

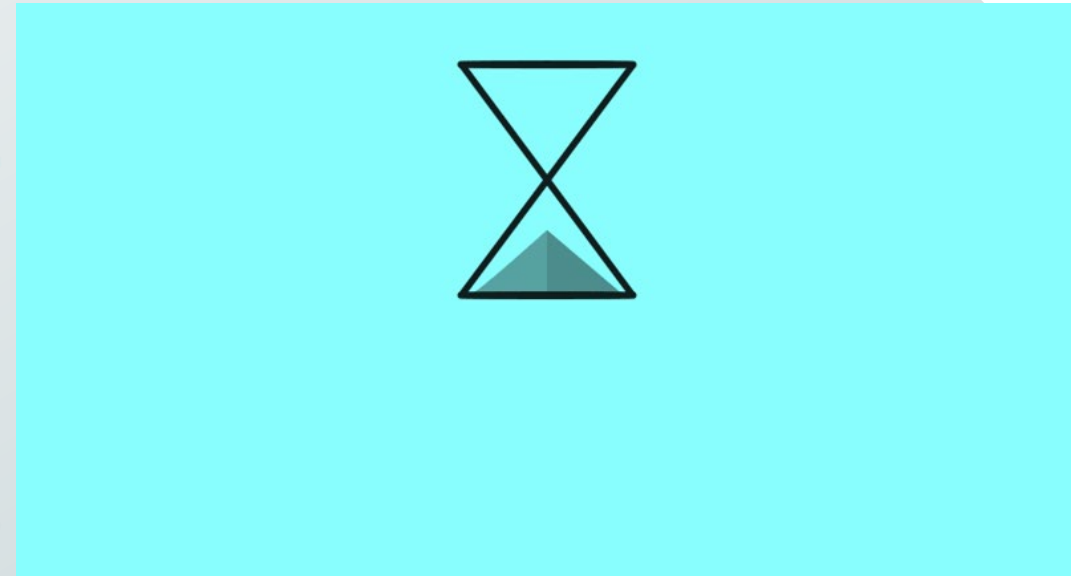
PROSTEP IVIP WEB-SEMINARS 2023



**Today, 27 October:
LOTAR**

Web-Seminars to come:

Date	Topic
24. November	CBPC



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

APPLICATION BENCHMARKS

- STEP AP242 BM (PDM)
- JT
- REQIF

COMMUNICATION / PR

STANDARDIZATION TOPICS

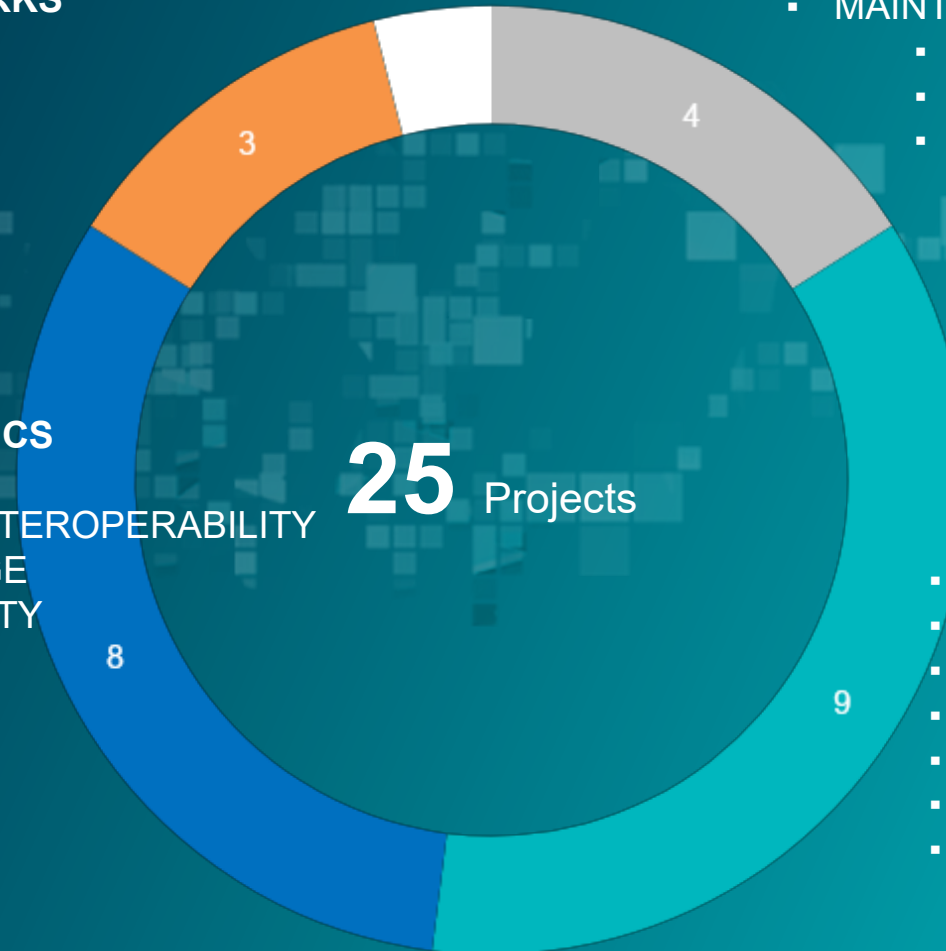
- OPENNESS OF IT SYSTEMS (CPO)
- STANDARDIZATION STRATEGY
- MAINTENANCE OF INTL STANDARDS
 - STEP AP242
 - JT
 - (SYSML, REQIF, ...)

IMPLEMENTATION SUPPORT TOPICS

- FUNCTIONAL DATA EXCHANGE
- MECHANICAL AND ELECTRICAL INTEROPERABILITY
- PDM STRUCTURE DATA EXCHANGE
- REQUIREMENTS INTEROPERABILITY

USER-DRIVEN TOPICS

- SYSTEMS ENGINEERING
- REQUIREMENTS MANAGEMENT
- PROJECT SCHEDULE MANAGEMENT
- VIRTUAL PRODUCT REPRESENTATION
- LONG-TERM DATA RETENTION
- CLOUD BASED PRODUCTION COLLABORATION
- ARTIFICIAL INTELLIGENCE



