LOTAR

LONG TERM ARCHIVING AND RETRIEVAL

prostep ivip Web Seminar "LOTAR"

29 January 2021

AIA AEROSPACE INDUSTRIES ASSOCIATION

ASD-STAN Standardization

AFNeT

PDES, Inc.

prostep IVIP

PROSTEP IVIP WEB-SEMINARS 2021

WEB SEMINAR

prostep IVIP

Today, 29 January:
Long Term Data Archiving (LOTAR)

Web-Seminars to come:

Date	Topic
26 February 2021	Standardization Strategy Board (SSB)
26. March 2021	3D Measurement Data Management (3D MDM)
30. April 2021	Data Preparation for Data Analytics (DPDA)
21. May 2021	Code of PLM Openness (CPO)

The Web-Seminar starts at 2:00 pm

Please visit our website www.prostep.org for more information

LOTAR Project "On A Page"

www.lotar-international.org

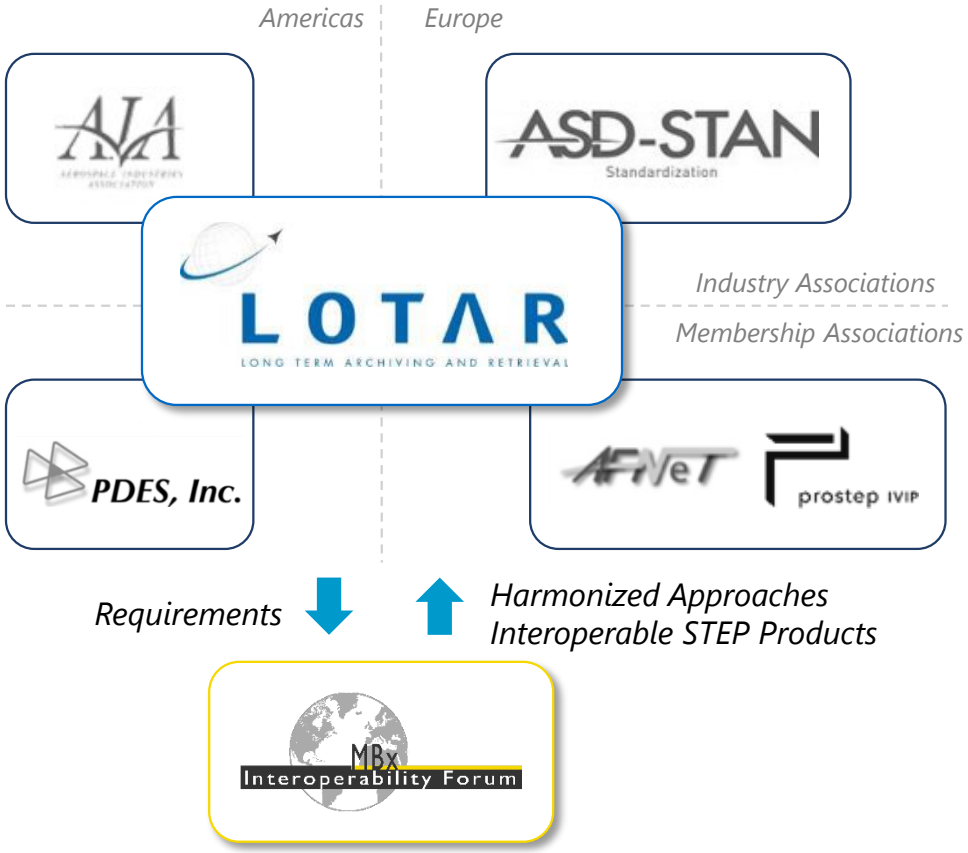
- LOTAR is an international consortium of Aerospace manufacturers
- Prime objective is creation and deployment of the **EN/NAS 9300 series of standards** for long-term archiving and retrieval of digital data, based on standardized approaches and solutions.
- Integration of LOTAR requirements in software tools ensured by close cooperation with:

MBx Implementor Forum (MBx-IF):

- Facilitated by AFNeT, PDES, Inc. and prostep ivip
- Consists of CAD, CAE, EWIS, STEP Translator & Validation Tool vendors
- Supports AP203, AP209, AP214, AP242

PDM Implementor Forum (PDM-IF):

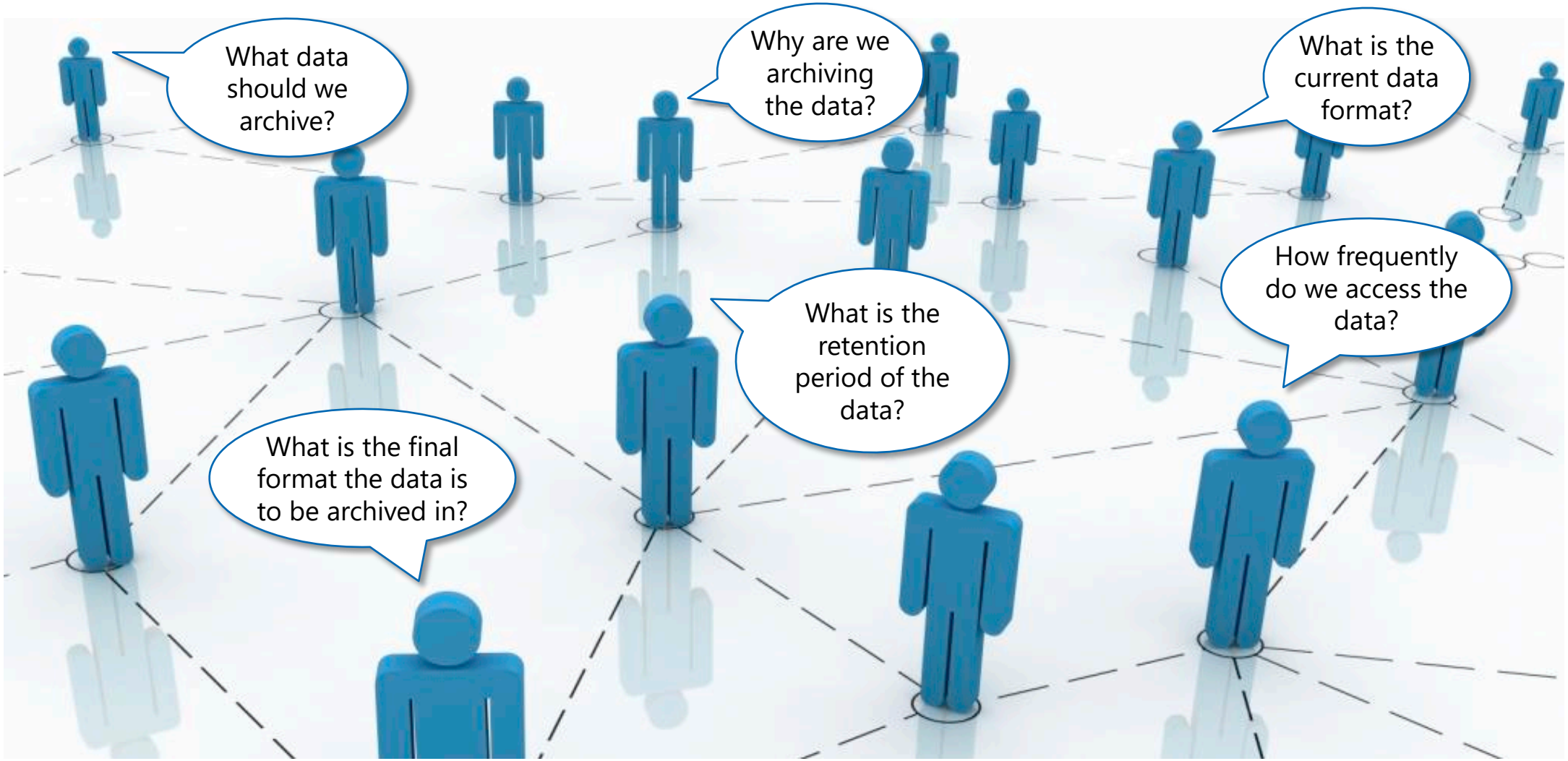
- Facilitated by AFNeT and prostep ivip
- Consists of PDM and STEP Translator vendors
- Supports AP242 BO / Domain Model XML



