Enabling Digital Enterprise

Moving interoperability standards forward

Brian Chiesi
GM – PDES, Inc.

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2023

BOEING · ELYSIUM · NORTHROP GRUMMAN · Parker · PDES, Inc.®
Connecting the Digital Enterprise

Chiesi's Digital History

Civil Engineer –
Structures

B2 – Struct. Engr.
- 100% Digital
- CADAM, NCAD, NCAL
- 3D wireframe
- NC driven tape layup

V-22 –
- Cockpit/E-Bay IPT leader,
- 777 toolset deployment leader
- 3D integration leader

Ch47G
- Structures – Integration leader
- Deploy – execute new PLM/MES
- Paperless factory

Boeing Commercial - Enterprise
- Director – Digital transformation
  - 787 extension – capabilities and locations
  - Business Architecture team
  - Systems integration
- Enterprise Data standards deployment

1980	1983-87	1990	1993	1997-2001	2005	2011 – 20	2021 -

767/737-300 Struct.
- 100% Mylar
- Hand analysis

777 – Phila. FLE DBT Leader
- 100% 3D Design – CATIA
- 100% Elec. Analysis
- Integrated analysis
- NC Programing
- CMM Programming
- Integrated supply chain

Rotorcraft –
- Tool development leader
- Integrated PLM – MES
- Digital Factory

Satellite/Enterprise –
- MBD – process development & implementation
- Various Enterprise initiatives – Program execution, engineering & supplier excellence

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Results …

Civil Engineer –
Structures

- Digital NC – QA program
- Error and Flow reduction
- Rapid Corrective action

V-22 –
- Cockpit/E-Bay IPT leader,
- 777 toolset deployment leader

- 6 month award to Jig load
- 12 month reduction from F model
- Single digit error rates
- Paperless factory

- Initial deployment and demonstration of Digital thread
- Foundation for Model based enterprise
- Functional understanding of process, artifacts and interoperability standards

1980	1983-87	1990	1993	1997-2001	2005	2021 -

767/737-300 Struct.
- 100% Mylar
- Hand analysis

- 50% reduction – Nonrecurring & recurring cost (767 scaled)
- 3 month flow reduction
- Single digit Engr./MFG error rate

…rcraft –
…ool development leader
…ntegrated PLM – MES
…igital Factory

Satellite/Enterprise –
- MBD – toolset development implementation
- Various Enterprise initiatives – Program execution, engineering & supplier excellence

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Learnings

- Applications
  - Enablers for functional execution and digital data creation

- Data
  - Life blood of digital thread
  - Encumbered by the data formats of applications/platforms
  - Dead data or incongruent data is drag on systems

- People are the key
  - Embrace and drive digital as a "system"
  - Knowledge – data content, formats, utilization
 - Challenge … getting out of their silos

- ## Established in 1988
  - A&D and Automotive OEMS
  - Develop and implement STEP standards

- ## Expanded Organization and Scope
  - Originally CAD , then CAD/CAM to full value stream & Long Term Archive and Retrieval (LOTAR)
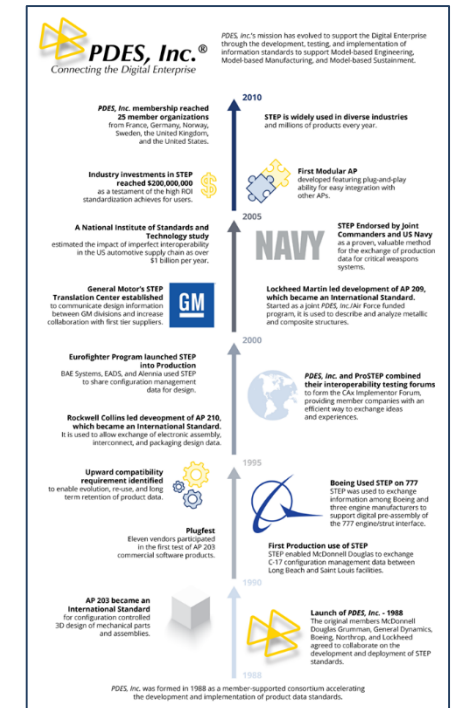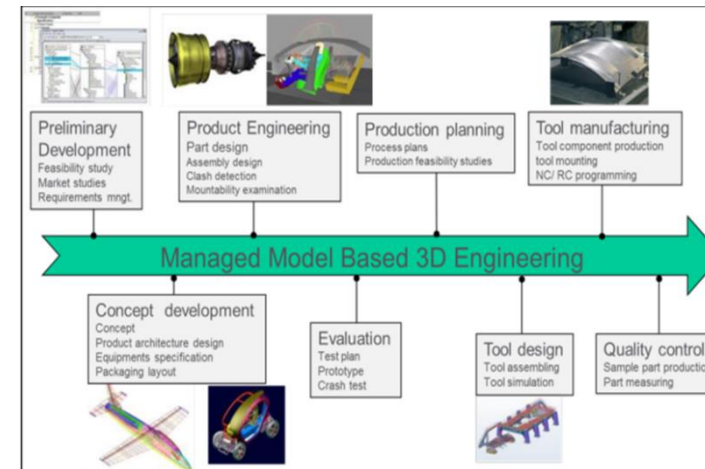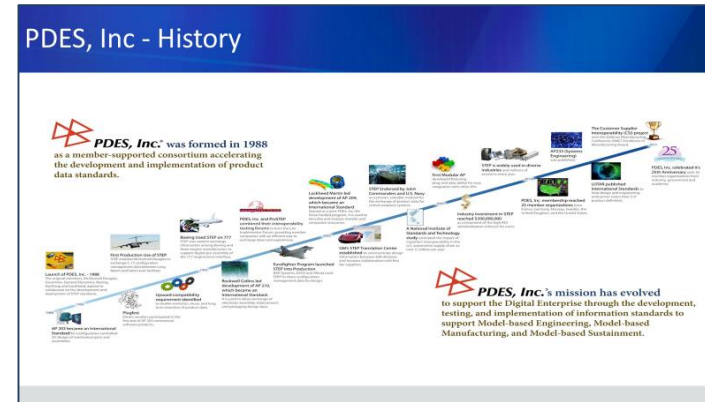
Collaboration

