A Solid “STEP” Forward to Model Based System Engineering (MBSE) using STEP AP242

David Selliman - CoreTechnologie

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2019

Agenda

- Corporate Overview of CoreTechnologie
- Understanding the birth of STEP AP242 and its future
- Case Study – How Airbus implemented STEP AP242
- Technical Packages
- Demo - How CoreTechnologie fits into STEP AP242 implementation
- Q & A

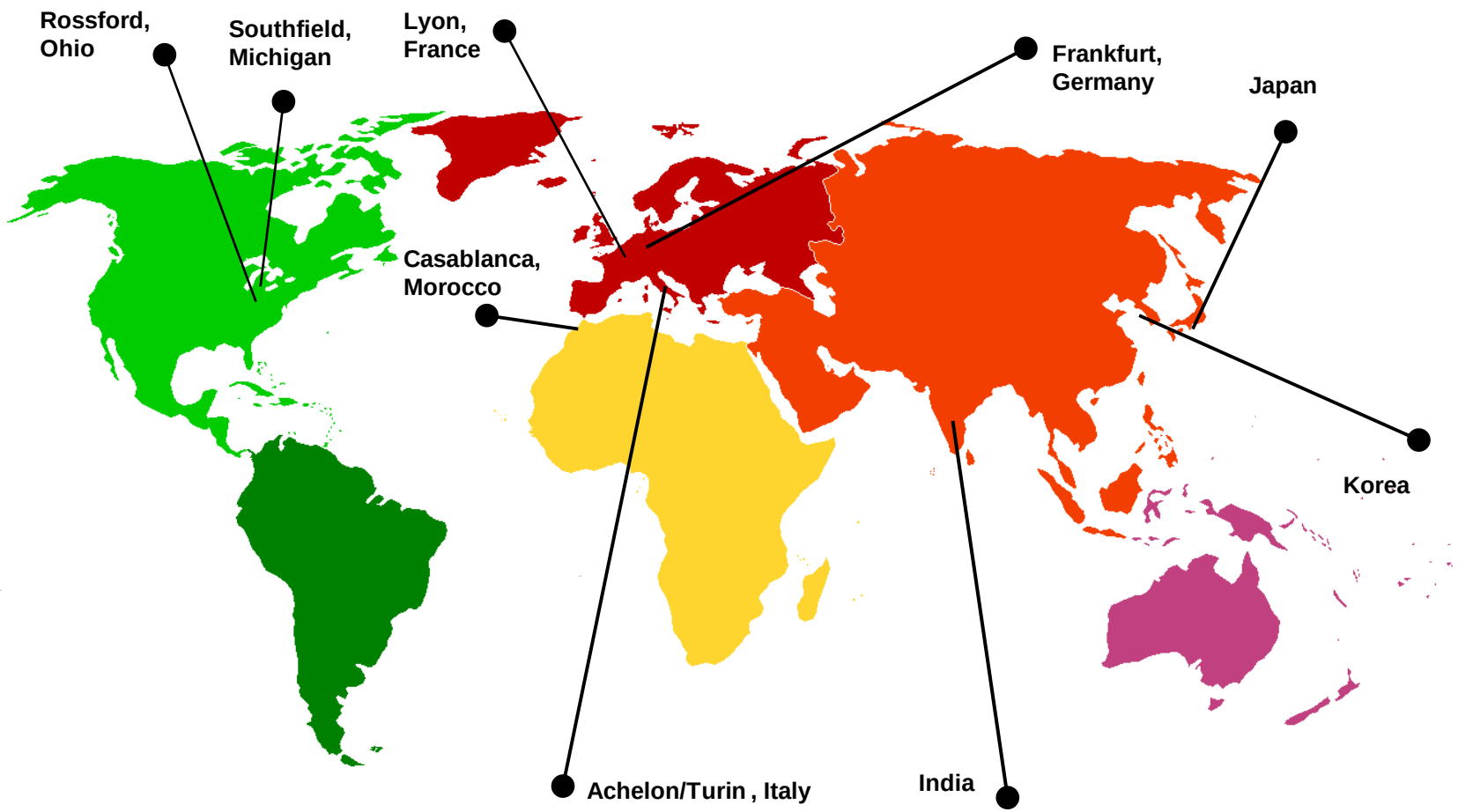
What you will learn?

- Creating established views of what was known as pages of 2D drawings
- Allowing the STEP AP242 format to be used from in the Product Lifecycle
- Why not STEP AP203 as it is widely used in the interoperability space?
- Assist in Technical Packaging
- STEP AP242 Converges with AP203 and 214

Company Outline

- Name : CoreTechnologie Group
- Headquarters : Frankfurt, Germany
- Founded in : 1997
- Key resources : Dominique Arnault, COO
  Armin Brüning, President
  Gauthier Wahu, CTO
  David Selliman, Vice President of North America
- Business : Products
  - 3D_Evolution - 3D CAD Interoperability Suite
  - 3D_Analyzer - 3D CAD Viewing & Analysis Tool
  - 3D_Kernel_IO - Software Development Kit
  - Data conversion service
  - Client-specific process integration
- CoreTechnologie prides itself as a private corporation which is 100% debt free

Global Footprint



Mission and Vision

- CoreTechnologie Vision:

✓ Keep innovating to offer the latest and the most sophisticated CAx 3D products and services
✓ Take the CAx 3D interoperability field to a new dimension through value added modules and services

- CoreTechnologie Mission:

✓ Effortless Interoperability: Enable a flexible and easy data Exchange for partners at all levels
✓ Help organizations streamline their PLM process
✓ Shape the technology to optimize CAx 3D

Product Outline

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CAD API Libraries

- Feature Based Reading
- Native reading of all CAD systems: B-Rep, PMI, Metadata
- Software Development Kit for reading CAD Interfaces
- All major CAD formats
- C++ Data Structure
- Simple Integration

CAD Data Conversion

- Native reading of all CAD systems: Feature based, B-Rep, PMI, Metadata
- Feature-based conversions
- VDA Checker with healing
- Geometry simplification
- All 3D Analyzer Modules
- Batch Processing
- FEM Tools suite
  - De-featuring
  - Meta-face
  - Mid-face

3D Viewer

- Enables viewing of Feature based models
- Native reading for all CAD systems: Feature based, B-Rep, PMI, Metadata
- Markup with Measurements
- 3D Analyzer Modules
  - VDA Checker
  - Collision Detection
  - Model Comparison
  - Wall Thickness Checker
  - Backlash

4D Additive

- Data import and repair
- Metal printing
- Lattice structures optins (honeycomb, octet or centerpoints)
- Nesting and smooth surface
- Direct modeling
- De-featuring
- Wall Thickness Checker
- Backlash

Native Interfaces

- CATIA V4
- CATIA V5
- CATIA V6
- PRO/E / CREO
- Siemens NX
- IDEAS NX
- SolidWorks
- Inventor
- STEP
- ACIS
- XT – Format
- JT – Format

- CADDS
- IGES
- DWG
- 3D PDF
- 3D XML
- Rhino
- VRML
- FBX
- PLMXML
- STL
- DGN
- STEP242

All standard and native interfaces are developed and maintained by CoreTechnologie ensuring guaranteed support of the newest CAD format versions.