EN = European Norm (Standard)
NAS = National Aerospace Standard
CAx = Computer Aided "x" (Design, Engineering…)
PDM = Product Data Management

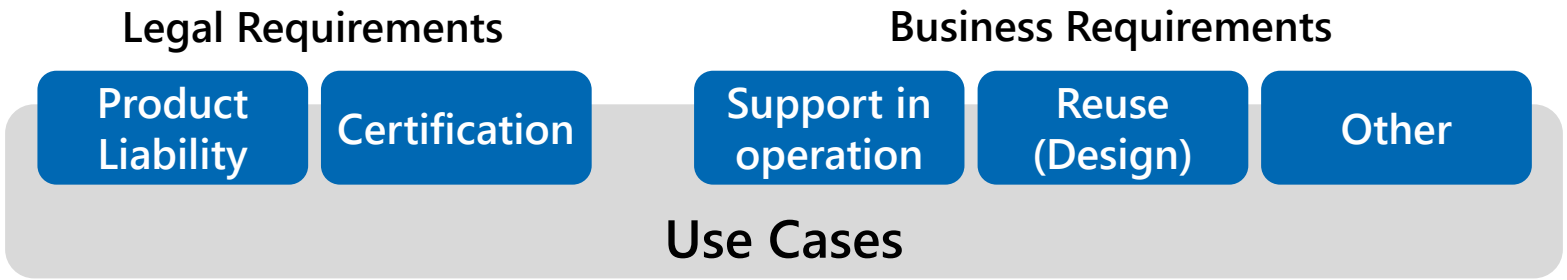
Information Lifecycle Planning

Driving Questions



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
- Additional to legal demands, there are industry established standards, company specific rules and recommendations.
- The standard defines architecture, processes and data formats to fulfill these requirements.

Technical and IT Background

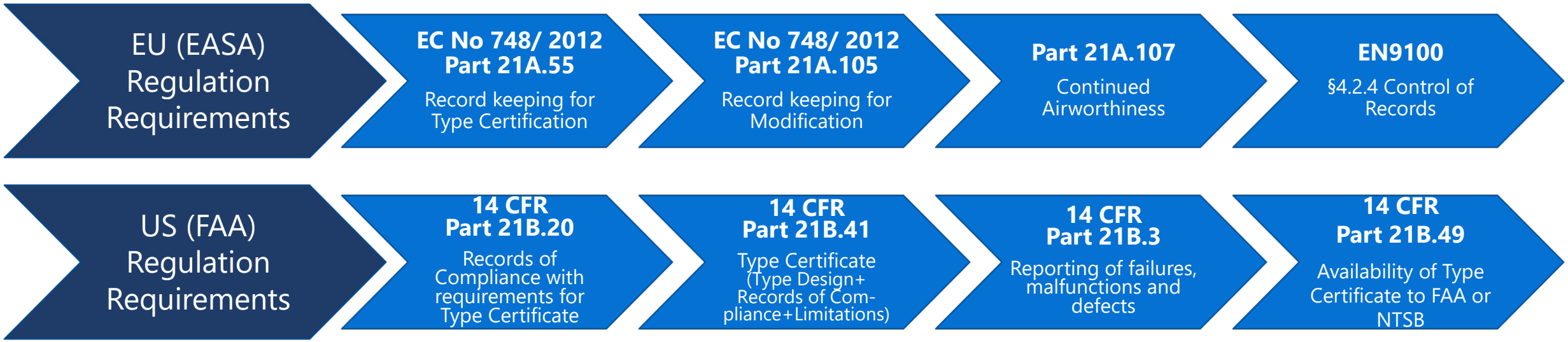
- The life cycles of applications and storage technologies have to be considered by setting up a long-term archiving and retrieval standard:

- Continuous development of technical product documentation leads to a change of methods and tools, which are used for design, manufacturing, customer support and archiving.
  - New releases of CAD / CAM / CAE / PDM / … systems offering new functionalities
  - After each migration, the data shall be checked for consistency and completeness.

  → A conversion of the native product data into a more stable format is essential.

Regulatory requirements for LOTAR aircraft certification and safety

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



FAA and EASA have promoted efforts to harmonize the regulations, so there are many similarities between them.