- **Standards Organizations**
  - ISO, NAS, EN

- **Industry and Government Entities**
  - NIST
  - INCOSE, NAFEMS, MTConnect
  - AFNeT, prostep ivip, OMG
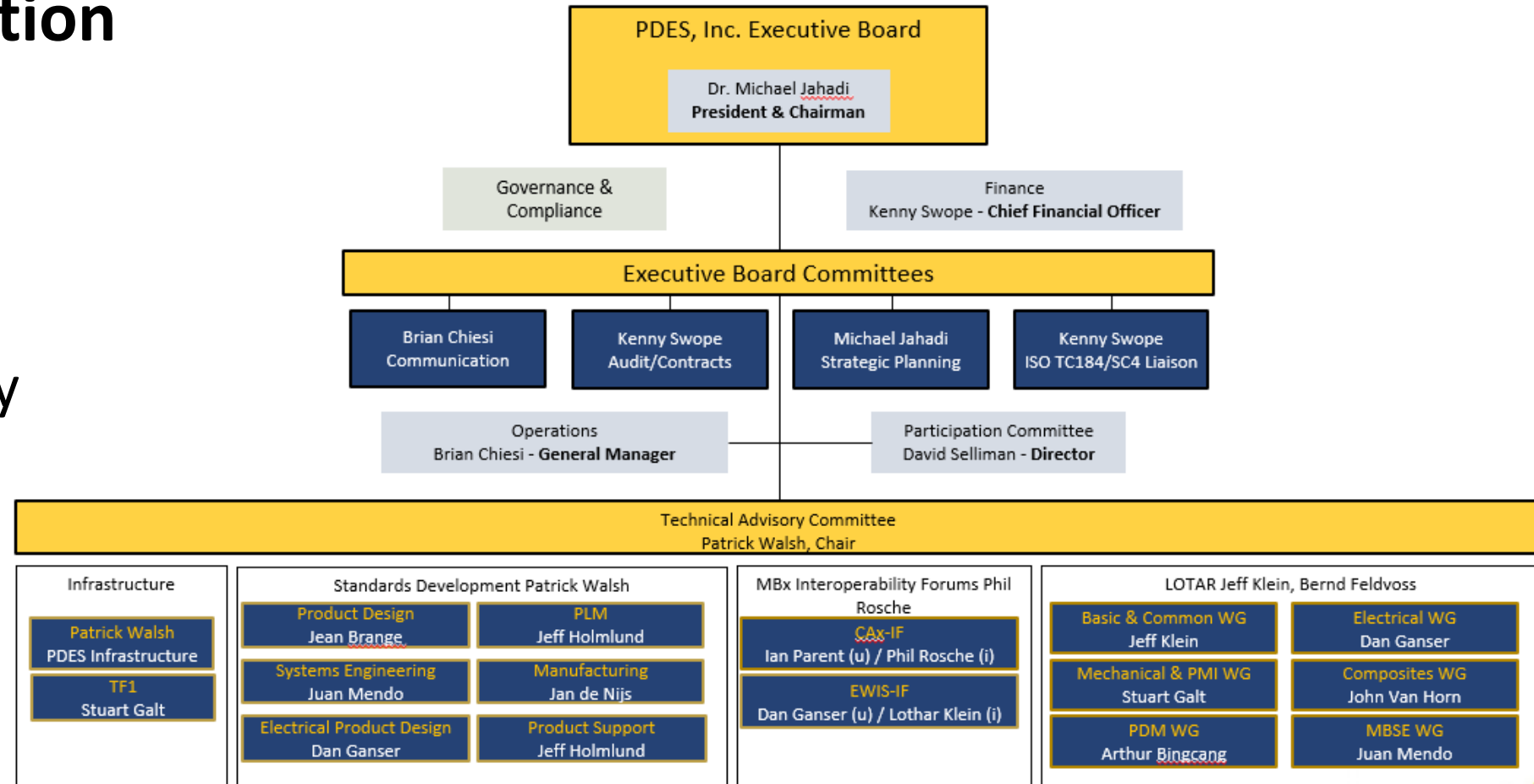 - MoD