3D_Evolution reads assembly structure, attributes, B-REP solids, feature history, PMI, and skins as well as tessellated models.

Why a standard format?

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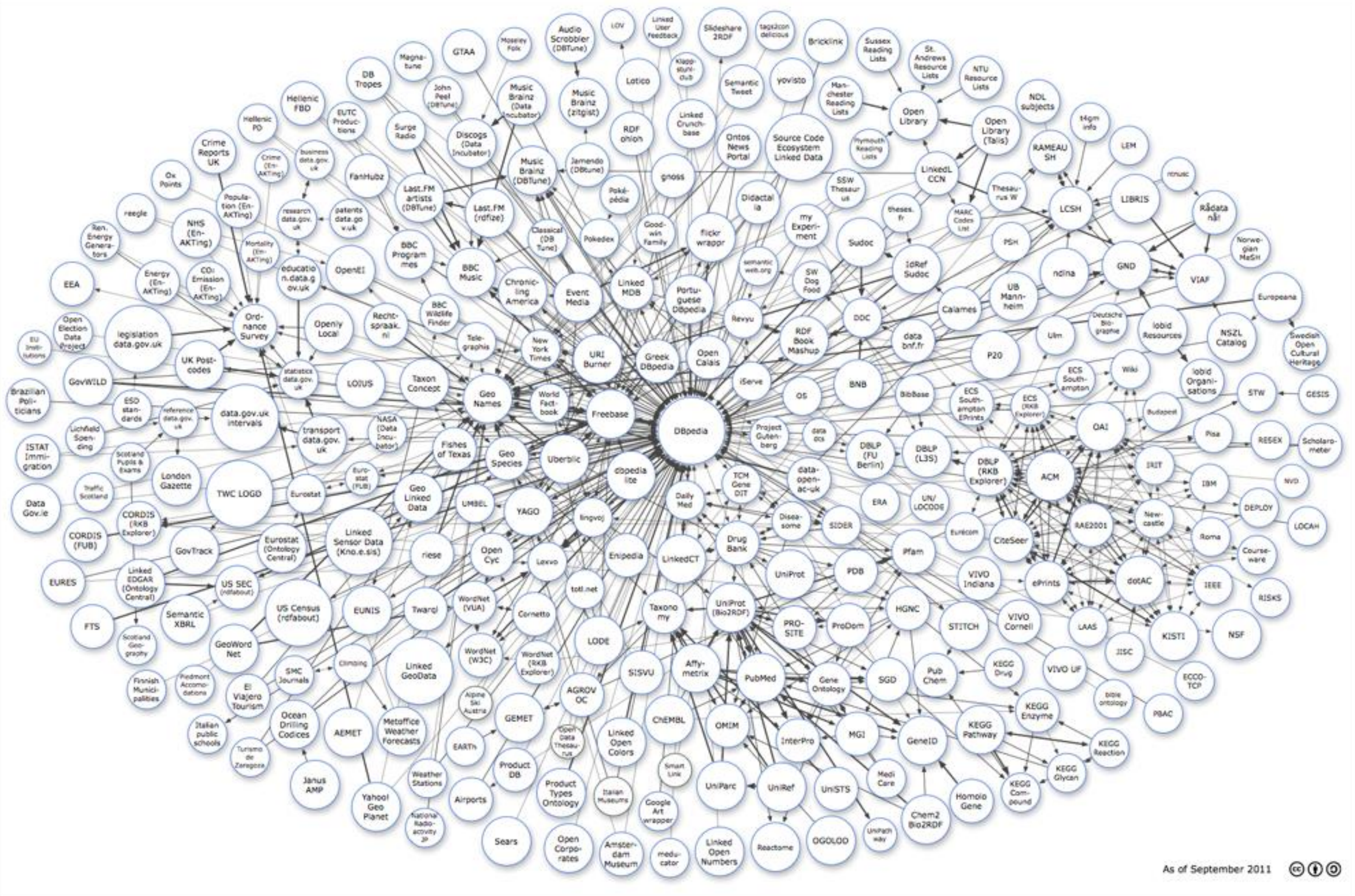

The birth of STEP AP242

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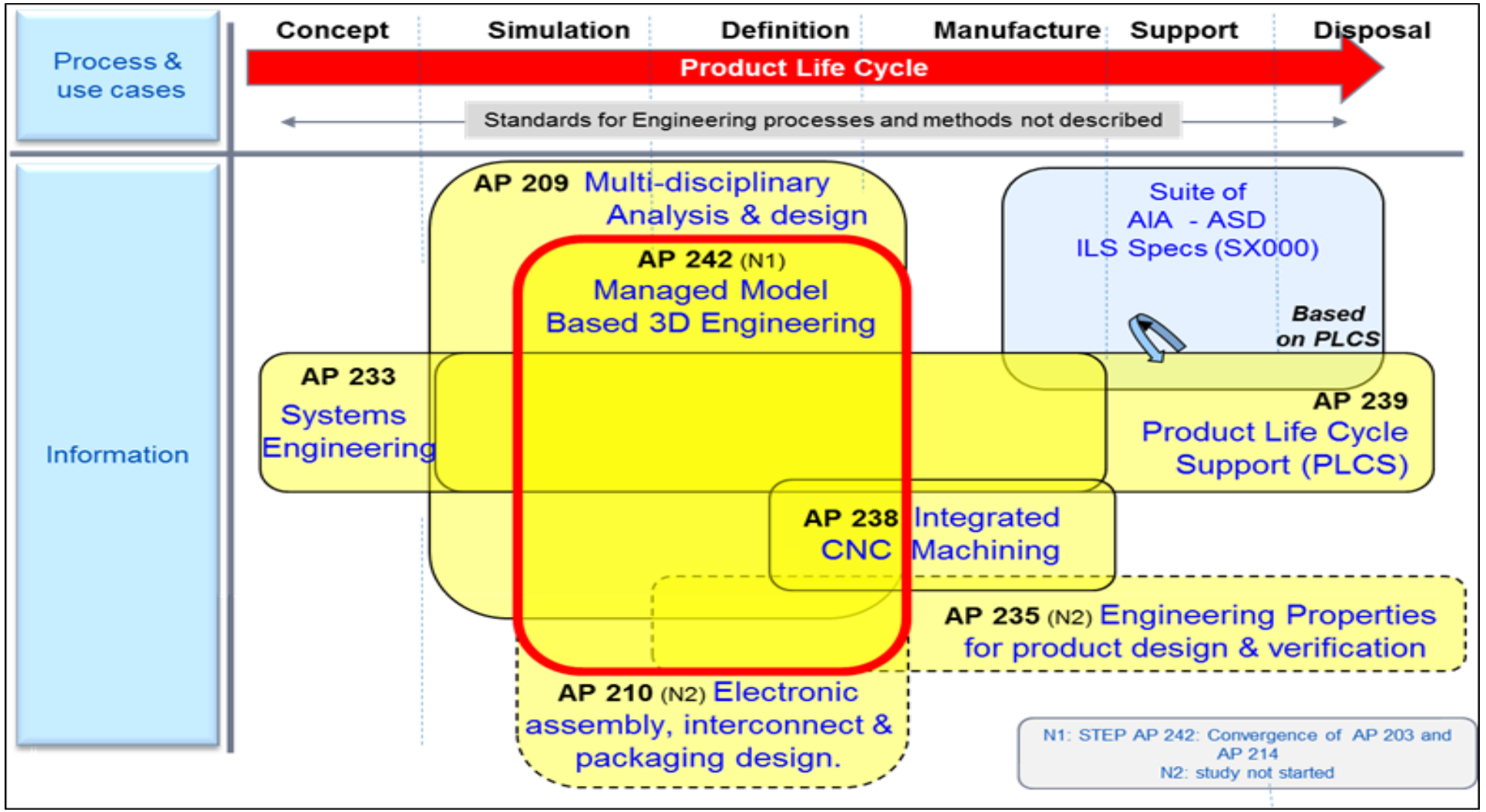