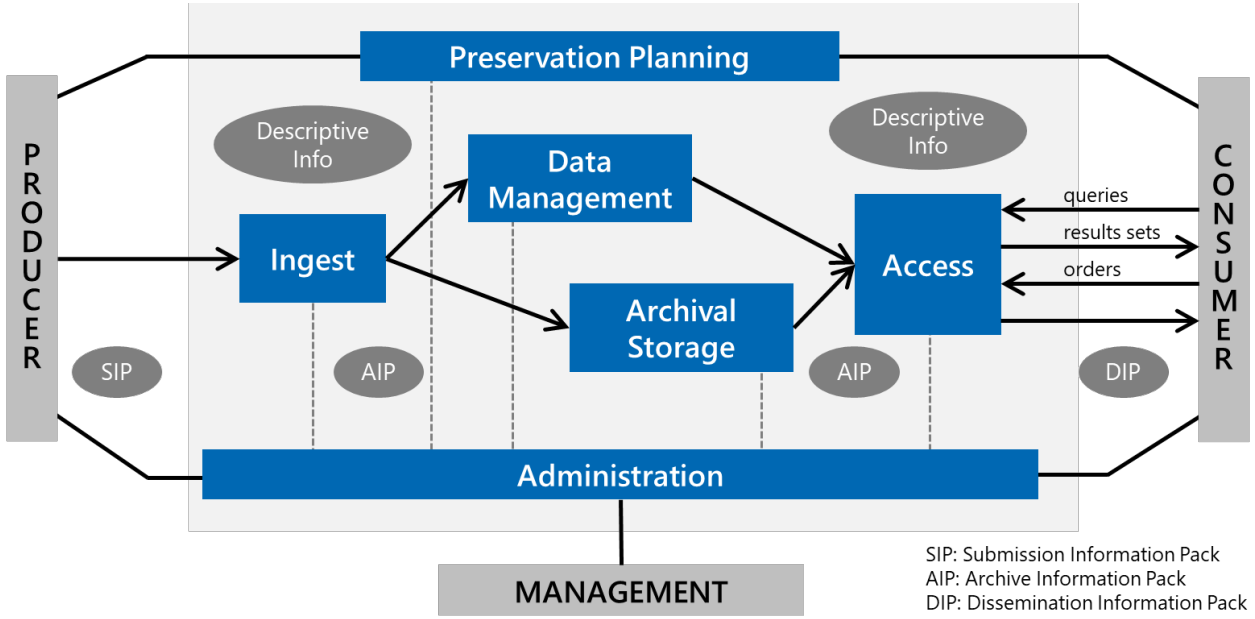
Expected benefits of the use of LOTAR standards

- 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 ISO 10303 STEP interfaces & functionalities
- By solving the challenges of long-term data retention, issues of data exchange are addressed

Development and use of LOTAR standards by the A&D industries allow for decreasing costs and risks of LT Archiving & Retrieval of digital aerospace product data

LOTAR Standard Foundation
ISO 14721:2012 (OAIS)

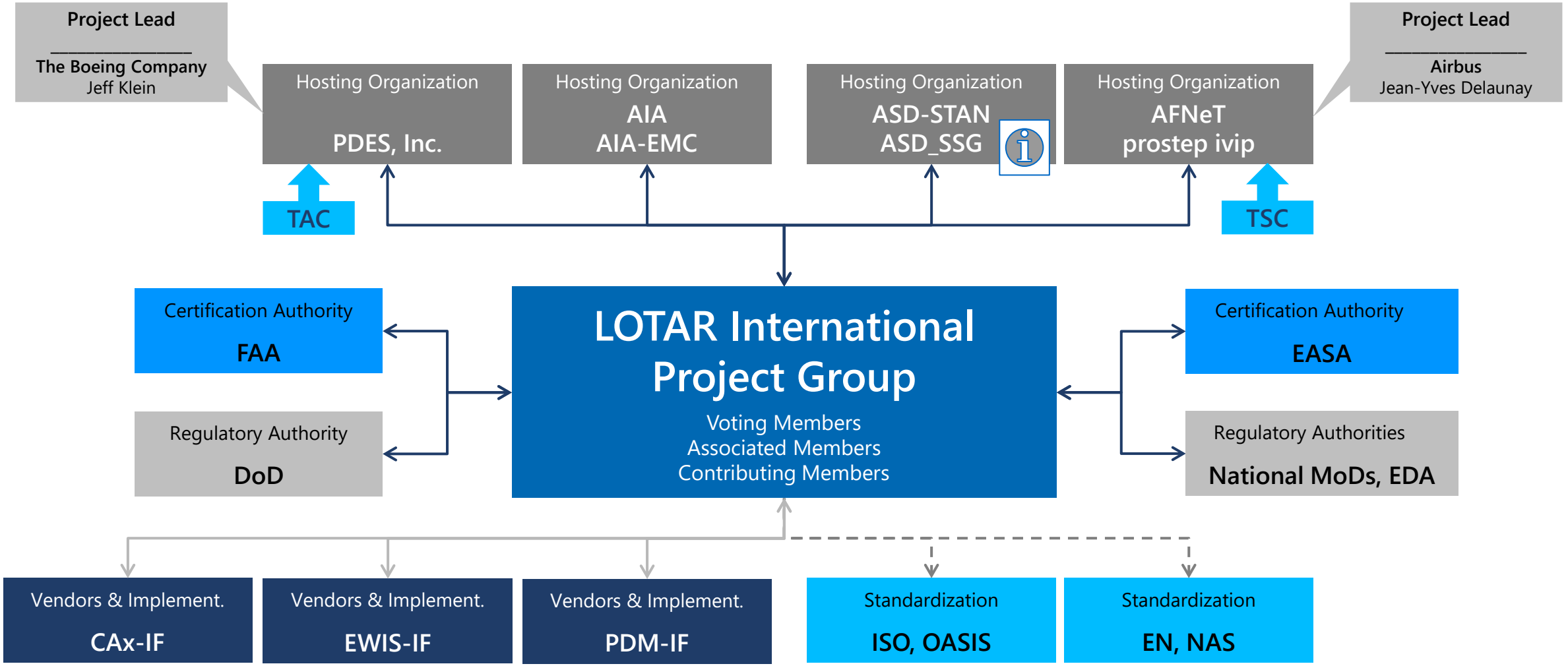
- "Open Archive Information System" (OAIS) Reference Model is basis for LOTAR processes
- Developed by the Space Industry (NASA & ESA)
- Extended to meet the specific requirements of LOTAR



- As neutral data format for the archives, ISO 10303 (STEP) has been chosen since it is the most advanced open format.

LOTAR Organization

External View



LOTAR Member Companies in 2021

Europe

- Airbus Commercial Aircraft
- Airbus Helicopter
- Airbus Defence & Space(*)
- AFNeT (GIFAS)
- Leonardo

Americas

- Boeing
- Embraer
- GE
- Gulfstream
- Lockheed Martin
- Raytheon Technologies
- Sandia National Labs

(*): *To be confirmed*

LOTAR Timeline

Late 1990s:
- AIA in the US and ASD-Stan in Europe launched separate initiatives for the Long-term Preservation of Aerospace & Defense Digital ProductDefinition Data.