- **Application & Solution providers**
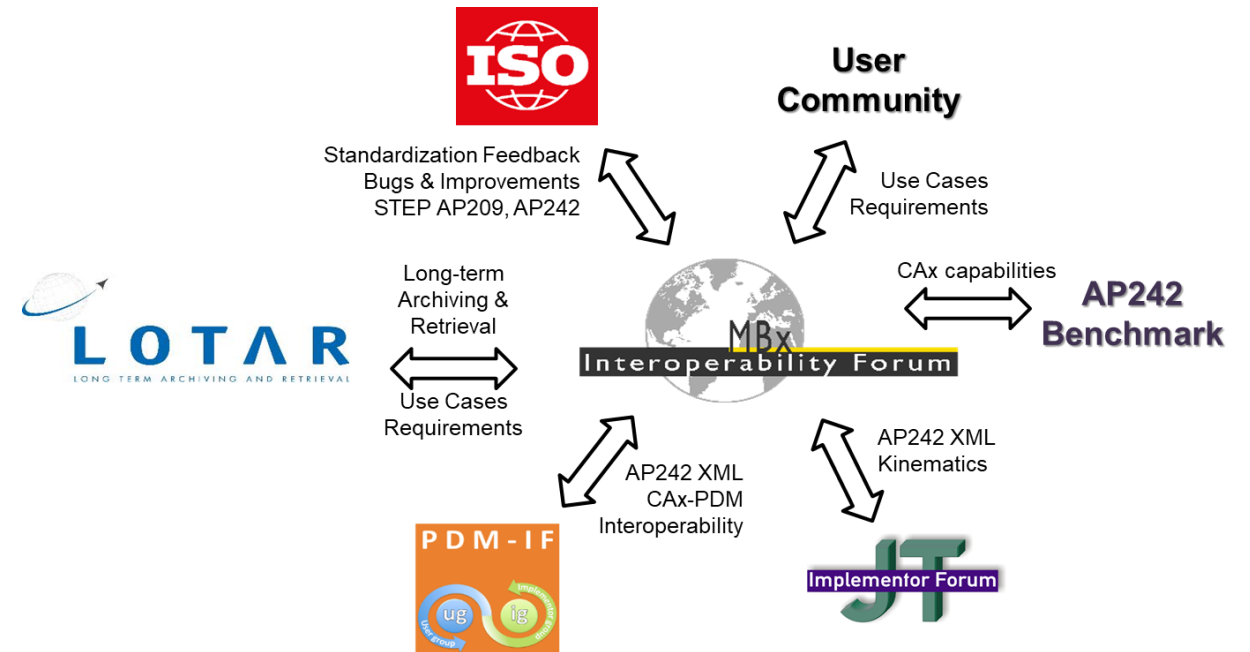
Goal: accelerate the development and implementation of data interoperability standards to enable digital thread

Organization Structure

- Focused on **execution**
  - Development
  - Collaboration
  - Implementation
  - Long term viability

- Integrated from Requirements to Archiving
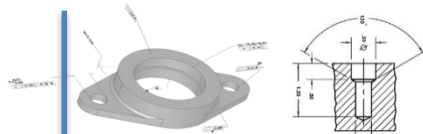

PDES, Inc. Executive Board

Dr. Michael Jahadi
President & Chairman

Governance & Compliance

Finance
Kenny Swope - **Chief Financial Officer**

Executive Board Committees

| Brian Chiesi Communication | Kenny Swope Audit/Contracts | Michael Jahadi Strategic Planning | Kenny Swope ISO TC184/SC4 Liaison |

Operations
Brian Chiesi - **General Manager**

Participation Committee
David Selliman - **Director**

Technical Advisory Committee
Patrick Walsh, Chair

Infrastructure	Standards Development Patrick Walsh		MBx Interoperability Forums Phil Rosche	LOTAR Jeff Klein, Bernd Feldvoss	
Patrick Walsh PDES Infrastructure	Product Design Jean Brange	PLM Jeff Holmlund	CAx-IF Ian Parent (u) / Phil Rosche (i)	Basic & Common WG Jeff Klein	Electrical WG Dan Ganser
TF1 Stuart Galt	Systems Engineering Juan Mendo	Manufacturing Jan de Nijs	EWIS-IF Dan Ganser (u) / Lothar Klein (i)	Mechanical & PMI WG Stuart Galt	Composites WG John Van Horn
	Electrical Product Design Dan Ganser	Product Support Jeff Holmlund		PDM WG Arthur Bingcang	MBSE WG Juan Mendo