CAx Implementor Forum: V & V of Use Cases

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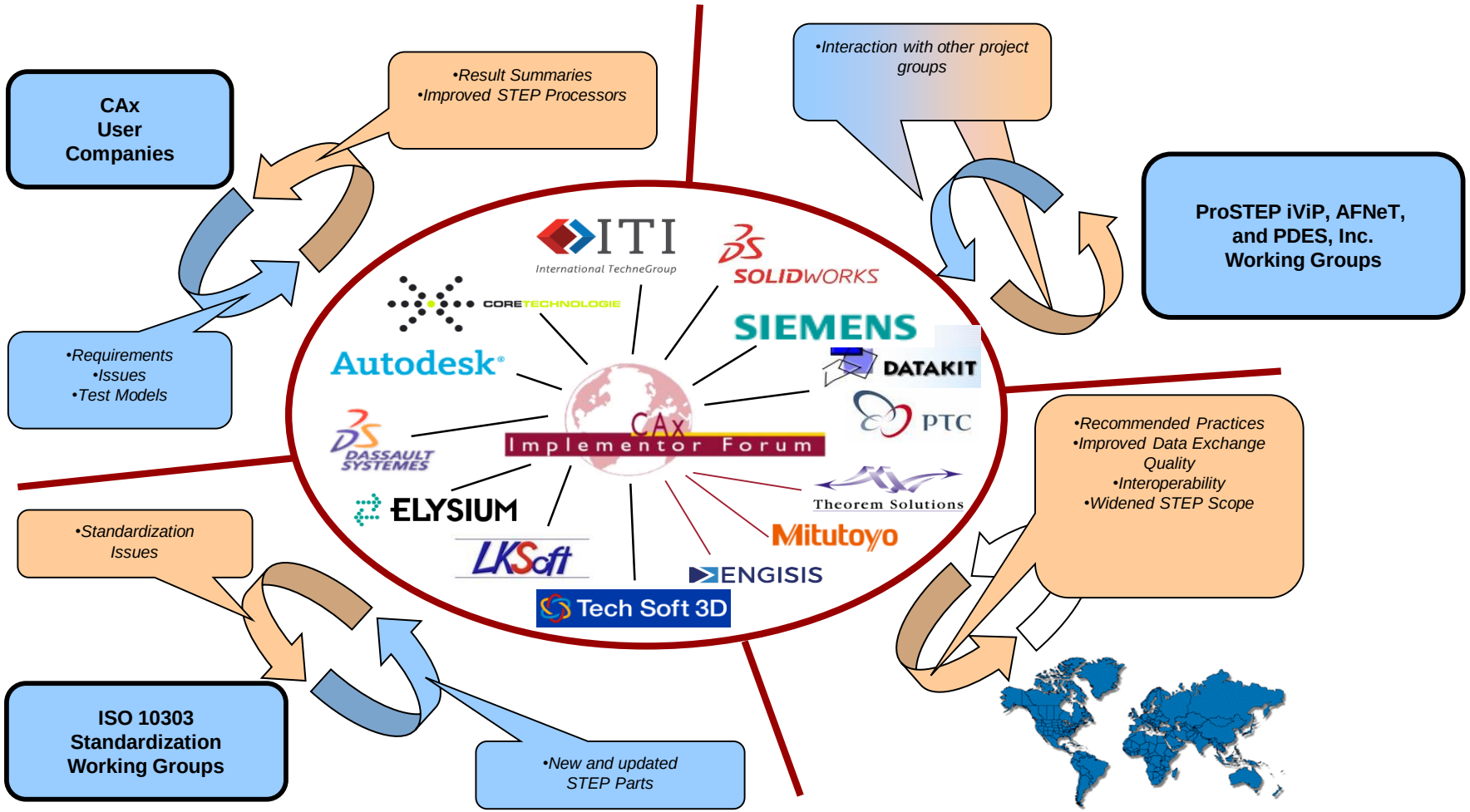
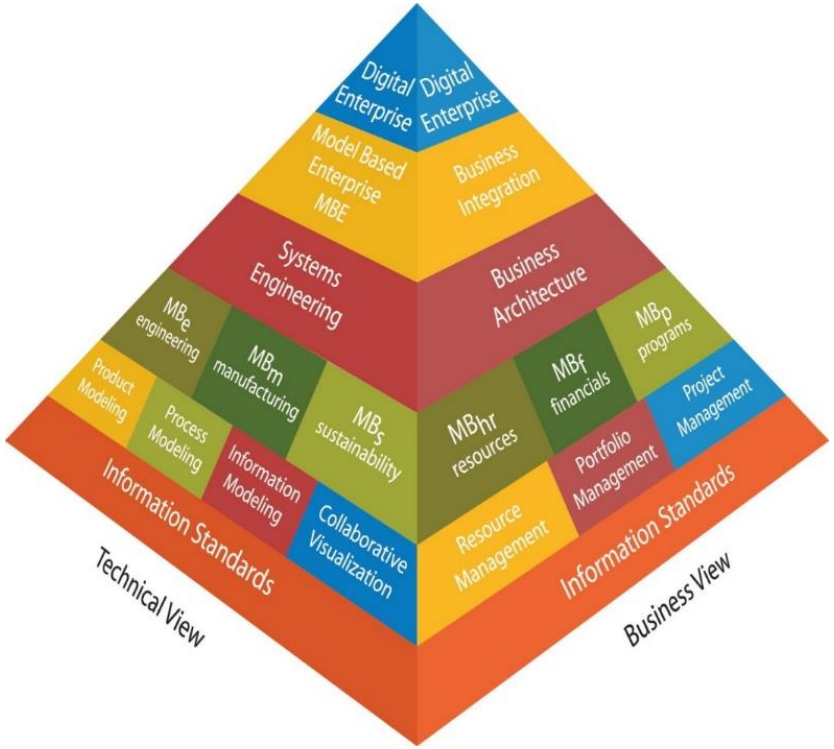