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

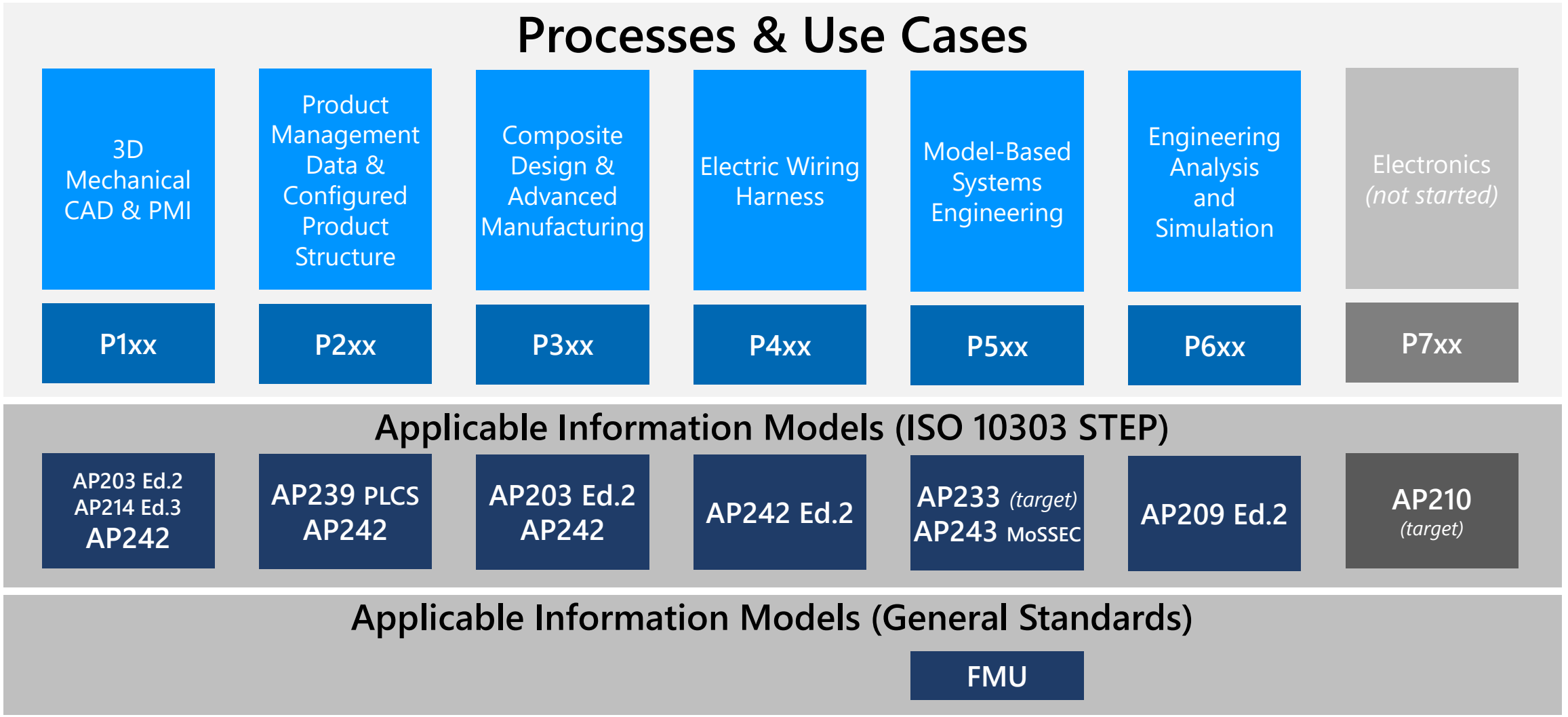
2014
- Launch of the Engineering Analysis & Simulation Workgroup (EAS WG)

2015
- Launch of the Additive Mfg (AM WG)

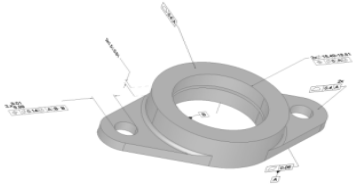
2018
- Evaluation of Model Based System Engineering Requirements
- Kicked off MBSE WG

* IAGQ: International Aerospace Quality Group

LOTAR Domains and related ISO Information Models



Eight LOTAR Working Groups at present

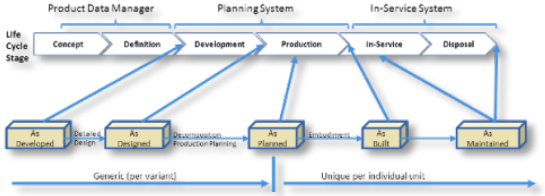


3D Mechanical CAD with Product & Manufacturing Information (PMI)

EN/NAS 9300-1xx series

STEP AP203 ed2
STEP AP214 ed3
STEP AP242 ed1 & ed2

2004 launch

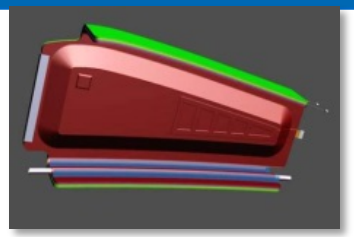


Product Data Management (PDM)