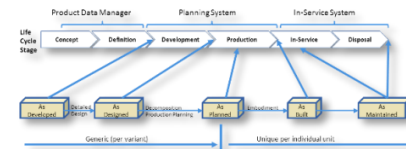# Technical Working Groups

Basic & Common Parts

EN/NAS 9300-001-099 series

Mechanical 3D CAD with Product and Manufacturing Information (PMI)
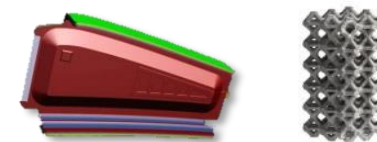
EN/NAS 9300-1xx series

STEP AP203 ed2
STEP AP214 ed3
STEP AP242 ed1 & ed2

Product Data Management (PDM)
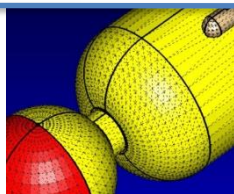
EN/NAS 9300-2xx series

STEP AP239
STEP AP242 ed1 & ed2

Composites and Advanced Manufacturing

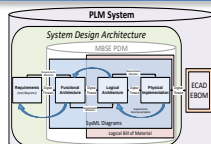**EN/NAS 9300-3xx series**

STEP AP203 ed2
STEP AP242 ed1 & ed2

3D Visualization

Requirements and Compliance Documents

Wiring Harness

EN/NAS 9300-4xx series
STEP AP242 ed2

Meta Data for Archive Packages

EN/NAS 9300-21
STEP AP239 ed3
STEP AP 242 ed2

Engineering Analysis and Simulation

 EN/NAS 9300-6xx series
STEP AP209 ed2

Model-Based System Engineering

EN/NAS 9300-5xx series
STEP AP233 ed2
STEP AP239 ed3
FMI, SysMl, etc.

Electronics (PCB, etc.)

EN/NAS 9300-700 series

Launch TBD

Mechanical Transport Elements (Tubing, Mech/Hydr., HVAC, etc.)
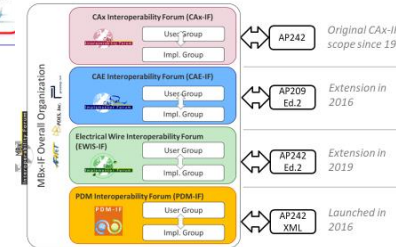
EN/NAS 9300-800 series

Launch TBD

Model Based Interoperability Forums

- Work across entire value stream

- Integrated
  - User, Implementor & Standards Groups

- Trusted – Closed testing
  - Interoperability testing
  - Identify errors, priorities, capabilities and requirements

- Test Results
  - Application coverage to STEP standard
  - In conjunction w/ Translators

Relation of the Interoperability Forums within the MBx-IF
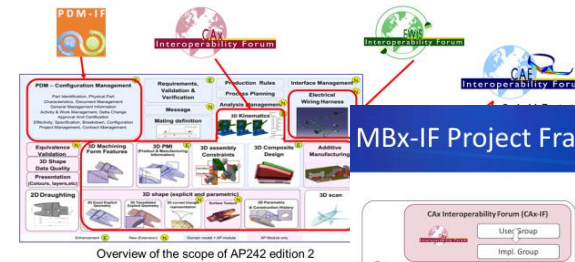
MBx-IF Project Framework

AP242 Coverage – Application Providers

AP242 Coverage – Applications w/Translators

- Publish EN/NAS 9300 series of LOTAR standards

- Develop methods, processes, and data models

- Develop recommendations and requirements of long-term archiving

- Work together:
  - Solution providers develop COTS capabilities
  - MBx-IF – testing, feedback, capability assessment
  - Standards teams – gaps, requirements, funded projects
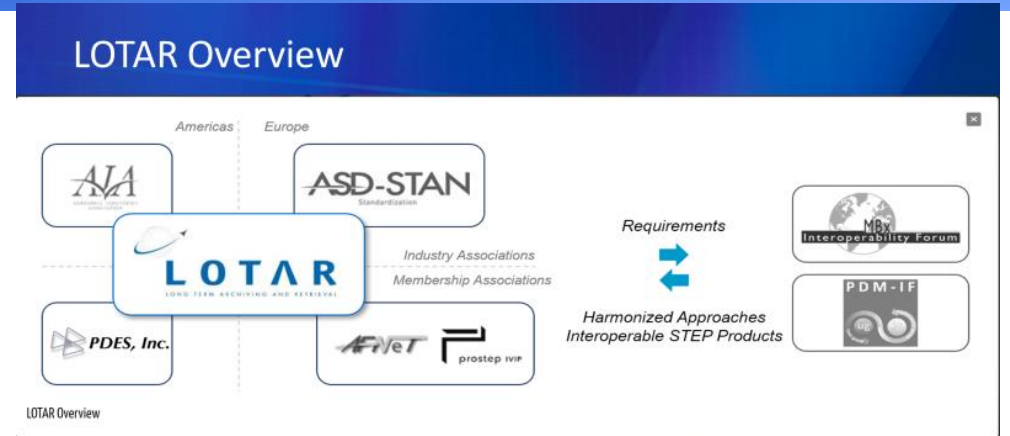
LOTAR Overview

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.