LOTAR



Bernd Feldvoss
AIRBUS



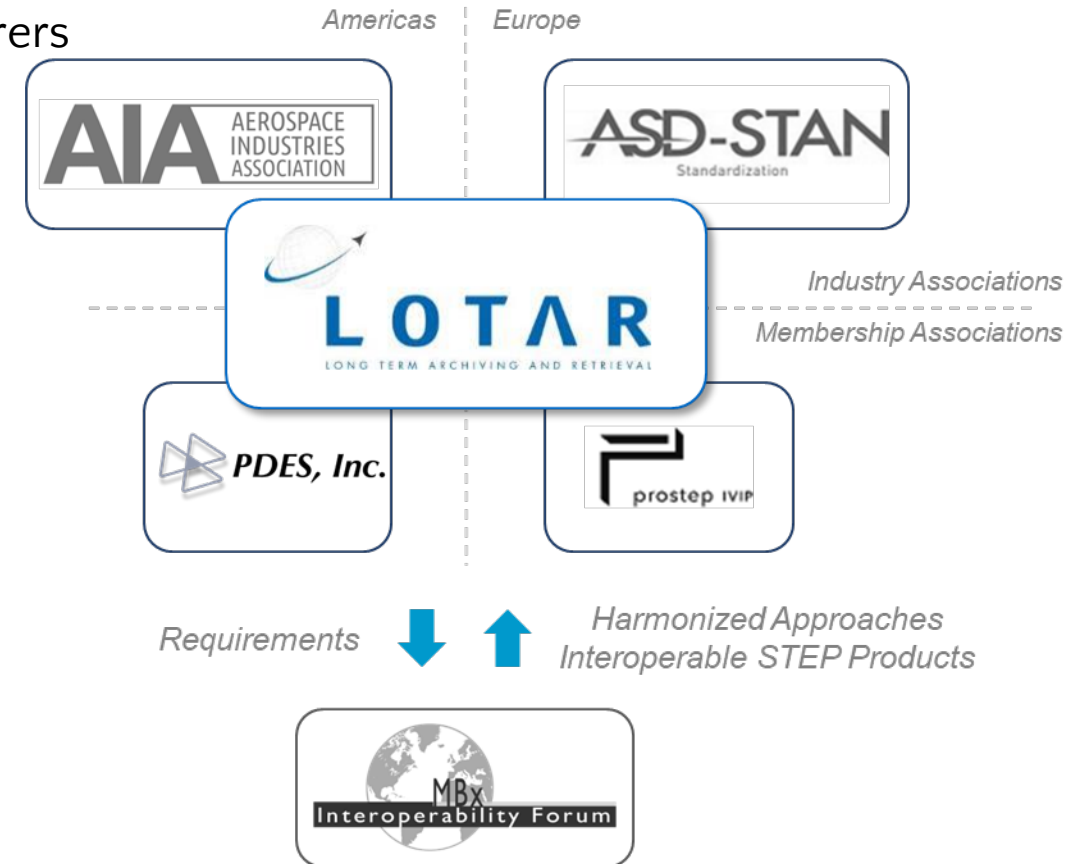
Jochen Boy
PROSTEP

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 STEP Translator & Validation Tool vendors for of CAD, CAE, EWIS and PDM
 - Supports AP203, AP209, AP214, AP239, AP242, AP243
 - Supports AP242 Business Object Model XML

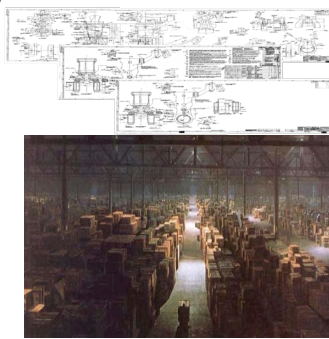


LOTAR Problem Statement

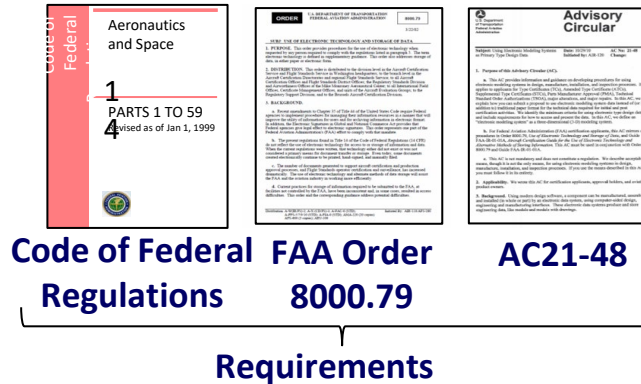


With the emergence of digital data-based processes, including model-based definition, requirements were identified which predicate the need for a long-term data retention solution(s) to meet the regulatory and business requirements. Traditional legacy retention and retrieval methods do not support complex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

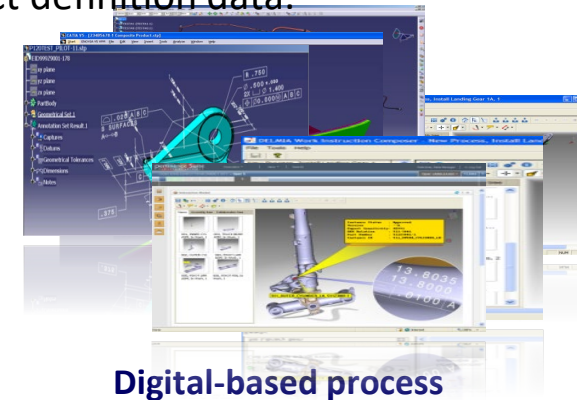
Past



Paper-based process



Future



Digital-based process

Project Description

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. The standards are published as NAS 9300 US (EN 9300 Europe), series and cover both the information content as well as the processes required to ingest, store, administer, manage and access the information.

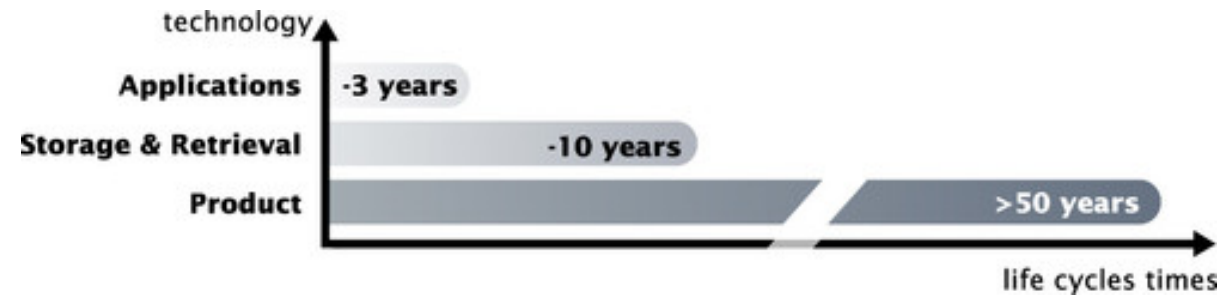
Key Team Members:

Team Leads and Represented Companies:

- **Boeing:** J. Klein, J.C. Mendo, S. Galt, A. Bingcang, J. VanHorne
- **Lockheed Martin:** J. Holmlund, M. Jahadi, C. Simpson
- **GE:** Xuefeng Zhang
- **Gulfstream:** D. Ganser, L. Nash
- **Raytheon:** J. Ganguli, I. Parent
- **Airbus:** B. Feldvoss, P. Duchier, F. Darre, K. Hall