EN/NAS 9300-2xx series

STEP AP239
STEP AP242 ed1 & ed2

2004 launch

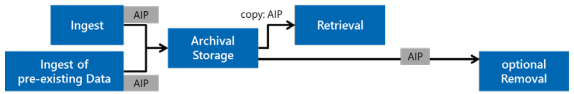


Composites and Advanced Manufacturing

EN/NAS 9300-3xx series

STEP AP203 ed2
STEP AP242 ed1 & ed2

2009 launch



Basic & Common Process Parts

EN/NAS 9300-00x and -0xx series

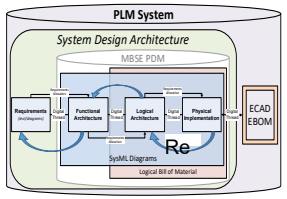
2003 launch

Wiring Harness

EN/NAS 9300-4xx series

STEP AP242 ed2

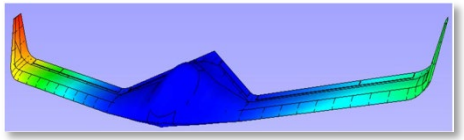
2012 launch



Model-Based System Engineering

EN/NAS 9300-5xx series

STEP AP233, AP239, AP242, AP243
FMI / FMU / SSP
SysML
AADL
ReqIF…

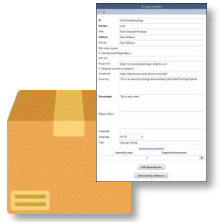


Engineering Analysis and Simulation

EN/NAS 9300-6xx series

ISO STEP AP209 ed2

2014 launch



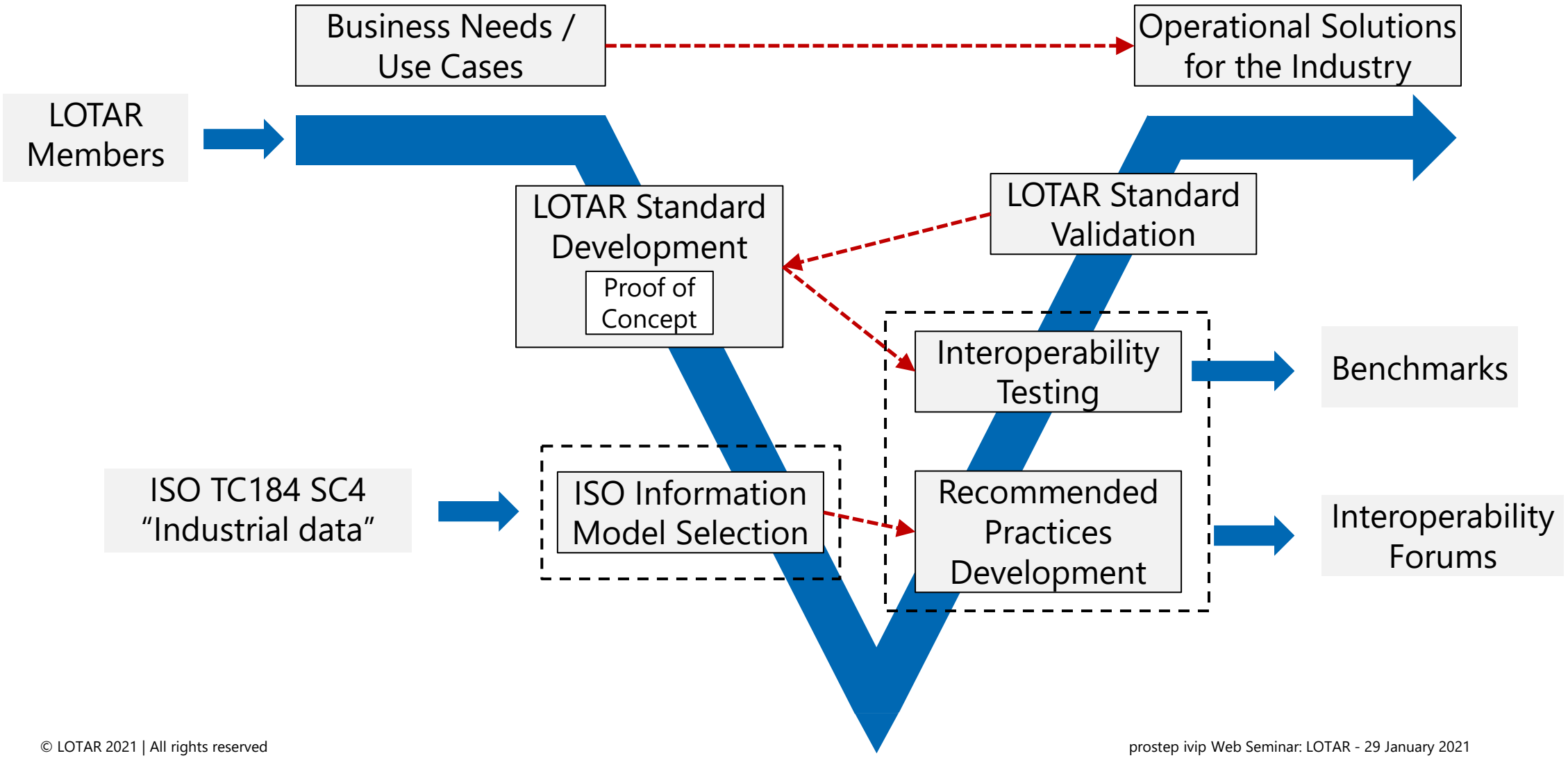
Meta Data for Archive Packages

EN/NAS 9300-21

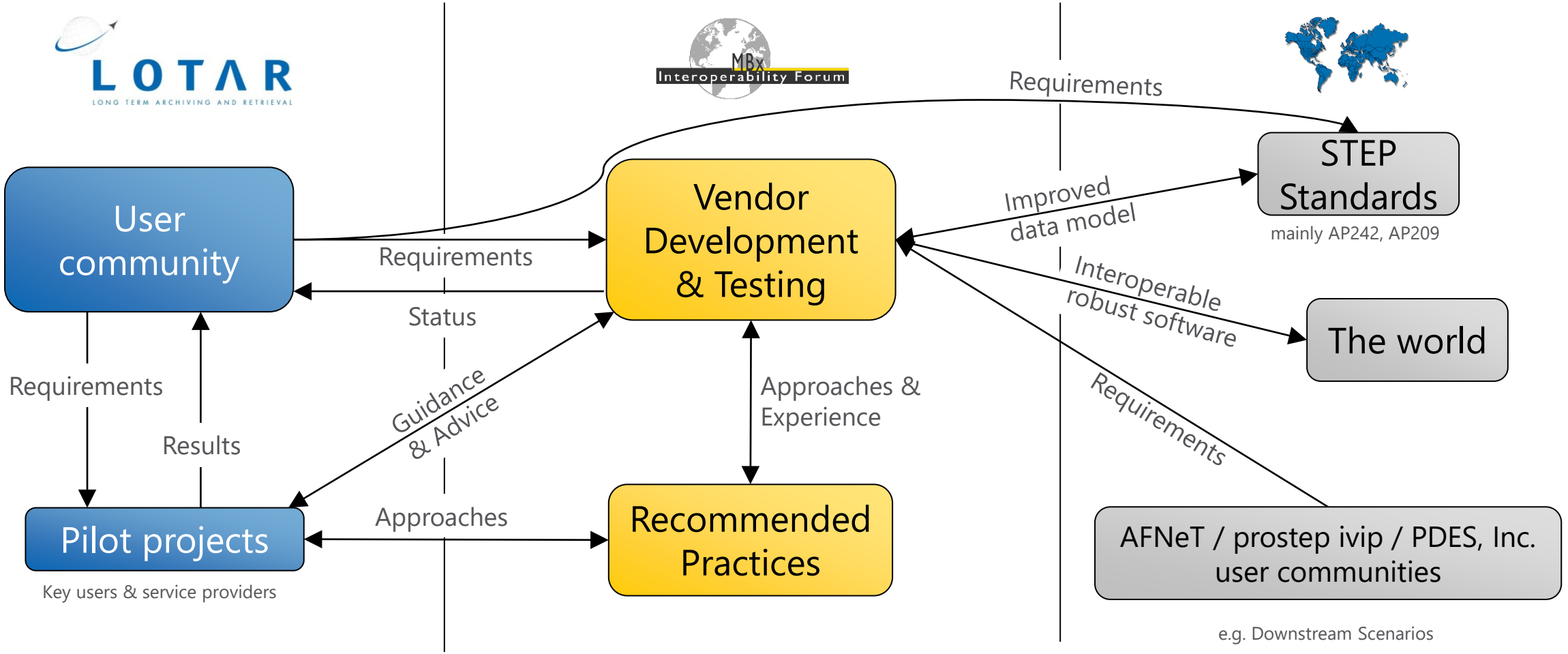
STEP AP239 ed3
STEP AP 242 ed2

2012 launch

“V cycle” for development and validation of LOTAR standards

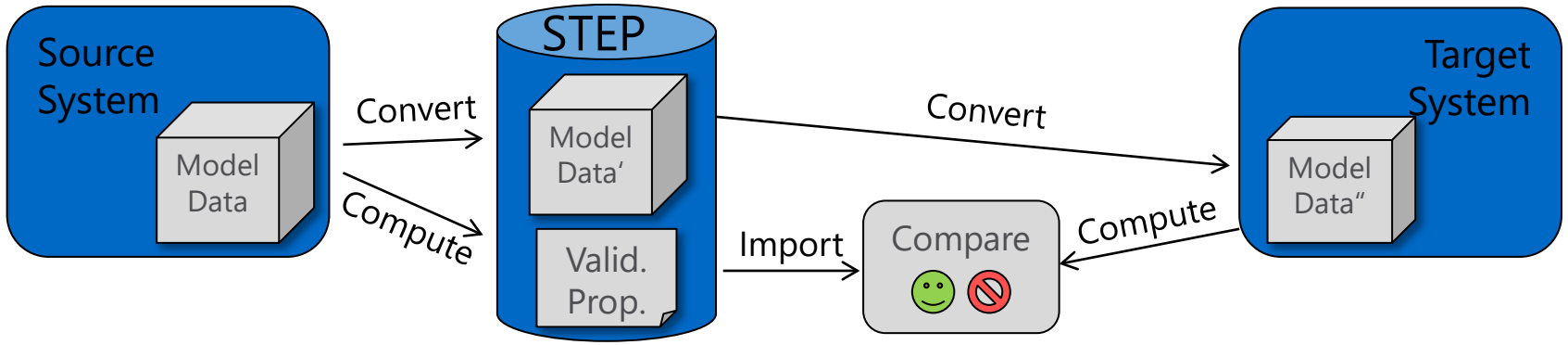


LOTAR / MBx Interoperability Forum Coordination



Validation of LOTAR STEP Data

- A distinctive feature of the combined use of LOTAR and STEP is the use of Validation Properties
- Validation Properties are related to the key characteristics of a digital model that help to ensure consistency of the data



- They are computed by the exporting system and included as key-value pairs in the STEP file