How does it all work
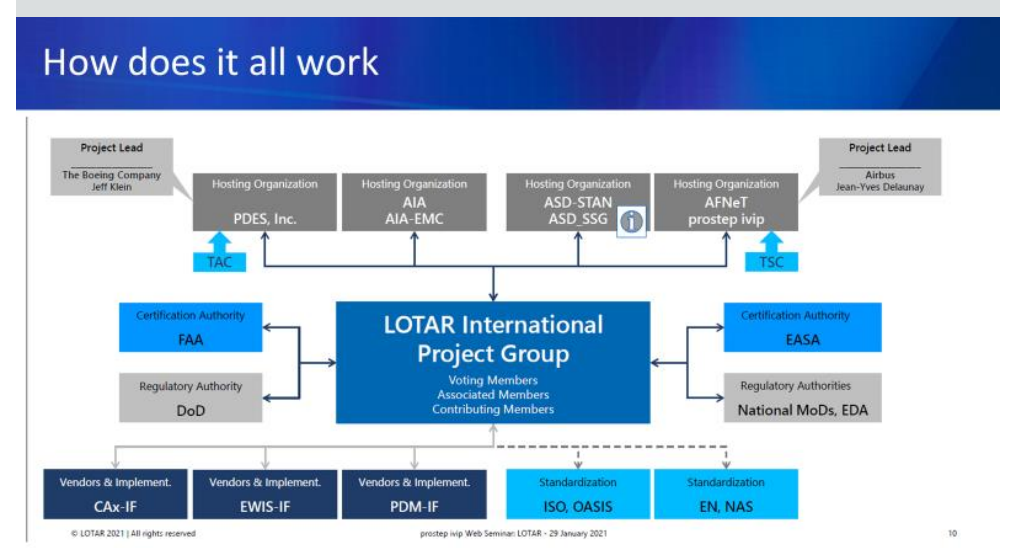
Benefits of Engagement …

- Technical Expertise
  – Underlying data structures
  – Intimate understanding of application interoperability capabilities
  – Best practices and procedures
- Support industry in moving standards forward
  – Requirements
  – Priorities
  – Resources … development, testing, implementation
- Accelerate digital collaboration
  – Supply and Partner ecosystem
  – Government data exchange
- Add leverage to the cause ….
  – Solution providers
  – Regulatory bodies

Reach out - PDES, Standards, LOTAR leaders ….

Summary

- Demand for digital transformation by customers and businesses

  – Business capabilities

  – Technologies

  – Integrated solutions

- Data creation – continues on Moore's Law

- Implementing Digital effectively/efficiently
  (add all the buzzwords - thread, twin, engineering, MBSE, manufacturing enterprise, etc)

  – What data is needed to meet business and regulatory requirements

  – Understanding digital products, formats, applications utilized in the ecosystem

  – Implement processes and data standards that minimize friction and replication

- There is no secret sauce … it is systemic issue we have to work together to solve

Applications, Data, People

Questions?

Contact Us

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PDES, Inc.
Connecting the Digital Enterprise

Model Based Manufacturing
Model Based Engineering
Model Based Sustainability

Contact us

Check us out

Overview of the scope of AP242 edition 2

On hold. Restart related to industry commitments

AP209 integrates 4 domains: CAD, CAE, SDM and PDM

SDM : Simulation Data Management
CAD : Computer Aided Design
CAE : Computer Aided Engineering
PDM : Product Data Management

AP209 includes the AP242 module, taking benefits of the STEP modular architecture