PDES, Inc./LOTAR Participation Overview with Boeing

Building the Digital and Sustainable Enterprise

- Built on open standards
- Recognize multiple views of the data
- Provide data security
- Protect intellectual property
- Independent of process
- Independent of tools
- Independent of language



Do we recognize how much value we generate when we do this right?

PDES, Inc. Organizational Structure

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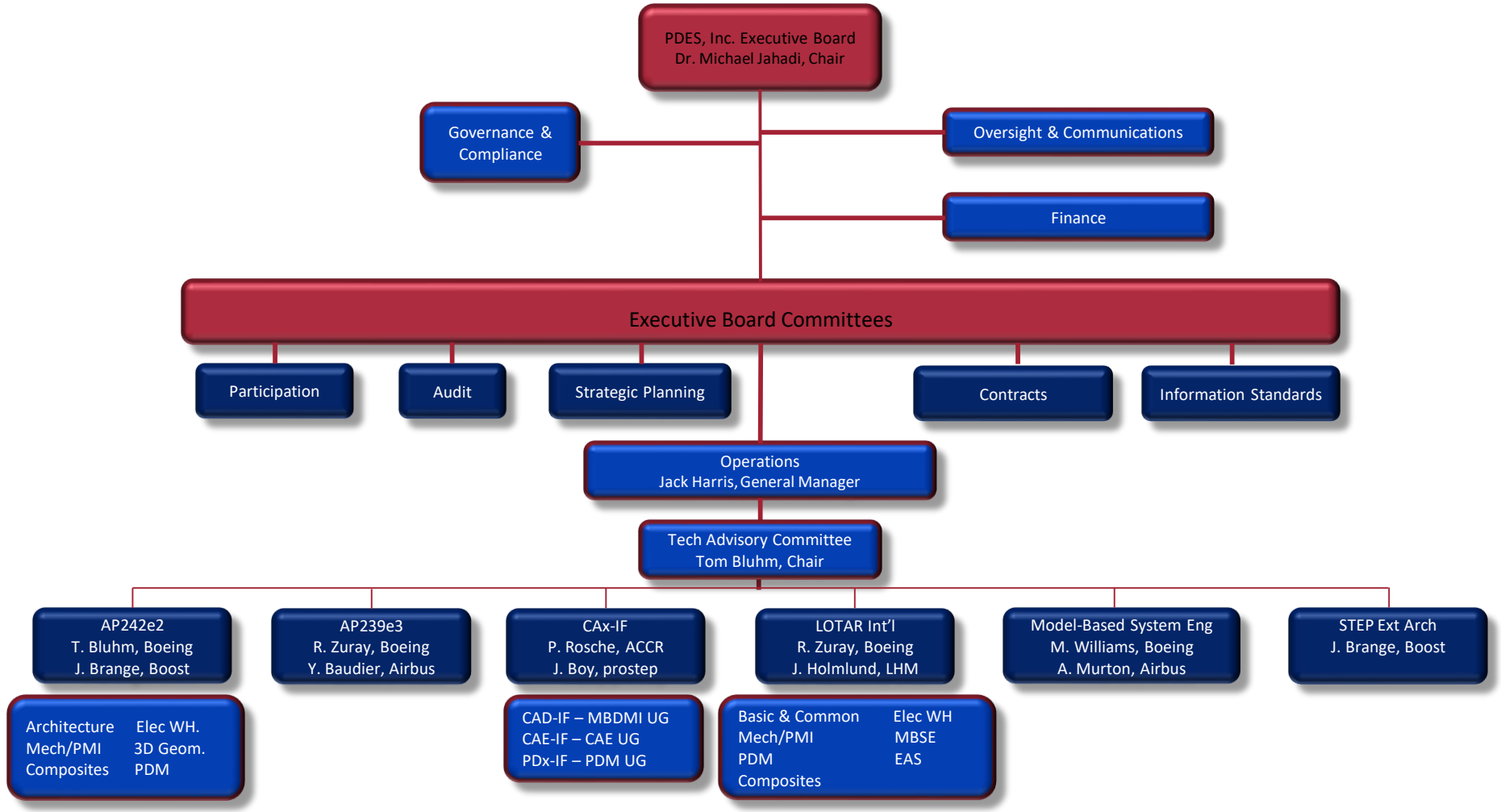

Proposed Projects for Technical Management Plan: Aug 2019 to July 2021

- Board & TAC Initiatives
  - Technology Management Plan (TMP)
  - Web Development Team – PDES Web site recommendations
  - Education/Outreach – Educational Requirements
- STEP Extended Architecture
  - Information Technology – Development Environment Services
  - Quality & Maintenance – SMRL Quality Initiative
  - Technology Roadmap – ISO 10303 5-yr roadmap
- ISO 10303 Development
  - Part 59 Edition 3
  - AP209 Edition 3/4
  - AP239 Edition 3
  - AP242 Edition 3
  - AP243/MOSSEC
  - Part 4000
- LOTAR
  - Project Management
  - Model-Based System Engineering (MBSE) WG
  - PDM WG
  - 3D Mechanical & PMI WG
  - Engineering Analysis & Simulation (EAS) WG
  - Electrical Wire Harness (EWH) WG
- Implementor Forums
  - MBx-IF – CAD/CAE (active)
  - MBx-IF – User Group (new)
  - EWIS-IF (new)
  - EWIS-IF – User Group (new)
  - PDM-IF (new)

Memorandum of Understandings (MOUs)