- Any importing system will compare its import results with these properties and thus determine success of the data transfer / data retrieval

Status of use of NAS/EN 9300 by LOTAR members

			NAS / EN 9300 LOTAR parts (CAD)					
A&D company	**Area of application**	**Scope**	CAD 3D Exact Geometry	CAD 3D Tessellated Geometry	CAD 3D PMI Present.	CAD Assembly structure	**ISO formats**	**Project status**
			Part 110	**Part 110**	**Part 120**	**Part P115**	**ISO 10303 "STEP"**	
Airbus Commercial	A350	3D Electrical Harness Installation & Definition	Yes	Yes	Yes	Yes	AP 214 ed3 (*) + AP 242 ed1	PROD
Airbus Defence & Space		"Full 3D" model based	Yes	Yes	Yes	Yes	AP 242 ed1	DEV
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	No	Yes	Yes	AP 203 ed2 (*) + U3D PDF	PROD
Gulfstream	G500, G600, G650	3D mBD mechanical, electrical and composite	Yes	No	Yes	No	AP 203 ed2 (*)	PROD
Lockheed-Martin	F35	3D mBD mechanical, electrical and composite	Yes	No	Yes	Yes	AP 203 ed2 + AP242 ed1	PLANNED
EMBRAER	Legacy 450 & Legacy 500	complete definition of the aircraft	Yes	No	Yes	Yes	AP 242 ed1	DEV
MTU Aero Engines	New parts of engines	3D definition without PMI of new mechanical part	Yes	No	No	In Prep.	AP 214 ed3	PROD

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

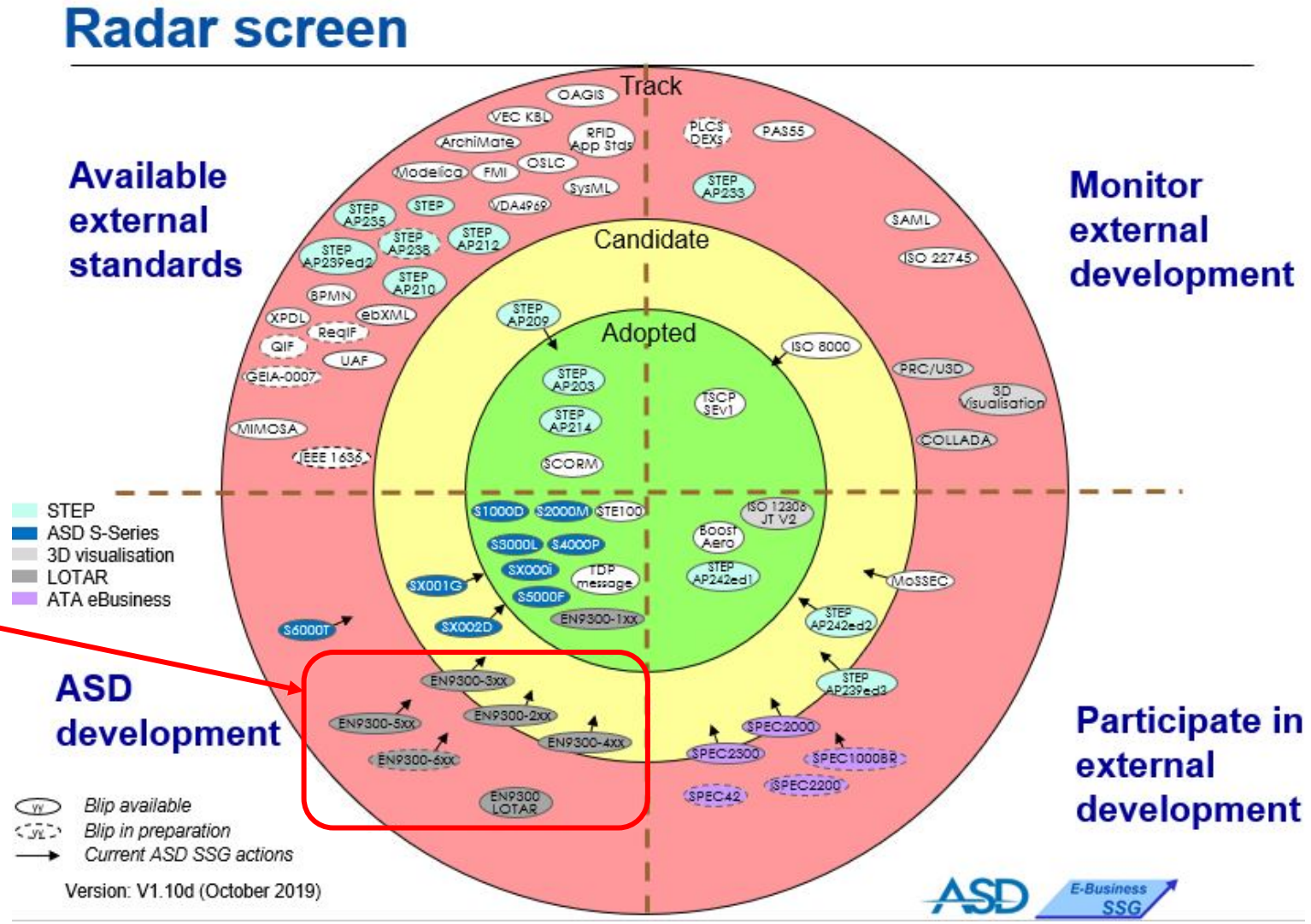
(*): Plan to migrate to STEP AP 242 ed1 when possible