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

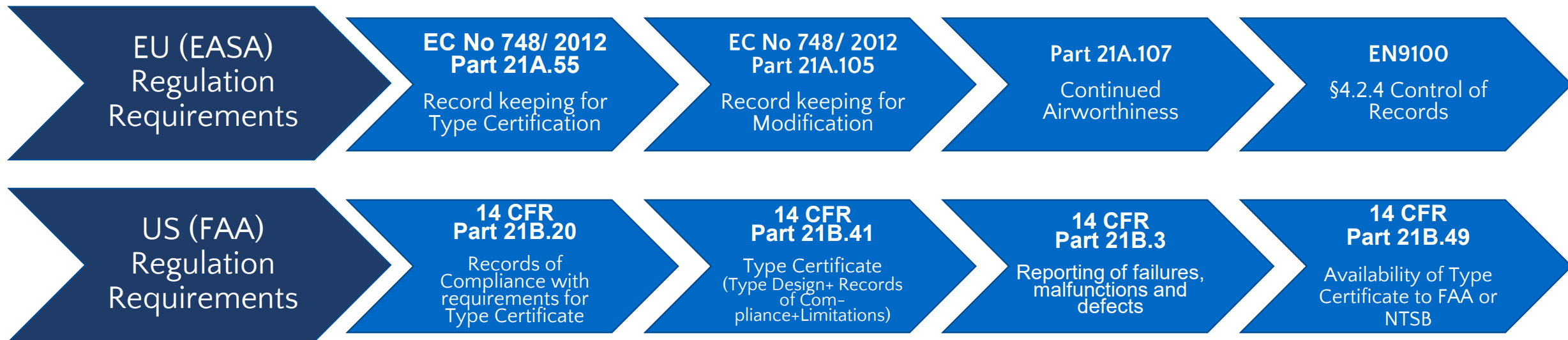


- Continuous development of technical product documentation technology leads to changes in methods and tools, which are used for design, manufacturing, customer support and archiving.
 - New releases of CAD / CAM / CAE / PDM / ... systems offering new functionalities
 - After each migration, the data shall be checked for consistency and completeness.
 - A conversion of the native product data into a more stable format mitigates the risk of information loss and minimizes the cost of migration.

Regulatory requirements for LOTAR aircraft certification and safety



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



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

What EASA requests for long-term archiving...



The **EASA Part-21**

(Certification of aircraft and related products, parts and appliances, and of design and production organisation) also contains the requirements for archiving:

21.A.5 Record-keeping

Regulation (EU) 2021/699

All relevant design information, drawings and test reports, including inspection records for the product or article tested for the purpose of certification, shall be held by the holder of a type-certificate, restricted type-certificate, supplemental type-certificate, design change or repair design approval or of an ETSO authorisation at the disposal of the Agency and shall be retained in order to provide the information necessary to ensure the continued airworthiness, continued validity of the operational suitability data and the compliance with the applicable environmental protection requirements of the product or the article.

[applicable from 18 May 2022]

GM1 21.A.5 Repair designs and record keeping

ED Decision 2021/007/R


For repair designs, the record-keeping requirement of point 21.A.5 applies to the data described in [AMC 21.A.433\(a\)](#).

[applicable from 18 May 2022]

...and how Airbus put it into action for the A350 program

In 2009, a CRI was signed in order to agree on the rules for archiving of 3D data. Just a few of them...



 European Aviation Safety Agency	Airbus A350 CERTIFICATION REVIEW ITEM	Ref.:	A-02
		Issue:	2
		Status:	Closed
		Date:	13.10.2009
		Page:	1 of 4
		Next Action:	
Subject:		Digital three-dimensional data for Type Design definition	
Category:		Interpretative Material	
Requirements:		Part 21A.4, 21A.31(a)(1) and (a)(2), 21A.55, 21A.133	

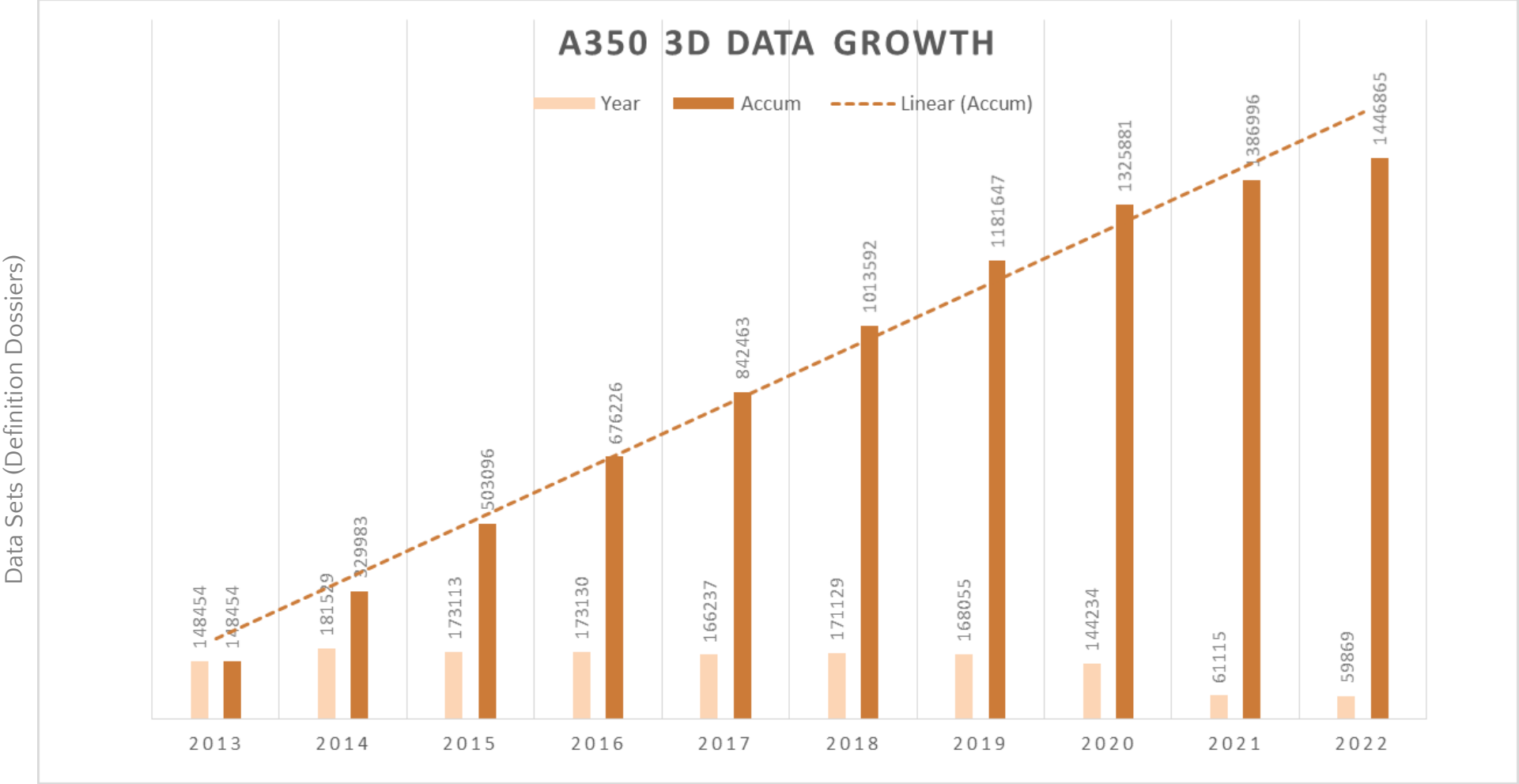
Authorities shall have **access to these data** when required.
For practicability reasons it might be the case that this access can only be provided in the Airbus facilities.