- Summary of the various MOUs and expected value
- MOU:
  - NAFEMS MOU Signed on September 25, 2018.
    - PDES, Inc. signed an MOU with NAFEMS to collaborate on Engineering Analysis and simulation.
  - INCOSE MOU signed on January 10, 2018
    - INCOSE and PDES Inc. Announce Collaboration to Accelerate Data Exchange in Model-Based Systems Engineering Environments.
  - 3DPDF MOU signed on February 1, 2016
    - Support of project work through joint projects and activities
  - AFNeT
    - Supports ISO 10303 development and Implementor Forums
  - prostep, ivip
    - Supports Implementor Forums and joint projects for ISO 10303

Summary

- The successful implementation of ISO STEP and LOTAR standards by the US and EU A&D industries relies on the governance through time of the suite of ISO product data exchange standards:
  - –ISO 10303: AP242 e2, AP209 e2, AP239 e3, AP238 e2, etc.,
  - –completed by other standards such as QIF, SysML, FMI, etc.
  - ➔ need to prepare 5-year roadmap of these standards and the associated portfolio management

- Need to consolidate the use of the STEP Extended Architecture, using SysML for information modeling, easing the extension to different implementation forms (services)

- Extension of PDES, Inc. support to the CAx, PDM and future Implementer Forums

Board and TAC Representatives

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Company	Board member	TAC Member
Airbus	Jean Pierre Souzy	Jean-Yves Delaunay
BAE Systems	Malcom Carrie	Malcom Carrie
Boeing	Brian Chiesi	Kenny Swope
Boost Conseil	Jean Brange	Jean Brange
CTCoreTechnologies	David Selliman	David Selliman
Dassault	Jacques Heinisch	Alain Roche
Elysium	Annalise Suzuki	A. Suzuki, Yasuhiro Asano
Engisis	Xenia Fiorentini	Sylvere Krima
Eurostep	Nigel Shaw	Phil Spiby
GE Aviation	Jaswinder Walia	Julian Chultarsky
Gulfstream	Dan Ganser	Dan Ganser
ITI	Don Hemmelgarn	Asa Trainer
Jotne EPM	Kjell Bengtsson	Kjell Bengtsson
Lockheed	Michael Jahadi	Jeff Holmlund
Mitutoyo Americas	Larry Maggiano	Larry Maggiano
PTC	Darryn Kozak	Mark Fischer

Organization	Board member	TAC Member
NASA	Jon Halladay	Kurt Woodham
NIST	Howard Harary	Bob Lipman
Sandia	Ty Christie	Ty Christie
Theorem Solutions	Stuart Thurlby	Trevor Leeson
Purdue	N/A	Nate Hartman
Wichita State	N/A	Shawn Erkstein
GATech	N/A	Chuck Zhang

Accomplishments

- Program level accomplishments:
  - NAFEMS MoU
  - INCOSE MoU
  - Project resource requirements developed
  - Study and recommendations for moving to new development environment complete
  - Road mapping activity started
  - Four Press releases
  - Reviewed 45 proposals for TIM meetings to select best value
  - Surveys/lessons learned for two annual meetings

- TAC and Project Level accomplishments
  - Four AP242 Steering committee meetings
  - Four LOTAR Steering committee meetings
  - Two AP239 Steering Committee meetings
  - Hundreds of weekly, biweekly and monthly team meeting conference calls for LOTAR WGs, CAx-IF, AP239, AP242, MBSE
  - Hundreds of issues and comments addressed for standards under development for ISO, AIA (LOTAR)
  - Comments submitted for ISO parts
  - Two rounds of CAx-IF testing and updates to recommended practices
  - MOSSEC proposed as new project and ISO standard
  - MBSE proposes new LOTAR/AIA standard

Technical Management Plan

PDES, Inc. and LOTAR

International

LOTAR 5 Year Development Roadmap

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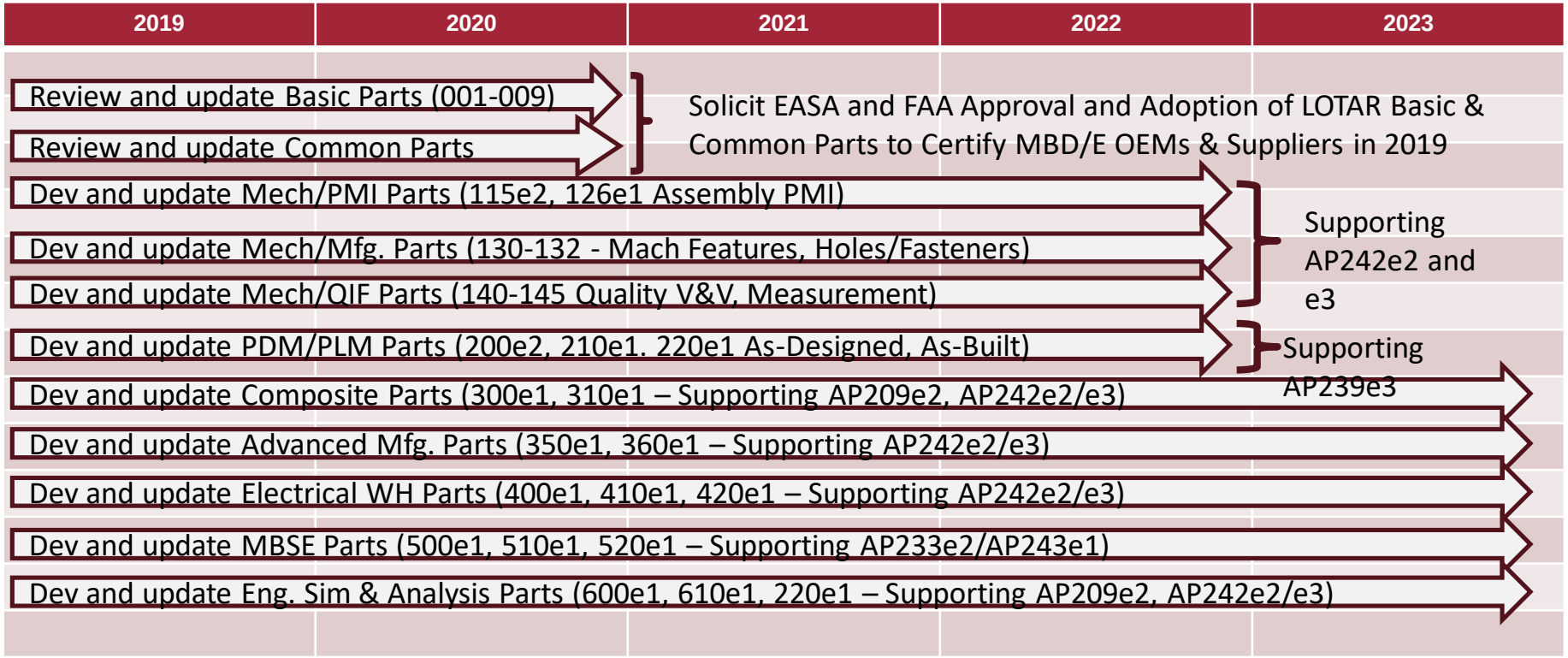

ISO 10303-239ed3

Scope:
- Activity Model
- Conceptual Model
- Domain Model
- Core Model
- Architecture
- STEPMod Support and Enhancement
- AP242/AP239 Harmonization
- Core Technical Capabilities used by AP239 ed3, AP242 ed2 and Common CTCs

Objectives:
Extend and enhance the scope of AP239 to include ILS S-Series Documents
Propose and use an updated STEP architecture
Harmonization between AP242 ed2 and AP239 ed2.
Resolve Gaps from harmonization activity
Common set of Core technical Capabilities

Participants:
Boeing, Airbus, Lockheed, Boost, NIST, AIA, ASD, ILS, etc. (see spreadsheet).