AIA and ASD SSG Recommendations to use LOTAR standards

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

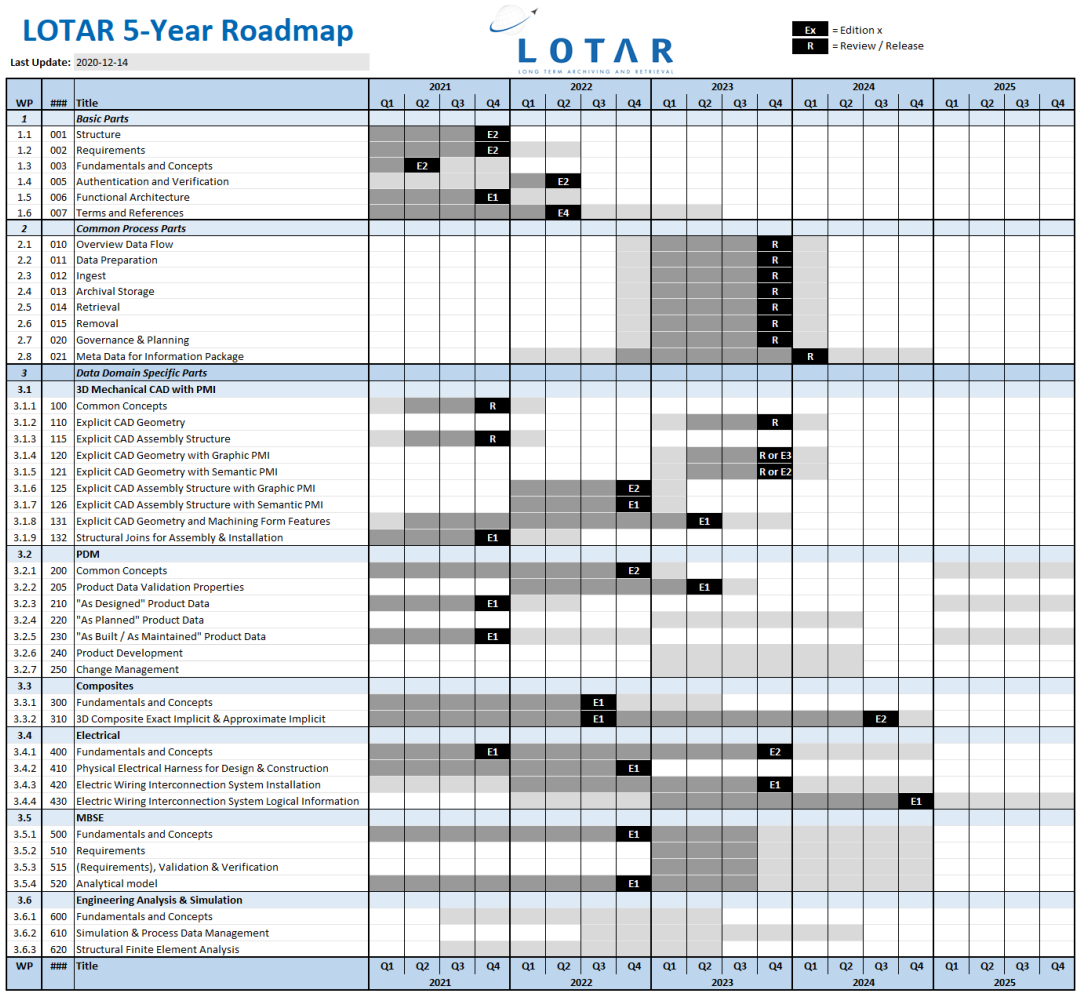
Standards component summary for
- EN9300 1XX
- EN9300 2XX
- EN9300 3XX
- EN9300 4XX
- EN9300 5XX
- EN9300 6XX

and related ASD recommendations



LOTAR 5-Year Roadmap (2021-2025)

- The LOTAR 5-years roadmap reflects:
  - the priorities of the A&D LOTAR members
    - business requirements, use cases
  - The LOTAR domains / technical disciplines to be covered:
    - P1xx, P2xx, P3xx, P4xx, P5xx, P6xx
    - Their associated product life cycles:
      - Conceptual design, simulation, design, manufacturing, support
  - The underlying standardization projects (following the V-cycle):
    - Dev. of ISO information models (STEP APs, etc.)
    - Dev. of additional international standards (FMI, etc)
    - Dev. of Rec. Practices, Interoperability Test Rounds, Interdisciplinary Test Models
    - The STEP infrastructure to be maintained