MBx-IF Project Framework
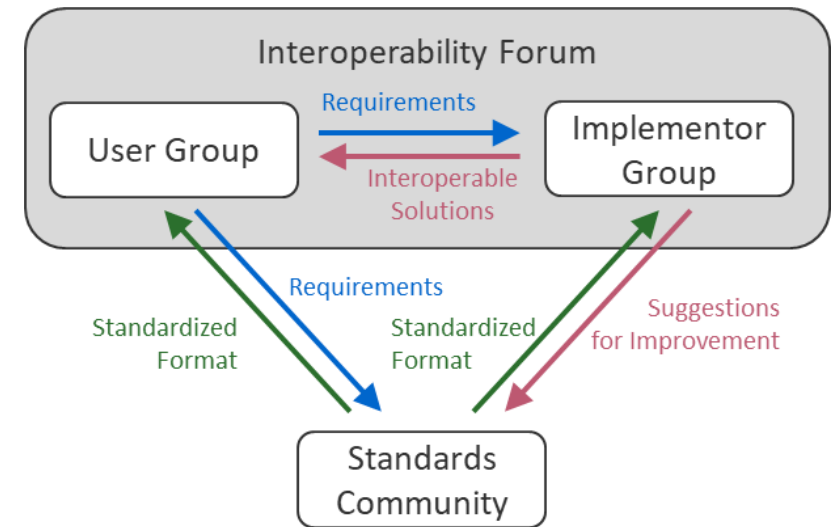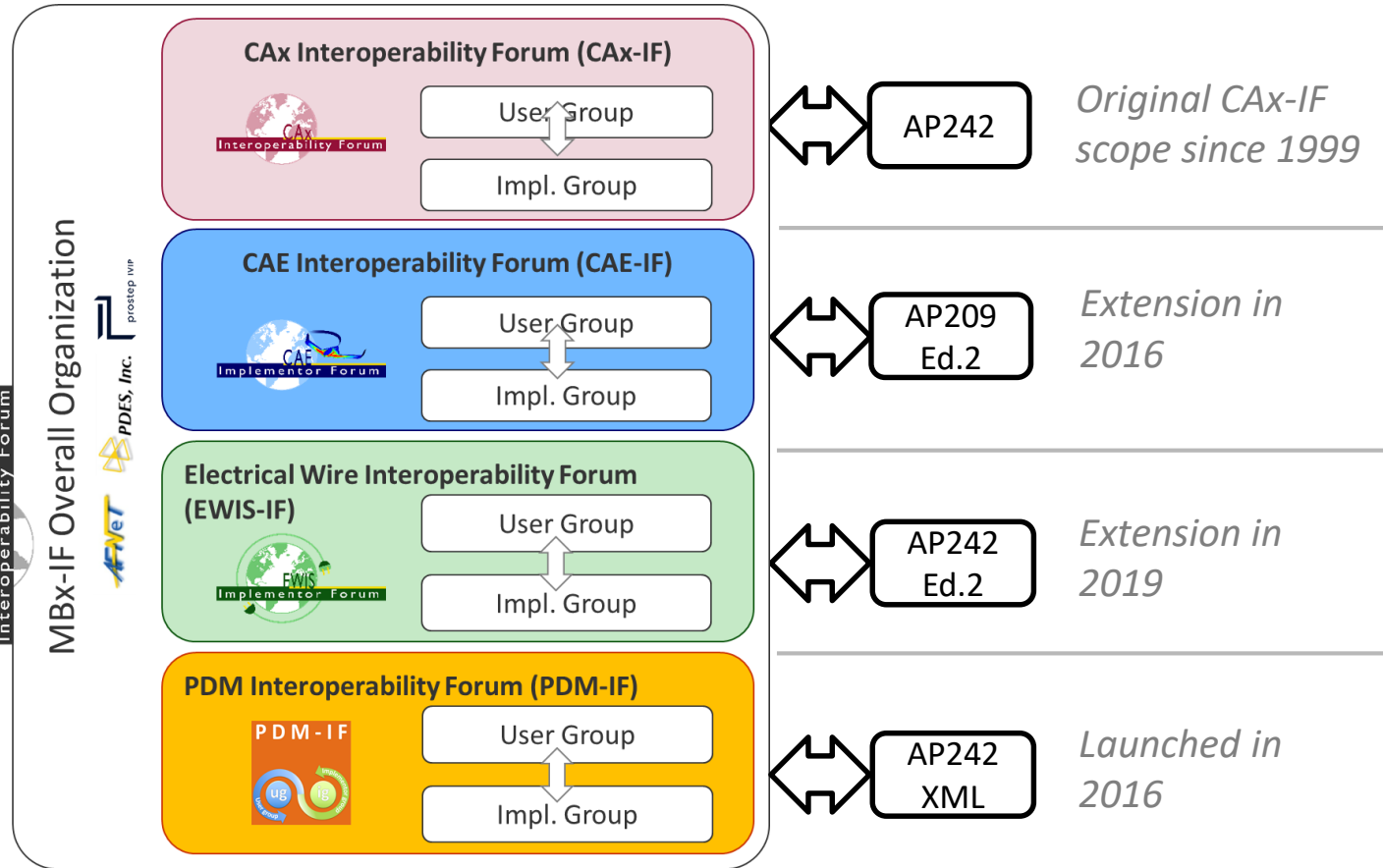
How Industry benefits from the MBx-IF

Member / Vendor Benefits

- Testing in a closed, trusted environment

- Early detection of errors leads to faster development cycles

- Beta-testing with other systems enhances product interoperability and robustness even before production release

- User requirements can be communicated, and common implementation approaches agreed.

User / Customer Benefits

- Stability of new capabilities
  - E.g. PMI Polyline Presentation: Since testing started in 2008, no major changes to implementation structure. Widely used in industry now!

- Early feedback on requirements
 - Concerning feasibility, and timeframe for support in various tools
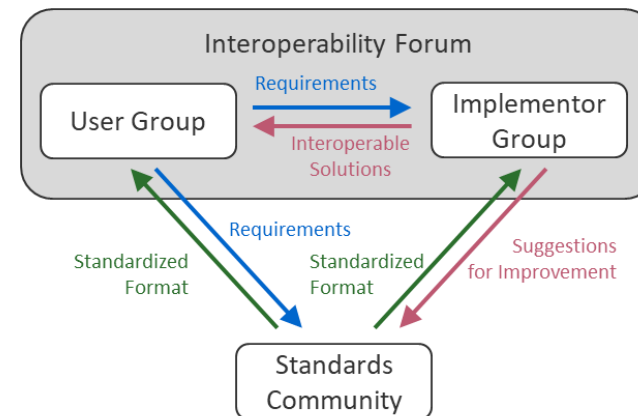
Goals of LOTAR