Strategic Alignment:
2. Develop and/or endorse standards that support the Digital Enterprise (DE)
    2.2 Harmonize with and support other standards focused on the DE.
    2.3 Maintain and update relevant standards
3.0 Increase the value of the PDES Organization
    3.3 Explore partnering with similar organizations

Major Deliverables by Quarter:
Q3 2017
- CD Complete Aug 31
- STEP New Architecture

Q4 2017
- AP239 ed3 CD Ballot
- AP239 ed3 comments discussed/resolved during ISO TC184/SC4 meeting in Korea, Nov 2017.
- AP239 Edition 3 DIS Started

ISO 10303-59ed3

Scope:
Part 59 concerns the equivalence validation of two sets of product data. A NWI to develop ISO 10303-59 ed3 was approved 30 JAN 2019.
Initial capabilities have been included in AP242 e2. The new edition is an intermediate step to enhance Product Data Quality capabilities. The new capabilities will become part of AP242 e3. This project support the continue development of this Product Data Quality standard.
Part 59 provides a means to define product data that can be validated and guaranteed. The next version will enhance capabilities as an intermediate step that focuses on manufacturability, quality of PMI data, and quality of polygon data.

Objectives:
1. Work with experts to clarify industry requirements
2. Prioritize data types to be in scope of Part 59 e3
   - Thin Solid Volume, Thick Solid Volume
   - Narrow Solid Space, Narrow Step
   - Tiny Round Faces, Tiny Hole Faces
   - Under cut, Lack of Draft Angle, etc.
3. Part 59 CD ballot, Q4 2019
4. Develop requirements for revised and new Application Modules
5. Develop AMs
6. Integrate AMs with AP242 e3

Potential Participants:
1. Japan PDQ Committee, 2. Boeing, 3. Airbus, 4. Sweden SME

Strategic Alignment:

Major Deliverables by Quarter:
2019 Q3 : Prioritized Data Types
2019 Q4 : Part 59 CD
2020 Q4 : Revised AMs
2021 Q2 : New AMs
2022 Q1: Part 59 capabilities integrated into AP242

AP209 ed3/ed4

Scope:
- Publication of AP209 ed3
- Recommended practices for structural testing and sensor integration using AP209 ed3
- Prepare proposal for AP209 ed4
- Perform piloting with industrial test data for NASTRAN, Ansys, Abaqus and Catman/sensor for structural testing

Objectives:
1. Align AP209 with edition 2 of AP242
2. Improve AP209 document quality
3. Identify new industrial requirements for edition 4, like
   - Non-linear analysis and materials
   - Contacts and superelements
   - Isogeometric analysis
4. Validate in Jotne application EDMopenSimDM

Potential Participants:
Jotne, Lockheed Martin, Airbus (?), Boeing (?), CT Core (?)

Strategic Alignment:
Interoperability of engineering analysis data

Major Deliverables by Quarter:
2019 Q4 : AP242ed2 included
2020 Q1 : CD ballot initiated
2020 Q2 : Draft recommended practices for structural testing with edition 3
2020 Q3 : DIS document accepted for ballot
2020 Q4 : Proposal for edition 4
2021 Q1 : Publication by ISO
2021 Q2 : Recommended practices for structural testing with edition 3

STEP Extended Architecture 10303 Five-year Technical Roadmap

Scope:
- New Application Protocols
- New editions of existing Application Protocols
- SMRL release cycle
- Guidelines on the Change Request release cycle
- Resource constraints on the development of STEP Parts

Objectives:
1. Provide sponsors a long-range view of emerging capabilities planned to be covered by STEP
2. Provide a framework that supports management of critical resources and cost estimates for future work
3. Manage technical requirements for improved and new capabilities

Participants:
Boeing, Airbus, Lockheed Martin, Boost, NIST, Eurostep

Team: Allison Barnard Feeney, Jean Brangé, Tom Bluhm, Judith Crockford, Nigel Shaw, Phil Spiby, Mike Ward, Sylvere Krima, Keith Hunten, Tom Thurmann, Brandon Sapp, Melissa Harvey, Tom Hedberg, Jean-Yves Delaunay

Strategic Alignment:
2. Develop and/or endorse standards that support the Digital Enterprise (DE)

Major Deliverables by Quarter:
2018 : Initiated Roadmap planning
2019 Q1 : Drafted capability requirements
2019 Q3 : Baseline initial requirements, draft proposed timelines
2020 Q1 : Publish the roadmap

LOTAR Composite & Advanced Mfg

Scope:
- 300 (Common Concepts),
- 310 (Ed1 “Exact Implicit” Ply Definition),
- 310 (Ed2 “Approximate Explicit” Tessellated Solid),

Objectives:
1. Work with experts to clarify business requirements
2. Prioritize requirements to be in scope with various product domains.
3. Prepare use cases and test cases for part validation
4. Coordinate with other standardization projects related to this domain.
5. Develop, publish and maintain standards designed to provide the capability to archive and retrieve digital product and technical information.