For distribution purpose, it must be possible to derive the visualization format from the 3D CAD design data, which **must not alter the content and must be fully consistent with the original 3D CAD design definition**

For every 3D CAD design data change, the 3D visualization record must be **replaced upon official release of the design data** (automatic update of such 3D visualization record is preferred)

The 3D design data must be **archived with a reliable and harmonized process** so that the **original content is preserved**. The IT obsolescence shall not endanger these data.

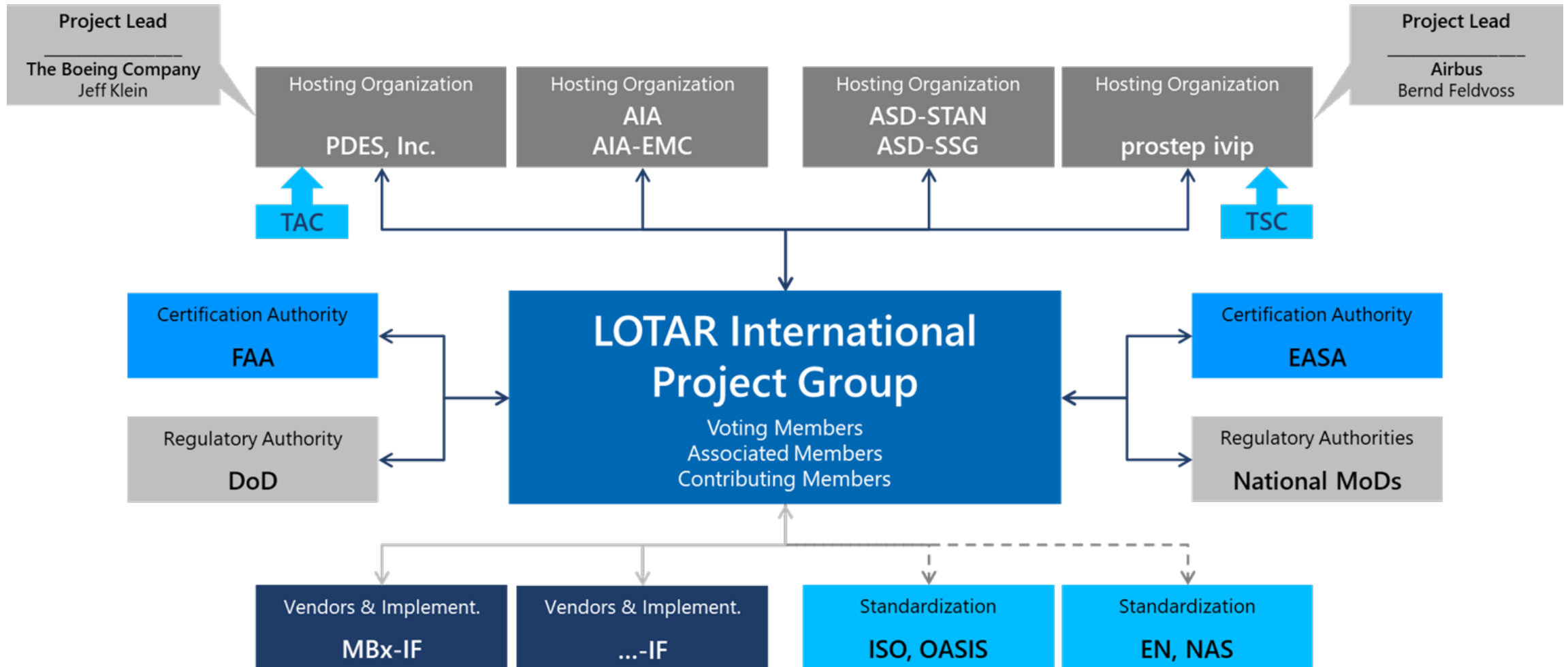
LTA3D Archival Growth (A350)



LOTAR Organization



External View



LOTAR Member Companies

2023



AIRBUS

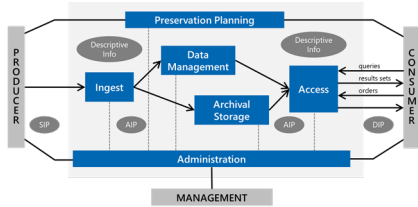
LOCKHEED MARTIN 



Gulfstream[®]



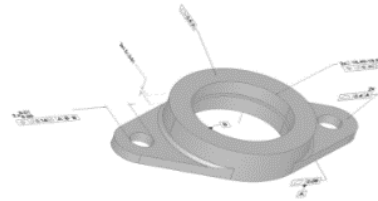
LOTAR Working Groups at Present



2018 •

Basic & Common
Process Parts

EN/NAS 9300-00x & -01x series

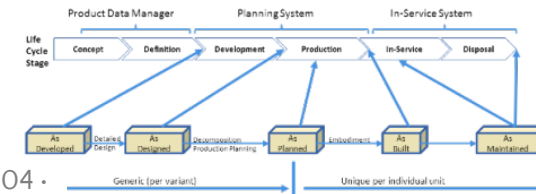


2004 •

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

EN/NAS 9300-1xx series

STEP AP203 Ed.2, AP214 Ed.3, AP242

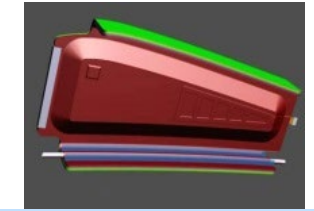


2004 •

Product Data Management
(PDM)

EN/NAS 9300-2xx series

STEP AP239, AP242



2009 •

Composites and Advanced
Manufacturing

EN/NAS 9300-3xx series

STEP AP203 Ed.2, AP242

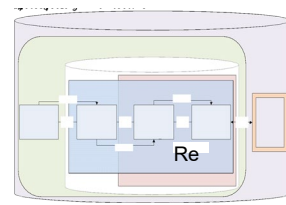


2012 •

Electrical Wiring Harness

EN/NAS 9300-4xx series

STEP AP242 Ed.2

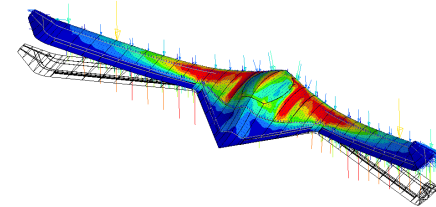


2018 •

Model-Bases Systems
Engineering (MBSE)

EN/NAS 9300-5xx series

STEP AP233, AP239, AP242, AP243
FMI, SysML, AADL, ReqIF...

