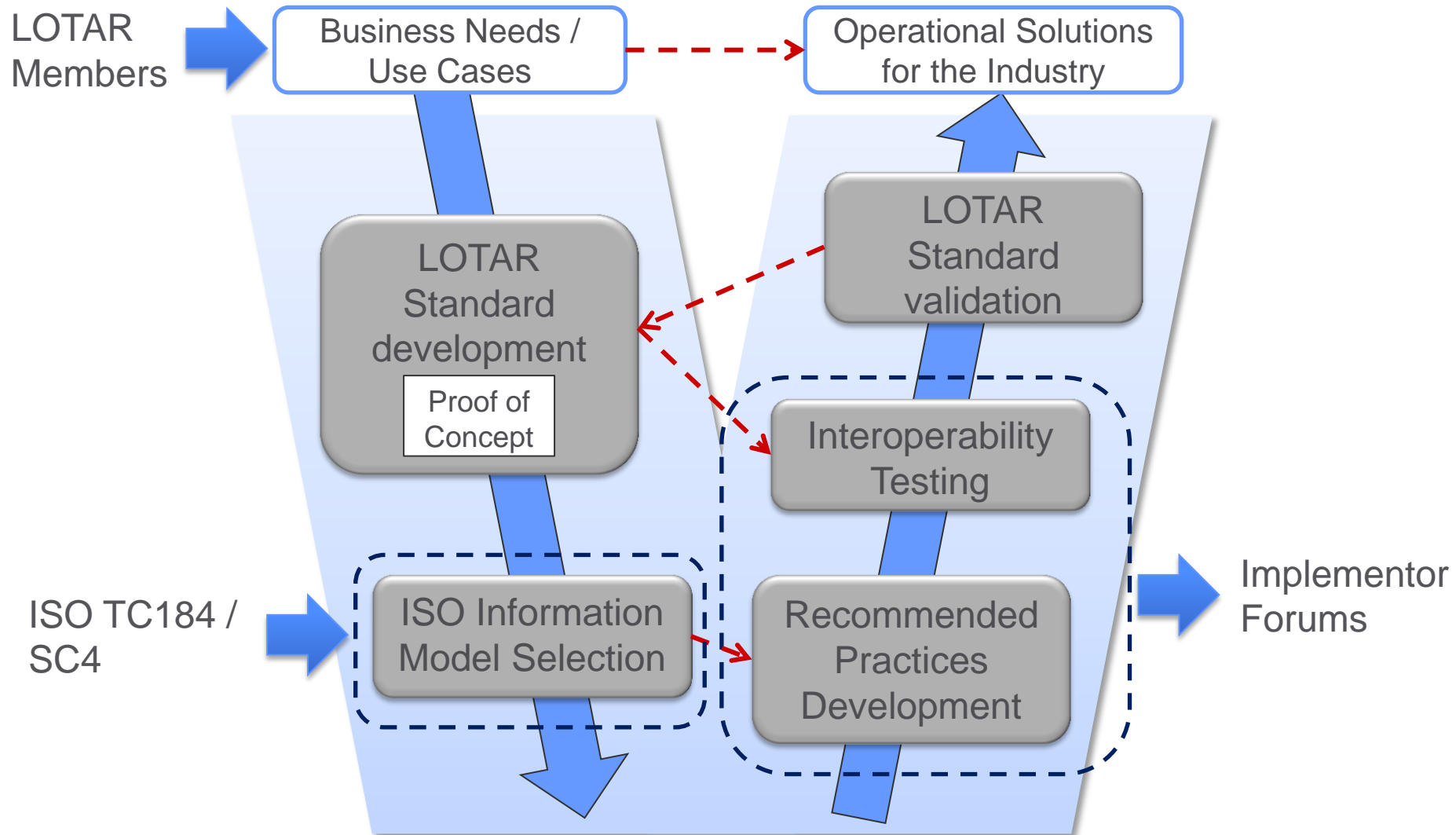
## Processes & Use Cases



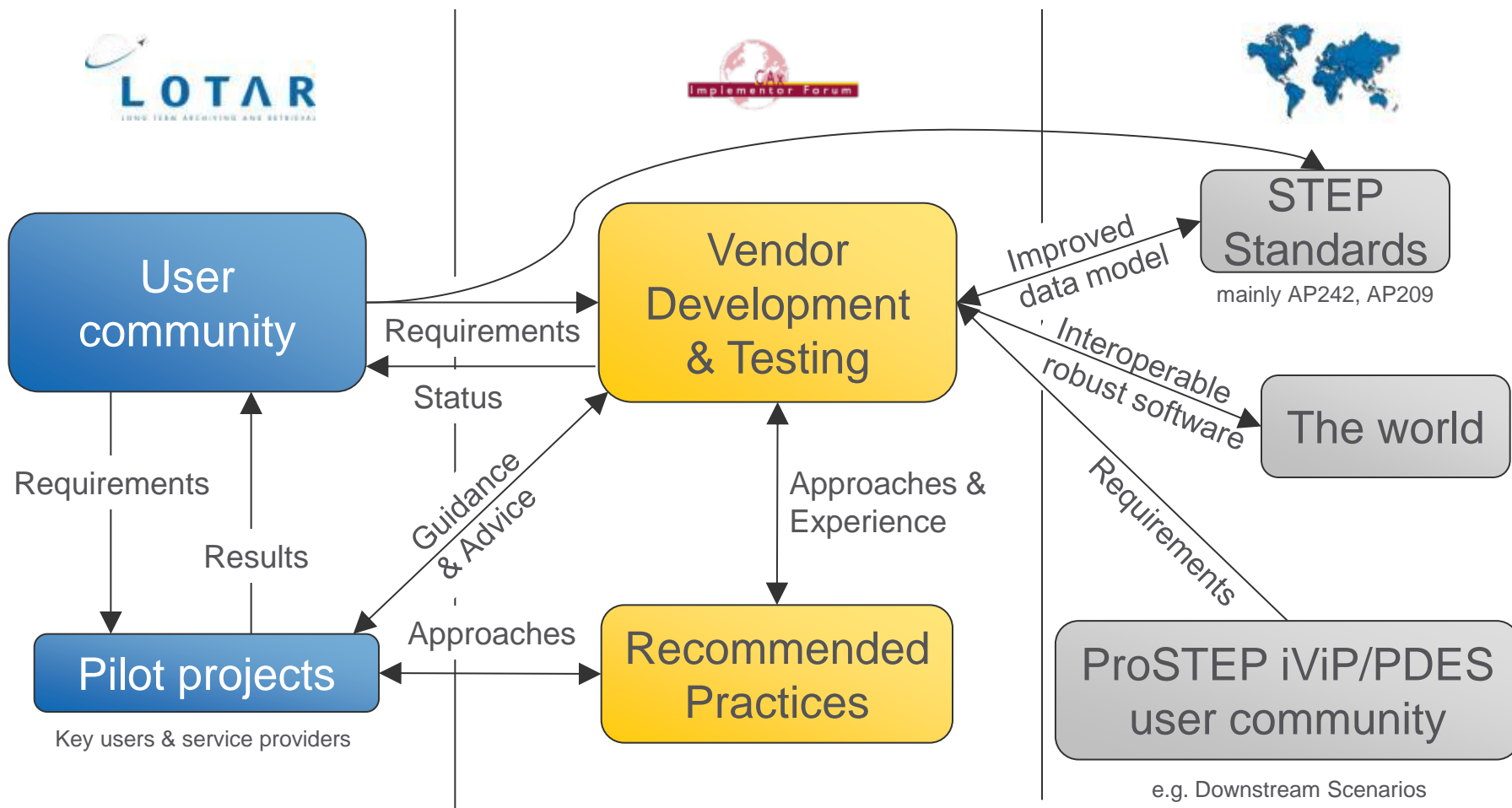
## Applicable Information Models (ISO 10303 STEP)

AP203e2 AP214e3 AP242e1	AP239 AP242e1	AP203e2 AP242e1	AP242e2 (target)	AP233 (target)	AP209e2 (target)	AP210e2 (target)
-------------------------------	------------------	--------------------	---------------------	-------------------	---------------------	---------------------