Participants:
AFNeT, Airbus, BAE, Boeing, Embraer, GE, Gulfstream, Lockheed Martin, Safran, Sandia Labs

Strategic Alignment:
2. Develop and/or endorse standards that support the Digital Enterprise (DE)
2.2 Harmonize with and support other standards focused on the DE.
2.3 Maintain and update relevant standards
3.0 Increase the value of the PDES Organization
3.3 Explore partnering with similar organizations

Major Deliverables by Quarter:

Q1 2020
- Part 300 Draft for Internal Ballot
- Validation pilots

Q2 2020
- Part 300 Draft for External Ballot (AIA/ASD)

Q3 2020
- Part 310ed1 Draft for Internal Ballot
- Validation pilots

Q4 2020
- Part 310ed1 Draft for External Ballot (AIA/ASD)

LOTAR Electrical Wiring Harness

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Scope: • 400 (Common Concepts), • 410 (Physical harness definition for design & construction),	**Objectives:** 1. Work with experts to clarify business requirements 2. Prioritize requirements to be in scope with various product domains. 3. Prepare use cases and test cases for part validation 4. Coordinate with other standardization projects related to this domain. 5. Develop, publish and maintain standards designed to provide the capability to archive and retrieve digital product and technical information.
Participants: AFNeT, Airbus, BAE, Boeing, Embraer, GE, Gulfstream, Lockheed Martin, Safran, Sandia Labs **Strategic Alignment:** 2. Develop and/or endorse standards that support the Digital Enterprise (DE) 2.2 Harmonize with and support other standards focused on the DE. 2.3 Maintain and update relevant standards 3.0 Increase the value of the PDES Organization 3.3 Explore partnering with similar organizations	**Major Deliverables by Quarter:** **Q1 2020** • Various Part revisions and publications • Validation pilots **Q2 2020** • Various Part revisions and publications • Validation pilots **Q3 2020** • Various Part revisions and publications • Validation pilots **Q4 2020** • Various Part revisions and publications • Validation pilots

Technical Working Groups

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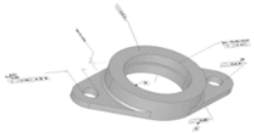


Mechanical 3D CAD with Product and Manufacturing Information (PMI)

EN/NAS 9300-1xx series

STEP AP203 ed2
STEP AP214 ed3
STEP AP242 ed1 & ed2

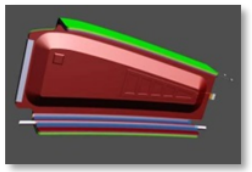
2004 launch

Product Data Management (PDM)

EN/NAS 9300-2xx series

STEP AP239
STEP AP242 ed1 & ed2

2004 launch

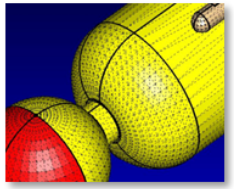


Composites and Advanced Manufacturing

EN/NAS 9300-3xx series

STEP AP203 ed2
STEP AP242 ed1 & ed2

2009 launch



3D Visualization

Requirements and Compliance Documents

2012 launch
2017 Complete

Wiring Harness

EN/NAS 9300-4xx series

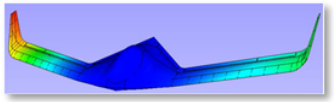
STEP AP242 ed2

2012 launch

Meta Data for Archive Packages

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

2012 launch

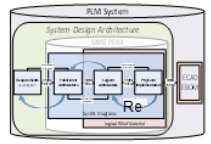


Engineering Analysis and Simulation

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
FMI, SysML, etc

2018 launch

Basic & Common Parts

EN/NAS 9300-001-099 series

2019 launch

Overview of LOTAR standards & links with associated ISO standards for information models

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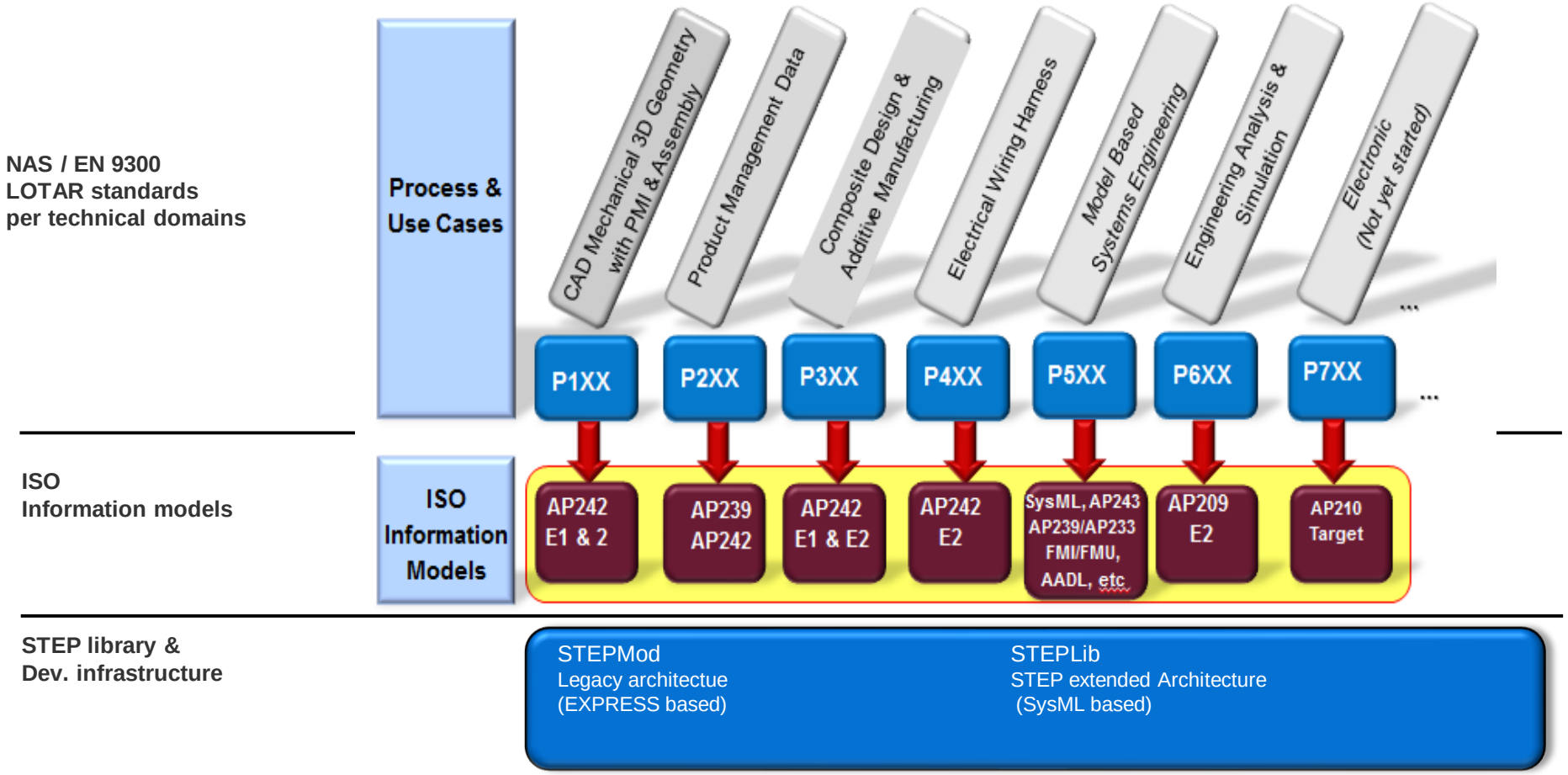