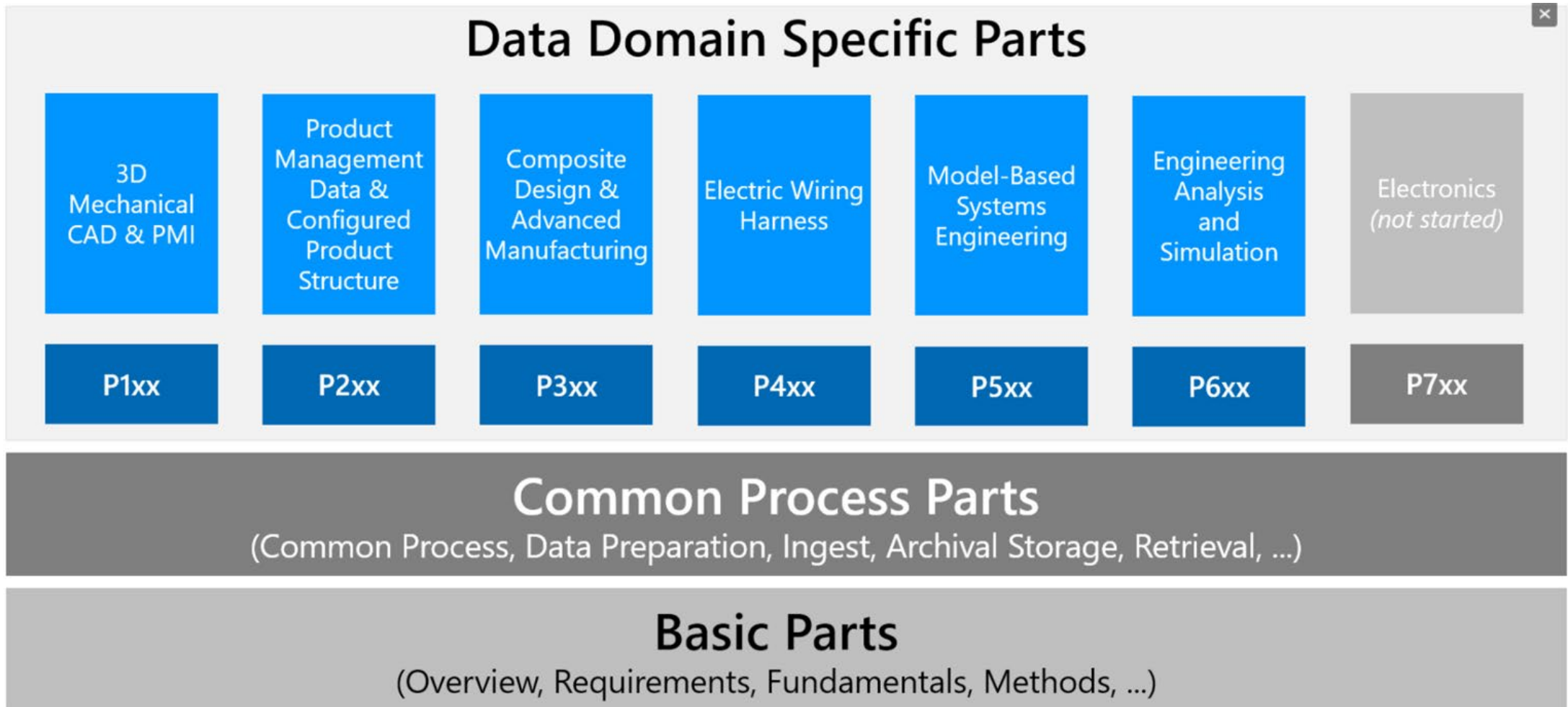


2014 •

Engineering Analysis and
Simulation (EAS) *(on hold)*

EN/NAS 9300-6xx series

STEP AP209 Ed.2



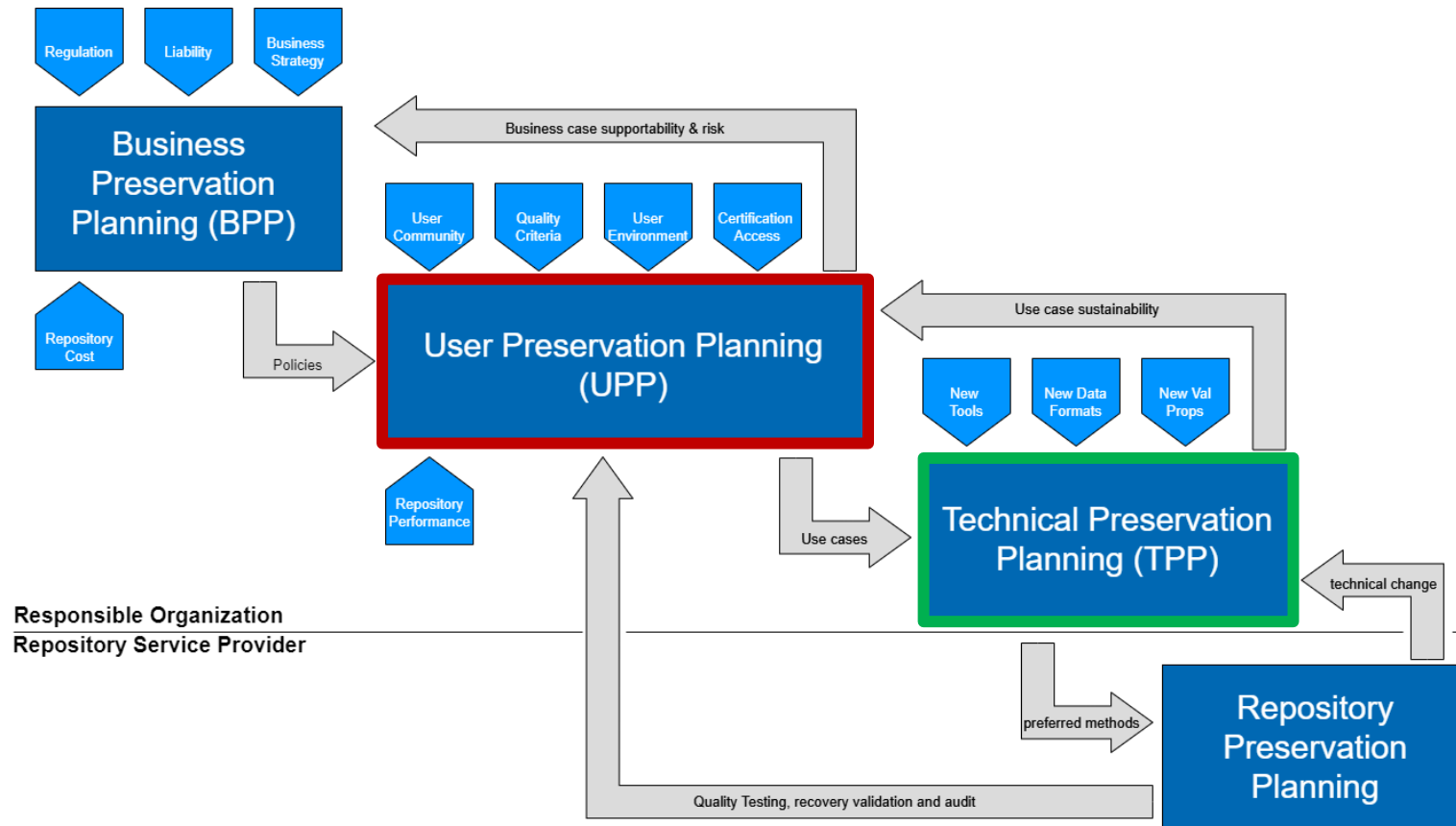
VP	###	Title	2024				2025				2026				2027				2028			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1		Basic Parts																				
1.1	001	Structure																				
1.2	002	Requirements		R																		
1.3	003	Fundamentals and Concepts		R																		
1.4	005	Authentication and Verification				R																
1.5	006	Functional Architecture																				
1.6	007	Terms and References				R																
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 PM																				
3.1.1	100	Common Concepts																				
3.1.2	110	Explicit CAD Geometry			R or E																	
3.1.3	115	Explicit CAD Assembly Structure	E2																			
3.1.4	120	Explicit CAD Geometry with Graphic PM				R or E																
3.1.5	121	Explicit CAD Geometry with Semantic PM				R or E																
3.1.6	125	Explicit CAD Assembly Structure with Graphic PM				R or E																
3.1.7	126	Explicit CAD Assembly Structure with Semantic PM						E1														
3.1.8	131	Explicit CAD Geometry and Machining Form Features																	E1			
3.1.9	132	Structural Joins for Assembly & Installation							E1													
3.1.10	140	Kinematics																				
3.1.11	100	Sheet Metal																	E1			
3.1.12	100	Welding																	E1			
3.2		PDM																				
3.2.1	200	Common Concepts			E2																	
3.2.2	205	Product Data Validation Properties																				
3.2.3	210	"As Designed" Product Data																				
3.2.4	220	"As Planned" Product Data																	E1			
3.2.5	230	"As Built / As Maintained" Product Data	E1																E2			
3.2.6	240	Product Development								E1												
3.3		Composites																				
3.3.1	300	Fundamentals and Concepts					E1															
3.3.2	310	3D Composite Exact Implicit & Approximate Implicit								E1												
3.4		Electrical																				
3.4.1	400	Fundamentals and Concepts												E2								
3.4.2	410	Physical Electrical Harness for Design & Construction																				
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			E2 or F																
3.5.2	510	Requirements				E1																
3.5.3	515	(Requirements) Validation & Verification					E1															
3.5.5	520	Analytical model						E2														
3.5.5	530	Architecture models								E1												
3.5.6	540	LBCM								E1												
3.6		Engineering Analysis & Simulation																				
3.6.1	600	Fundamentals and Concepts																				
3.6.2	610	Simulation & Process Data Management	The LOTAR Engineering & Analysis Workgroup is currently on hold. Next steps will be planned when activities in this domain are resumed.																			
3.6.3	620	Structural Finite Element Analysis																				
VP	###	Title	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
			2024				2025				2026				2027				2028			

LOTAR

Five-Year Roadmap 2024–2028

- Chart indicates planned new releases and updates of LOTAR EN/NAS 9300-xxx documents