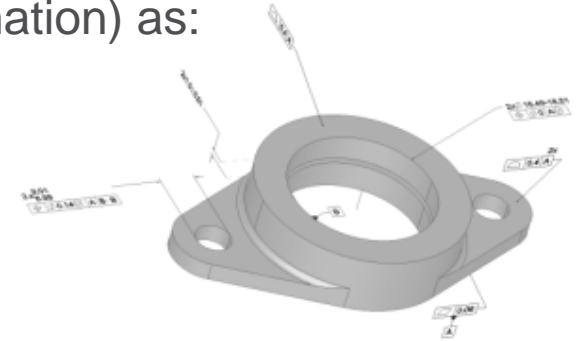
# „V cycle“ for development and validation of LOTAR standards



# LOTAR / CAx Implementor Forum Coordination



- 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<sup>(\*)</sup>:
- 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

## ■ 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<sup>(\*)</sup>:

- 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

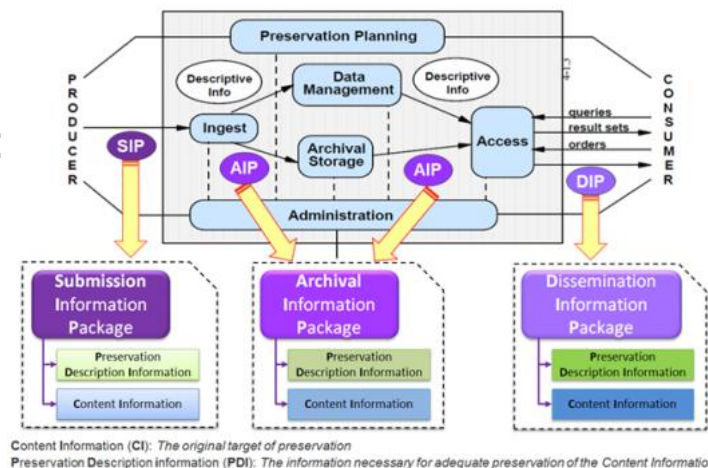


*(\*): Accomplished or in work; more planned*

# LOTAR WG: Meta-Data for Archiving (Technical Specification/Rec Practice)

## ■ 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<sup>(\*)</sup>:

- 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

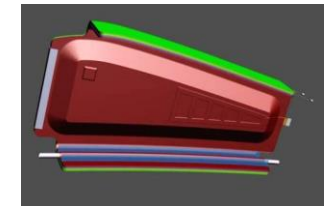
## ■ Scope:

- 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 → Cost independent from shape
- 3D composite structures information such as Sequences, Plies, Cores, Material properties, Rosette, Orientation...
- Preservation of CAD 3D tessellated solids

Full shape freedom



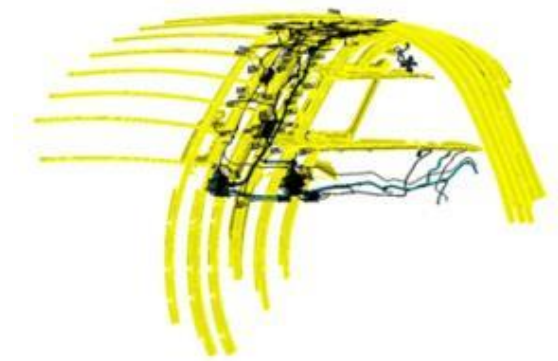
## ■ Deliverables(\*):

- 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

## ■ Scope:

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



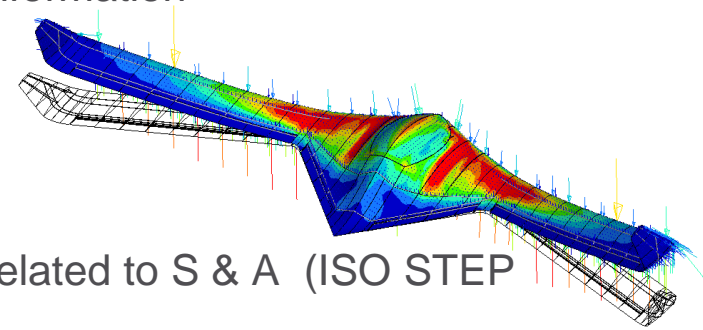
## ■ Deliverables<sup>(\*)</sup>:

- 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*

# LOTAR WG “Engineering Analysis & Simulation” (EN/NAS 9300-6xx)

- 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

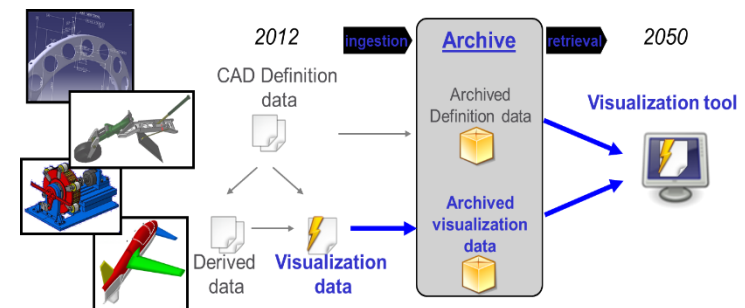
# LOTAR WG: 3D Visualization (Technical Specification/Rec Practice)

## ■ 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



# LOTAR Support of Interoperability Projects relevant to the A&D Industry



- 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 2<sup>nd</sup> Edition
    - Scope extension to support LOTAR of Electric Harness data
    - Extensions and enhancements of existing capabilities
  - STEP AP239 3<sup>rd</sup> 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

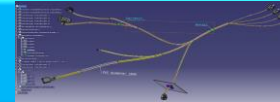
Part Identification, Physical Part Characteristics, Document Management  
General management information  
Activity and work management  
Effectivity, Specification, Breakdown and Configuration

Process Plans

Requirements

Design Rules

Electrical Wire Harness



AP242 Domain Support

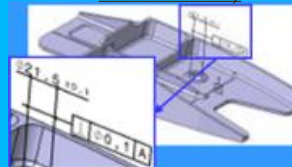
Presentation

3D Machining Form Features



3D PMI

(Product & Manufacturing Information)

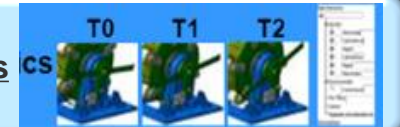


3D Assembly Constraints

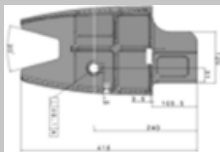


3D Shape Data Quality

3D Kinematics

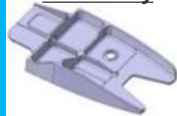


2D Draughting

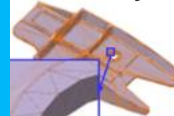


3D Shape (Explicit and Parametric)

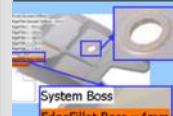
3D Exact/Explicit Geometry



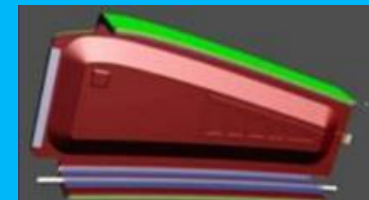
3D Tessellated Geometry



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 2<sup>nd</sup> 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 Implentor 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



# Any questions?

***Rick ZURAY***

LOTAR International co-chair  
Technical Principal  
Enterprise CAD/CAM Services  
The Boeing Company  
Office: +1 (425) 717-2654  
Mobile: +1 (206) 778-6730  
Mail to: [richard.s.zuray@boeing.com](mailto:richard.s.zuray@boeing.com)



***Jean-Yves DELAUNAY***

LOTAR International co-chair  
Product & Process Information Interoperability  
EZMI  
Airbus  
Office: +33 (0)5-61-18-31-31  
Mobile: +33 (0)6-76-36-50-59  
Mail to: [jean-yves.delaunay@airbus.com](mailto:jean-yves.delaunay@airbus.com)

***Jeff HOLMLUND***

LOTAR International Project Coordinator Americas  
CAD/CAM Enterprise Operations & Support Lead  
Lockheed Martin Aeronautics Company  
Office: +1 (817) 935-4457  
Mail to: [jeffrey.a.holmlund@lmco.com](mailto:jeffrey.a.holmlund@lmco.com)

***Jochen BOY***

LOTAR International  
Project Coordinator Europe  
PROSTEP AG  
Office: +49 (0)6151 9287-382  
Mobile: +49 (0)178 9509-369  
Mail to: [Jochen.Boy@prostep.com](mailto:Jochen.Boy@prostep.com)