- Develop a **EN/NAS 9300 series of standards** for archiving and retrieval of product data

- Develop and submit **methods, processes, and data models** of 3D CAD and PDM data as ASD-STAN standard

- Develop **recommendations and requirements** of long-term archiving of 3D CAD and PDM data in industry

- Working with providers to have **COTS capabilities** in conjunction with MBx-IF and conjoined funded pilot projects

LOTAR Overview
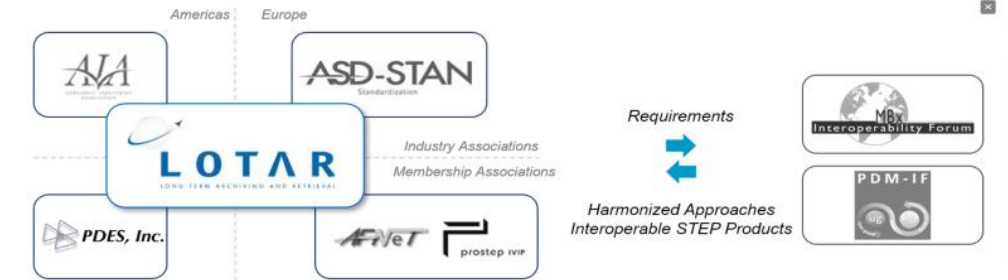
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LOTAR Requirements Structure

- Meeting the legal and business requirements of the aerospace and defense industry:
  - EN/NAS 9300 considers requirements coming from:
  - Legal and certification rules FAA-FARs, EASA-EARs, DoD & MoD requirements specifications
  - Regulations on long term archiving of technical documentation
  - Design Reuse
  - Support in operation

How does it all work
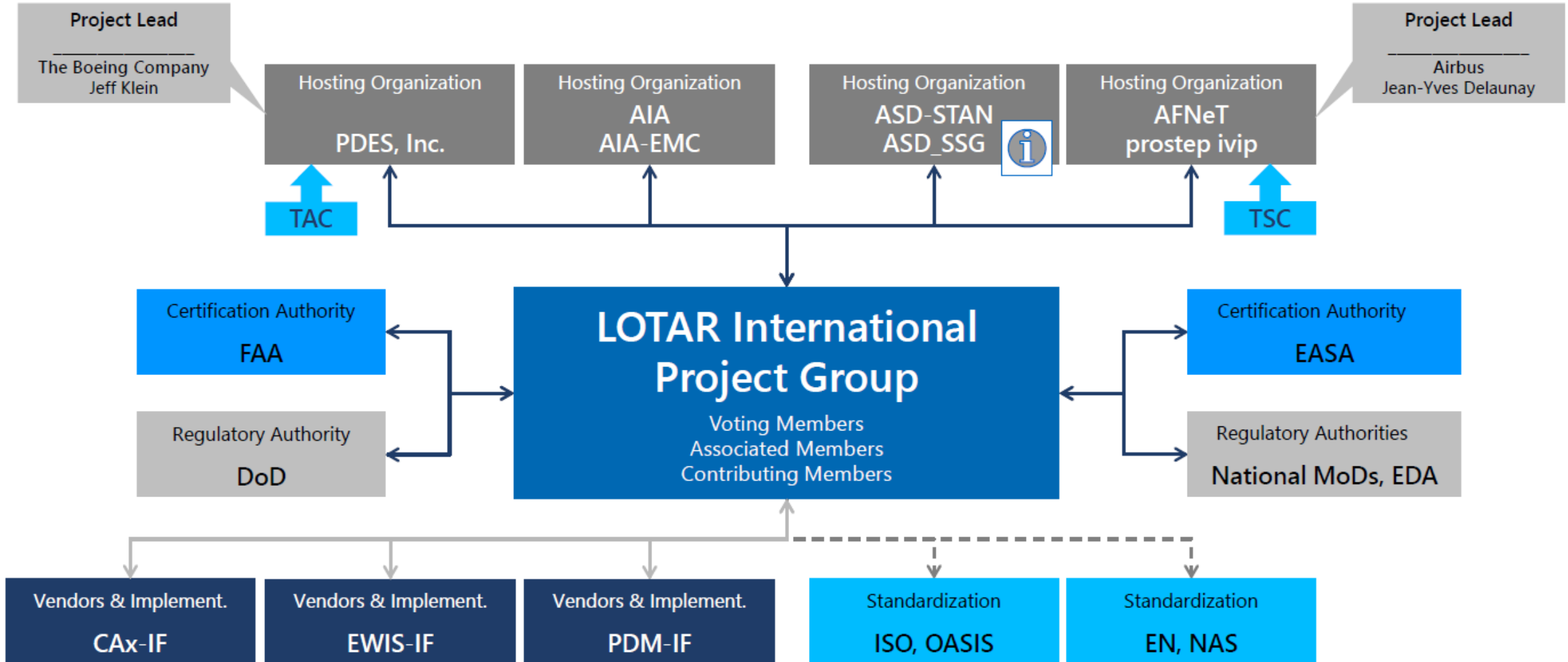
Conclusions

- Rapidly evolving **competitive, technological and regulatory environments** requires businesses to create, move and store data across disparate applications and systems with minimum friction and duplication