LOTAR 5-Year Roadmap

LOTAR — LONG TERM ARCHIVING AND RETRIEVAL

Ex = Edition x
R = Review / Release

Last Update: 2020-12-14

WP	###	Title	2021 Q1	2021 Q2	2021 Q3	2021 Q4	2022 Q1	2022 Q2	2022 Q3	2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2025 Q2	2025 Q3	2025 Q4
1		***Basic Parts***																				
1.1	001	Structure				E2																
1.2	002	Requirements				E2																
1.3	003	Fundamentals and Concepts		E2																		
1.4	005	Authentication and Verification						E2														
1.5	006	Functional Architecture				E1																
1.6	007	Terms and References						E4														
2		***Common Process Parts***																				
2.1	010	Overview Data Flow												R								
2.2	011	Data Preparation												R								
2.3	012	Ingest												R								
2.4	013	Archival Storage												R								
2.5	014	Retrieval												R								
2.6	015	Removal												R								
2.7	020	Governance & Planning												R								
2.8	021	Meta Data for Information Package													R							
3		***Data Domain Specific Parts***																				
3.1		**3D Mechanical CAD with PMI**																				
3.1.1	100	Common Concepts				R																
3.1.2	110	Explicit CAD Geometry												R								
3.1.3	115	Explicit CAD Assembly Structure				R																
3.1.4	120	Explicit CAD Geometry with Graphic PMI												R or E3								
3.1.5	121	Explicit CAD Geometry with Semantic PMI												R or E2								
3.1.6	125	Explicit CAD Assembly Structure with Graphic PMI								E2												
3.1.7	126	Explicit CAD Assembly Structure with Semantic PMI								E1												
3.1.8	131	Explicit CAD Geometry and Machining Form Features										E1										
3.1.9	132	Structural Joins for Assembly & Installation				E1																
3.2		**PDM**																				
3.2.1	200	Common Concepts								E2												
3.2.2	205	Product Data Validation Properties										E1										
3.2.3	210	"As Designed" Product Data				E1																
3.2.4	220	"As Planned" Product Data																				
3.2.5	230	"As Built / As Maintained" Product Data				E1																
3.2.6	240	Product Development																				
3.2.7	250	Change Management																				
3.3		**Composites**																				
3.3.1	300	Fundamentals and Concepts							E1													
3.3.2	310	3D Composite Exact Implicit & Approximate Implicit							E1								E2					
3.4		**Electrical**																				
3.4.1	400	Fundamentals and Concepts				E1								E2								
3.4.2	410	Physical Electrical Harness for Design & Construction								E1												
3.4.3	420	Electric Wiring Interconnection System Installation												E1								
3.4.4	430	Electric Wiring Interconnection System Logical Information																E1				
3.5		**MBSE**																				
3.5.1	500	Fundamentals and Concepts								E1												
3.5.2	510	Requirements																				
3.5.3	515	(Requirements), Validation & Verification																				
3.5.4	520	Analytical model								E1												
3.6		**Engineering Analysis & Simulation**																				
3.6.1	600	Fundamentals and Concepts																				
3.6.2	610	Simulation & Process Data Management																				
3.6.3	620	Structural Finite Element Analysis																				
WP	###	Title	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
			2021				2022				2023				2024				2025			

Next LOTAR Meetings in 2021

- **1st Qtr. Workshop**
  - 15-19 March 2021 (Online Meeting)
  - In conjunction with MBx-IF Workshop (CAx Round 47J Review; EWIS Round 2E Review)
- **2nd Qtr. Workshop**
  - 14-18 June 2021 (Online Meeting)
  - In conjunction with MBx-IF Workshop
- **3rd Qtr. Workshop**
  - 19-23 September 2021 (Charleston, SC, USA)
  - In conjunction with MBx-IF Workshop (CAx Round 48J Review; EWIS Round 3E Review)
- **4th Qtr. Workshop**
  - 29 November – 3 December 2021 (Online Meeting)
  - In conjunction with MBx-IF Workshop

Reports of previous meetings available at https://lotar-international.org/dates-communication/progress-reports/

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

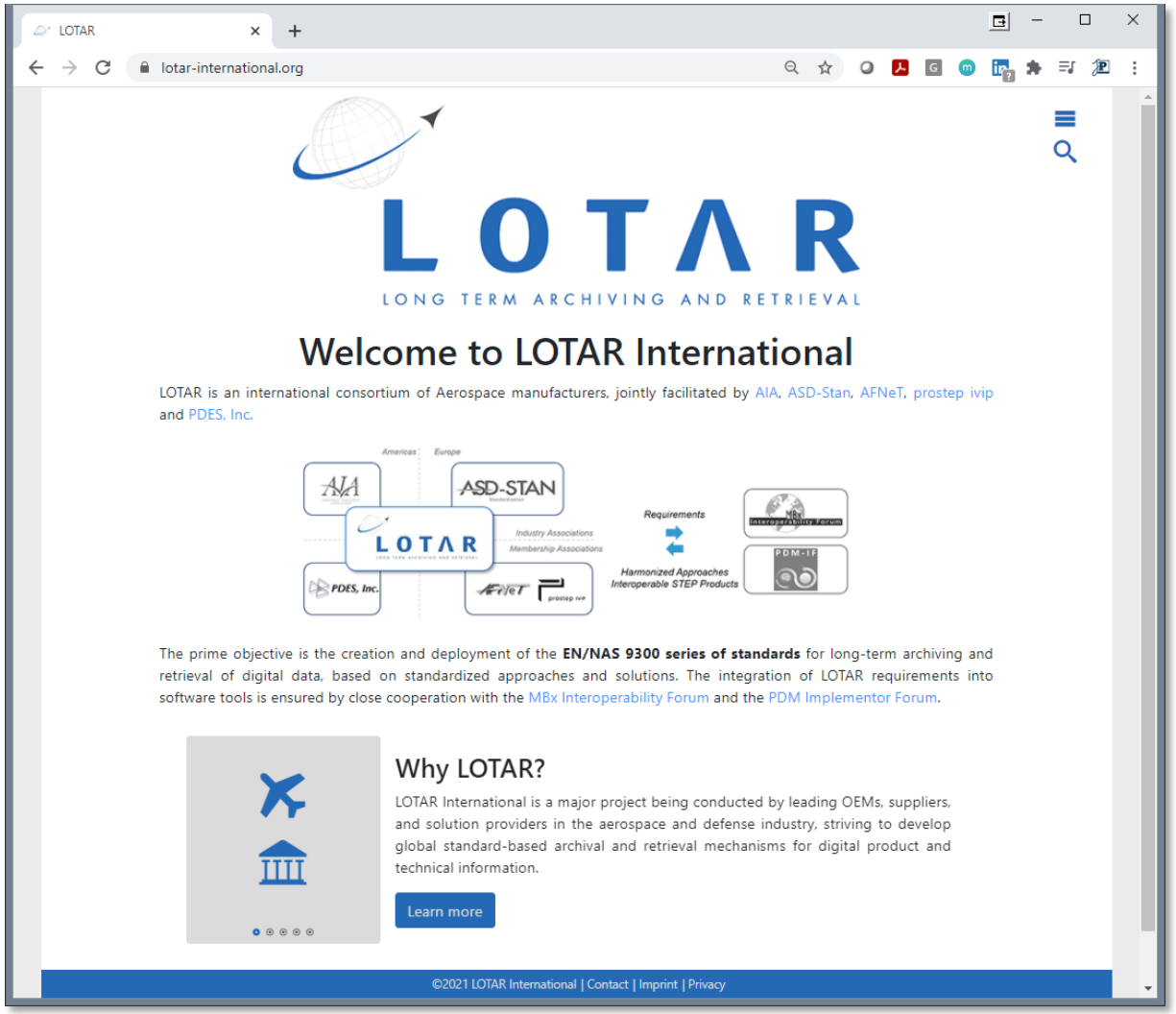
LOTAR Workgroups
- Basic & Common Parts
- 3D CAD with PMI
- PDM
- Composites
- Electrical Harness
- MBSE
- Engineering Analysis & Simulation
- 3D Visualization

Dates & Communication
- Public Presentation
- Progress Reports
- Next Steps

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

News

Links



THANK YOU FOR YOUR ATTENTION

Please get in touch with us for more information

lotar-info-l@lists.purdue.edu