- Each Working Group provides an annual update of their planning
- Like a weather forecast, this chart is more accurate in the short term and provides only a rough outlook to the long term
- Latest version is always publicly available on the LOTAR homepage under: “LOTAR Standard – Next Steps”

Different Levels of Preservation Planning



- **Business Preservation Planning (BPP)** develops and documents the long-term data **retention strategy** of the responsible organization.

- **User Preservation Planning (UPP)** ensures that BPP retention **policies** are implemented.

- **Technical Preservation Planning (TPP)** provides expertise in the way that product information is **developed**, both in terms of **how processes use software** to represent aspects of the product, and the way in which information is represented when being transferred between different software products.

- **Repository Preservation Planning (RPP)** is concerned with minimizing the costs and risks associated with the way that data is held in the **archive**.

Preservation planning based on EN9300 Part 020 [LOTAR-2012]

Preservation Planning Assessments – A350

Periodic

Output from this step:

			PA Preparation		PA Overall Results		PA Detailed Results			
AIP Category	Source CAD System	Content Information Standard	PoP Size	Sample Size	PA OK or Warning	PA Succ Rate	Conversion		Validation	
							Conv OK	Conv Succ Rate	Val OK	Val Succ Rate
CAD 3D Exact Geometry	CATIA V5R18 SP2	AP214 ISO Edition 3	28283	648	648	100.00%	648	100.00%	648	100.00%
CAD 3D Assembly Structure	CATIA V5R18 SP2	AP214 ISO Edition 3	33034	650	650	100.00%	650	100.00%	650	100.00%
CAD 3D Annotation	CATIA V5R18 SP2	AP214 ISO Edition 3	12611	630	630	100.00%	630	100.00%	630	100.00%
CAD 3D Tessellated Geometry	CATIA V5R18 SP2	AP242 ISO	50510	654	654	100.00%	654	100.00%	653	99.85%
CAD 3D Exact Geometry	CATIA V5R21 SP2	AP214 ISO Edition 3	306233	662	662	100.00%	662	100.00%	654	98.79%
CAD 3D Assembly Structure	CATIA V5R21 SP2	AP214 ISO Edition 3	241837	661	661	100.00%	661	100.00%	661	100.00%
CAD 3D Annotation	CATIA V5R21 SP2	AP214 ISO Edition 3	651	328	328	100.00%	328	100.00%	320	97.56%
CAD 3D Tessellated Geometry	CATIA V5R21 SP2	AP242 ISO	276754	661	661	100.00%	661	100.00%	661	100.00%
CAD 3D Exact Geometry	CATIA V5-6R2017 SP2	AP242 ISO Edition 1	80928	658	656	99.70%	656	99.70%	654	99.39%
CAD 3D Assembly Structure	CATIA V5-6R2017 SP2	AP242 ISO Edition 1	64429	656	656	100.00%	656	100.00%	656	100.00%
CAD 3D Annotation	CATIA V5-6R2017 SP2	AP242 ISO Edition 1	106870	659	659	100.00%	659	100.00%	659	100.00%
CAD 3D Tessellated Geometry	CATIA V5-6R2017 SP2	AP242 ISO Edition 1	75684	657	657	100.00%	657	100.00%	657	100.00%
			1277824	7524	7522	99.97%	7522	99.97%	7503	99.72%

Summary

Only 2 retrieval errors:

2 Exact Geometry Errors already during ingest: Design defect – Flexible equipment – bad solid non-manifold (edge shared with more than 3 faces) – Tightener

In addition we faced only a few retrieval warnings (validation KO) because of minor design defects and because accuracy of CatiaV5R27 improvements in comparison with CatiaV5R21 used during ingestion

Action plan: 2 models to be re-designed.