  - Increased Product and Systems Complexity
  - Global Collaboration
  - Evolving Technologies and Processes
  - Regulatory data retention and retrieval

- PDES, Inc. is uniquely positioned to **support members'** needs in identifying requirements. developing recommended best practices, and implementation test cases for **connecting the digital enterprise**

- More information on **PDES, Inc. -** pdesinc.org

AP242 Coverage – Application Providers

The CAx Implementor Forum is significantly improving STEP translator quality and decreasing translator time-to-market

MBx Interoperability Forum

CAx Interoperability Forum

User Group

Implementor Group

Implementation Support

Participating Vendors

AP242 Implementation Coverage

CAE Interoperability Forum

EWIS Interoperability Forum

MBx-IF Calendar

Links

❘ AP242 IMPLEMENTATION COVERAGE

This page will provide an overview of which capabilities - based on MBx-IF Recommended Practices - are supported in the production versions of the CAD systems and STEP translators participating in the CAx-IF testing.

Show information for: Dassault Systèmes (3DEXPERIENCER2023x FD01) ⌄

Combine with: --- None selected --- ⌄

Dassault Systèmes (3DEXPERIENCER2023x FD01)
Last updated: 9 Mar 2023

Recommended Practices Functionality	AP203 Ed.2 Import	AP203 Ed.2 Export	AP214 Ed.3 Import	AP214 Ed.3 Export	AP242 Ed.1 Import	AP242 Ed.1 Export	AP242 Ed.2 Import	AP242 Ed.2 Export
AP242 BO / Domain Model XML Assembly Structure								
Part Properties					X	X	X	X
Document Properties					X	X	X	X
Simple External References					X	X	X	X
Nested External References					X	X	X	X
User-Defined Attributes					X	X	X	X
Validation Properties					X	X	X	X
AP242 BO / Domain Model XML Kinematics								
Geometry								
Wireframe	X	X	X	X	X	X	X	X
Geom. Bounded Surface Model	X	X	X	X	X	X	X	X
BREP Solid	X	X	X	X	X	X	X	X
3D Tessellated Geometry					X	X	X	X
Assembly Structure	X	X	X	X	X	X	X	X
Alternative Shapes								
Alternative Representations for same Shape					X	X	X	X
Composite Material								
Basic Composite (Ply Laminate Table)	X	X			X	X	X	X
Cartesian Rosette	X	X			X	X	X	X
Rosette Guided by a Curve							X	X
Ply Shape Explicit Contour	X	X			X	X	X	X
Ply Shape 3D Tessellated Representation					X	X	X	X
Composite Material	X	X			X	X	X	X
Core Solid	X	X			X	X	X	X

AP242 Coverage – Applications w/Translators

Membership Levels

Membership Requirements

Most PDES, Inc. members pay annual dues and participate in the consortium's technical activities.

The table below summarizes the financial requirements for each type of membership. Note the Industry category is sub-defined by size and type of business in order to allow for variations in the annual dues.

First year membership dues are payable at the start of the participant's term; the second and subsequent years' dues are payable on the anniversary of the start date.

Participant Type	Participation ID	Organization Type/Size	Term	Fee	Board Seat
Industry	Industry 1	Corporate User - Sales Greater than $1B	2 Years	$50K	Yes
Industry	Industry 2	Corporate Division Users - Sales Greater than $1B	2 Years	$35K	Yes
Industry	Industry 3	Corporate User - Sales Between $100M-$1B	2 Years	$25K	Yes
Industry	Industry 4	Corporate User - Sales Less than $100M	2 Years	$15K	Yes
Industry	Industry 5	Solution Provider - Sales Greater than $50M	2 Years	$25K	Yes
Industry	Industry 6	Solution Provider - Sales Less than $50M	2 Years	$6.3K	Yes
Industry	Industry 7	Small Manufacturing User - Less than 500 Employees	2 Years	$3K	No
Government Associate	Govt Agency 1	DoD, DoE, Natl Labs - Sales N/A	2 Years	$25K	Yes
Universities & Community Colleges	Academic Associate	Endorsed by an Industry Participant	2 Years	No Fee	No
Non Profit Associate	Industry Consortium	Endorsed by an Industry Participant	1 Year	$15K	No

Organization Types:

• "User" is a commercial entity that utilizes STEP/LOTAR standards in conducting its business operations – for example by using CAD, CAM, CAE tools

• "Solution Provider" is a commercial entity that develops and/or sells STEP-related software products and interfaces

• "Small Manufacturing User" is an entity that is typically a supplier to a "User" company, a Small and Medium Enterprise

For more information about PDES, Inc. membership requirements, please contact General Manager Brian Chiesi.

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