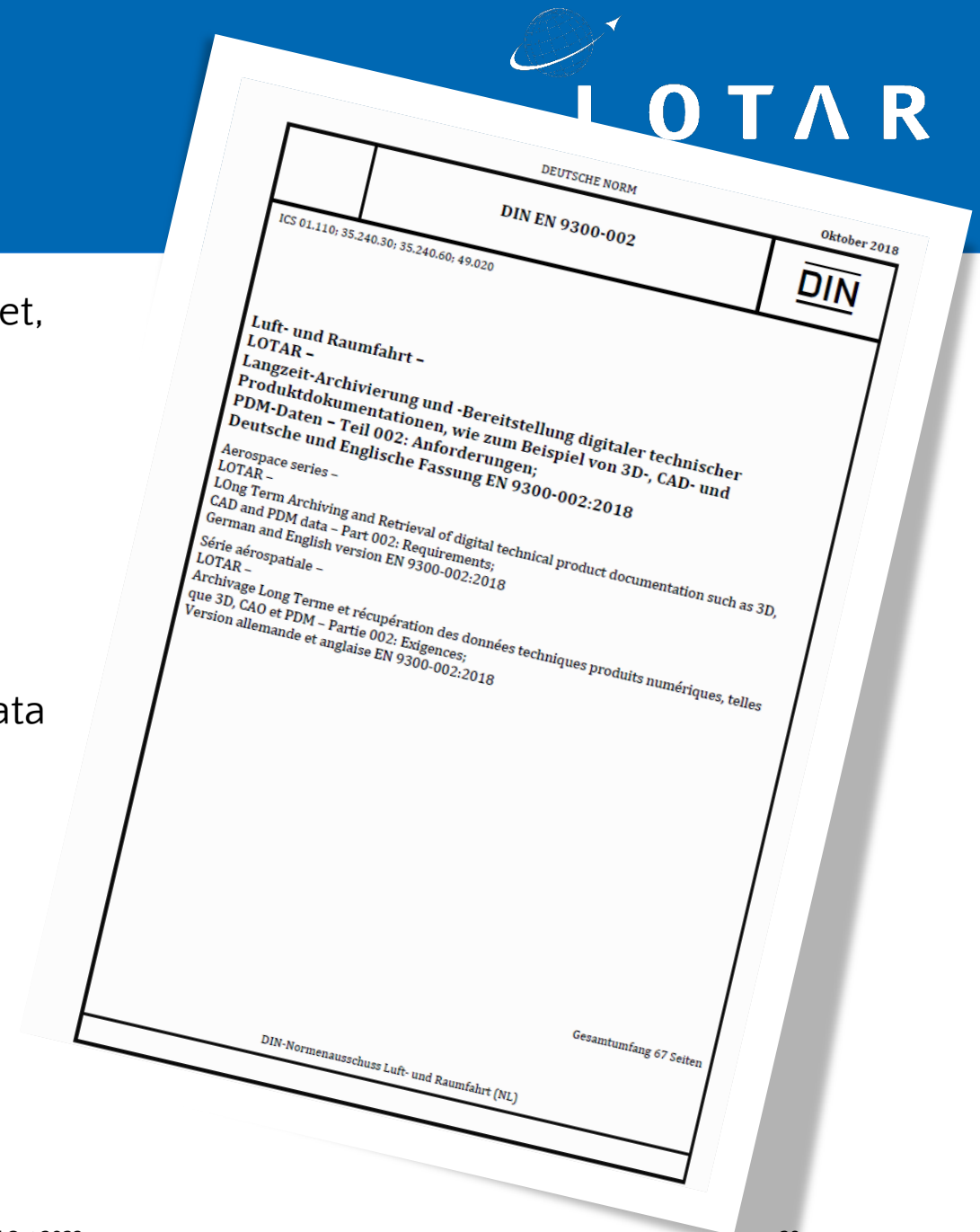
Audit and EN9300 Compliance

To prove to EASA that the record keeping requirements are met, AIRBUS undergoes an external audit every two years

Based on:

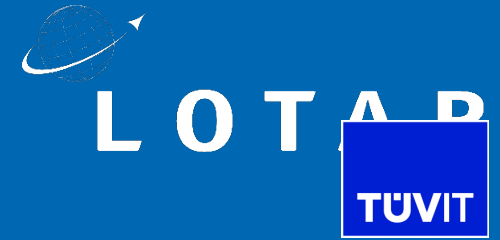
- EN9300-002: LOTAR Requirements
- EN9300-003: LOTAR Fundamentals and Concepts
- EN9300-100: Common Concepts for LTA&R of 3D MCAD Data
- EN9300-110: CAD Mechanical 3D Explicit Geometry
- EN9300-115: Explicit CAD Assembly Structure
- EN9300-120: CAD 3D Explicit Geometry with Graphic PMI

LTA&R: Long-Term Archiving & Retrieval
MCAD: Mechanical Computer Aided Design
PMI: Product & Manufacturing Information



Example Requirement: Validation Information

From EN9300-002: LOTAR Fundamentals & Processes



EN 9300-002:2018 (E)

7.3.1 Data Preparation

Data preparation covers the phase of preparation for submission, and is outside the scope of the OAIS model. This has the following detailed requirements:

- 3) **Preparation of the validation information associated to each source product information:** When technically feasible, the Producer shall check the quality control criteria (e.g., validation properties) of the information to be preserved. The validation report of each source product information has to be created, as associated input to the Ingestion process of the Archive.

Source: EN9300-002

Example Requirement: Validation Information

Corresponding AIRBUS Process Definition

AIRBUS

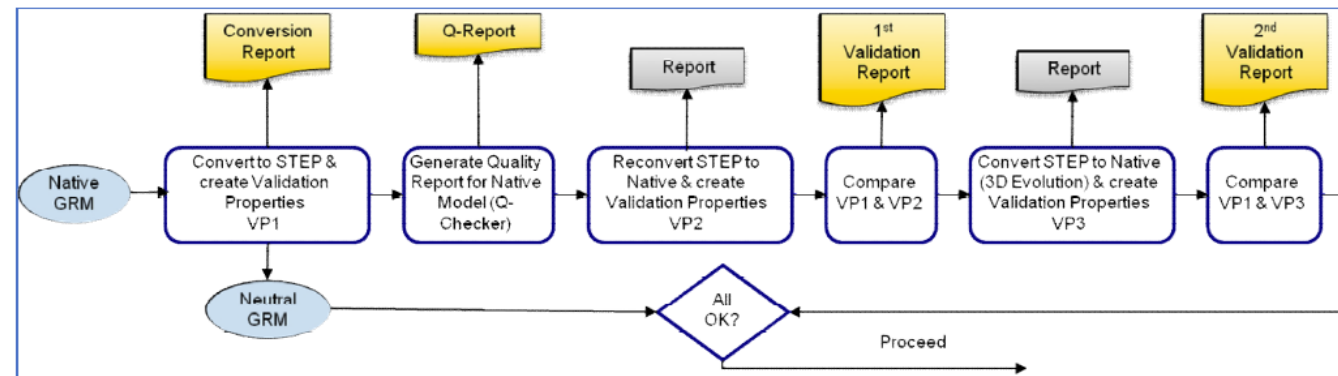


Figure 2-5: Conversion/validation process overview

The CATIA STEP converter generates the STEP file that contains CAD entities with Validation Properties (VP) computed in the original CAD system. Then the STEP file is imported in two validation tools CATIA (loop validation) and 3D Evolution (second validation) that compute the VP deviation (difference between computed and read VP from STEP).

- Both CAD validation tools are using different algorithms for VP calculation and additionally some of them are not customizable. That's why there can be differences in each validation report.
- Airbus uses the thresholds advised by the CAx Implementor Forum **[CAx-IF]**
- The same thresholds are applicable for both Ingest and Retrieval.

Source: AIRBUS Procedural Documentation AIRINA v1.2

Audit and EN9300 Compliance

- AIRINA Re-Certification Audit will take place in June 2023
- AIRBUS A350 is not the only example of the LOTAR standard being actively used in industry:

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 Present.	CAD Assembly structure		
			Part 110	Part 110	Part 120	Part 115	ISO 10303 "STEP"	
Airbus Commercial	A350	Electrical Harnes, Mechanical System & Bracket Installation, Cabin	Yes	Yes	Yes	Yes	AP214 Ed.3 (*) + AP242 Ed.1	PROD
Airbus Commercial	BelugaXL	Electrical Harnes, Mechanical System & Bracket Installation, Cabin	Yes	Yes	Yes	Yes	AP242 Ed.1	PROD
Airbus Defence & Space		"Full 3D" model based	Yes	Yes	Yes	Yes	AP242 Ed.1	DEV
Dassault-Aviation	Falcon 7X	complete definition of the aircraft (airframe, brackets, pipes, harness)	Yes	No	Yes	Yes	AP214 Ed.3 (*)	PROD
Snecma	New parts of engines	3D definition with PMI of new mechanical part	Yes	No	Yes	No	AP214 Ed.3 (*)	PROD
Boeing	787	3D definition with PMI with assemblies	Yes	No	Yes	Yes	AP203 Ed.2 (*) + U3D PDF	PROD
Gulfstream	G500, G600, G650	3D mBD mechanical, electrical and composite	Yes	No	Yes	No	AP203 Ed.2 (*)	PROD
Lockheed-Martin	F35	3D mBD mechanical, electrical and composite	Yes	No	Yes	Yes	AP203 Ed.2 + AP242 Ed.1	PLANNED
EMBRAER	Legacy 450 & Legacy 500	complete definition of the aircraft	Yes	No	Yes	Yes	AP242 Ed.1	DEV
MTU Aero Engines	New parts of engines	3D definition without PMI of new mechanical part	Yes	No	No	In Prep.	AP214 Ed.3	PROD

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

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

Die Zertifizierungsstelle der TÜV Informationstechnik GmbH bescheinigt hiermit dem Unternehmen

AIRBUS S.A.S
1 Rond Point Maurice Bellonte
31707 Blagnac, France

für die eingesetzte Dokumentenmanagement- und Archivlösung

AIRINA

die Erfüllung aller anwendbaren Anforderungen der Prüfkriterien für Dokumentenmanagementlösungen

PK-DML, 5. Auflage 2019, EN 9300 series^{*)}.

^{*)} Angewandte Level: Verifikation Level 0 & Validation Level 1

Die Prüfanforderungen sind in der Anlage zum Zertifikat zusammenfassend aufgelistet.
 Die Anlage ist Bestandteil des Zertifikats und besteht aus 11 Seiten.
 Dieses Zertifikat gilt nur in Verbindung mit dem Prüfbericht.

PK-DML



2021 Trusted Site

Certificate ID: 9963.21

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Zertifikatsgültigkeit: 30.07.2021 - 30.07.2023

Essen, 30.07.2021


 Dr. Christoph Sutter
 Leiter Zertifizierungsstelle

TÜV Informationstechnik GmbH
 TÜV NORD GROUP
 Langerhansweg 20

«VOI»
 DML-30

Zertifikat

- LOTAR is an industry consortium whose purpose is to develop process standards focused on the preservation of digital data required to be retained for long periods of time.
- Coordinate closely with implementor forums to develop test cases and recommended practices.
- Participants are primarily from the aerospace industry.
- Driven by business, regulatory, and customer requirements.
- Working groups meet regularly online.
- Gather for in depth quarterly meetings. Alternate in person and online meetings.
- Look forward to seeing you at our next meeting.

- If you are interested in participating, submit your information through the LOTAR website here:
 - <https://lotar-international.org/why-lotar/joining-lotar/>

- Leverage industry initiatives around digital engineering / digital thread
- Build on MBSE momentum
- Restart Engineering Analysis and Simulation
- Consider new domains such as software and circuit design
- Build on integration with Implementor Forums
- Activities planned:
 - 2023 Q4 Online Meeting
 - 2024 Q1 Meeting in Person – Darmstadt, DE, at prostep ivip
 - 2024 Q2 Online Meeting
 - 2024 Q3 Meeting in Person – Location TBD (USA)
 - 2024 Q4 Online Meeting

LOTAR Homepage:

www.lotar-international.org



LOTAR
LONG TERM ARCHIVING AND RETRIEVAL

Welcome to LOTAR International

LOTAR is an international consortium of Aerospace manufacturers, jointly facilitated by [AIA](#), [ASD-Stan](#), [AFNeT](#), [prostep ivip](#) and [PDES, Inc.](#)

The prime objective is the 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. The integration of LOTAR requirements into software tools is ensured by close cooperation with the [MBx Interoperability Forum](#) and the [PDM Implementor Forum](#).

LOTAR Organization

The development of a worldwide accepted standard for long term archiving of a 3D master and product structure is an international collaboration of five hosting organizations. The project is conducted in a distributed manner, using regular online meetings for management tasks as well as on the working group level, combined with physical team meetings alternating between Europe and the US for joint discussions.

[Learn more](#)

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Any questions?

Thank you for your interest.

Please visit our next web-seminar:

Date: 24. November 2023

Topic: CBPC

For more information please visit
www.prostep.org