Need to ensure the longevity / enhancement of the STEP standards development infrastructure as part of the preservation plan, and the management of interdependencies with other standards

Airbus Case Study

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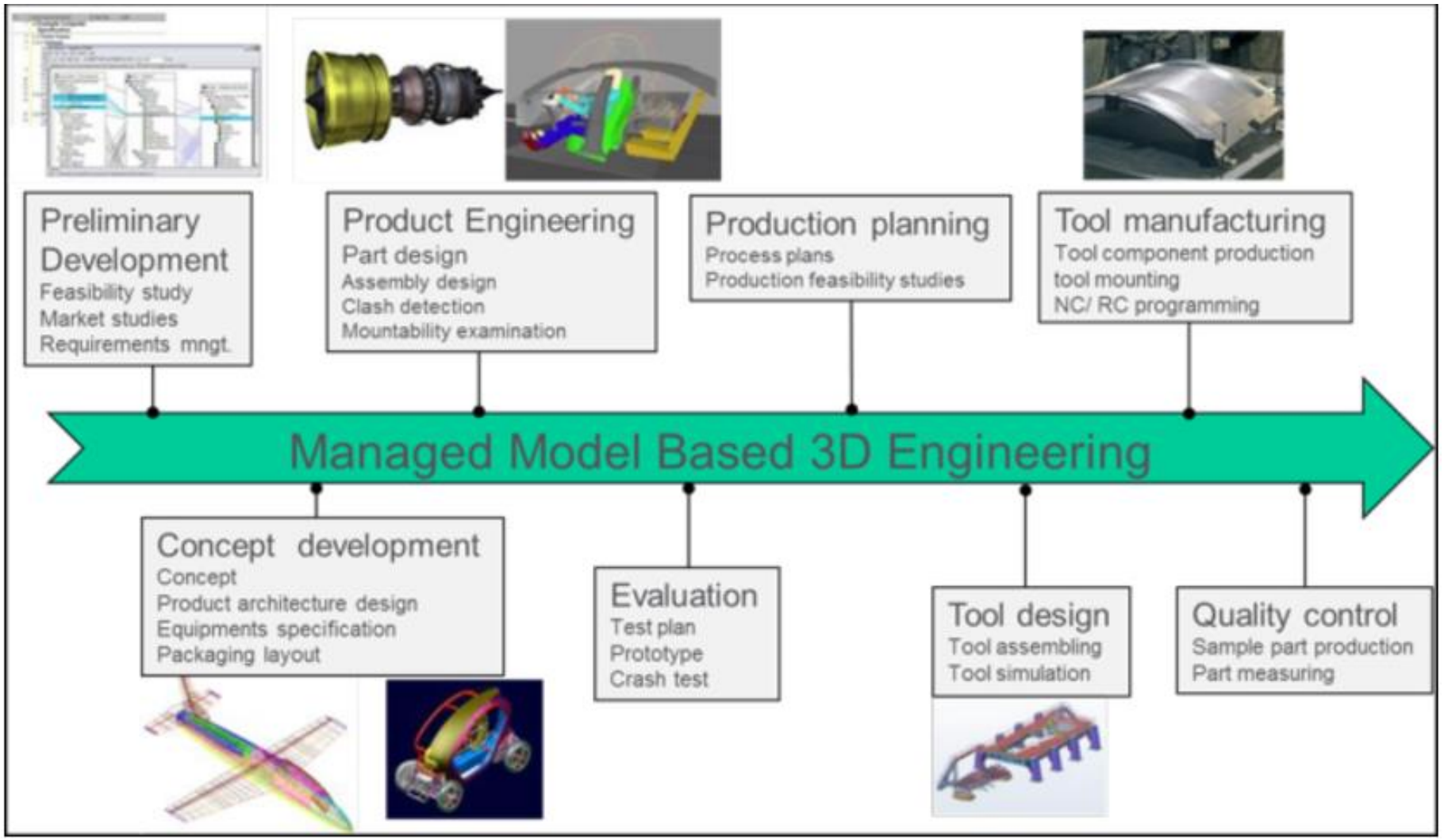
Airbus Case Study

Global Product Data Interoperability Summit | **2019**



Airbus Case Study – Incident Scenario

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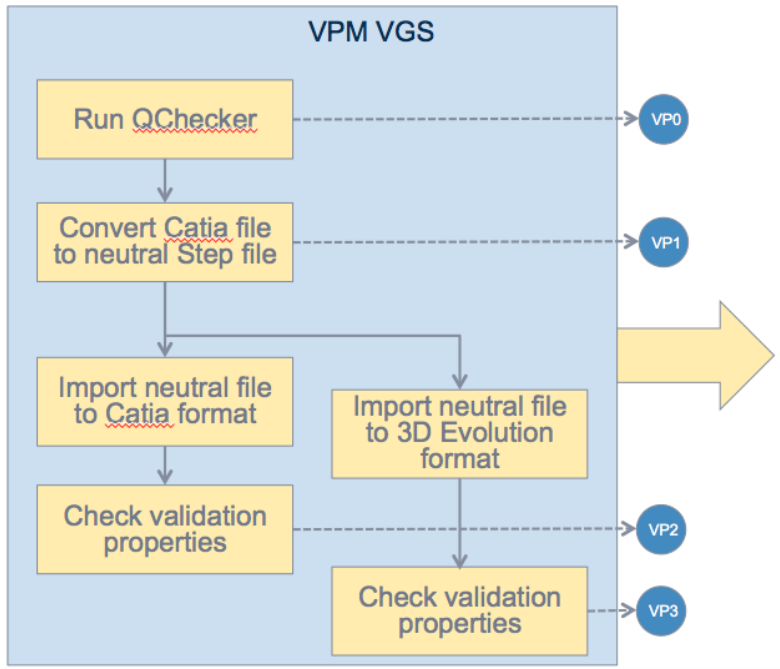
Conversion and Validation Process Flow Reminder



Global Status	
OK	VP1 = VP2 and VP3
WA	VP1 ≠ VP2 or VP3
KO	VP1 ≠ VP2 and VP3
	VP0 or VP1 are KO
ER	Process not complete

KO: Object cannot be released if fix is possible with current tool set.

ER: Object can only be released if not fixed after 24hrs. Object not archived

Scenario	Status	Criticality
Tool will not run for any file	ER	High
Tool will not run for one specific file	ER	Medium
Tool unable to process a STEP file (but file is STEP compliant)	ER	Medium
Both Catia and 3D Evolution report KO incorrectly (or for unknown reason)	KO	Medium
3D Evolution reports KO but Catia does not	WA	Low

Typical System Workflow with 3D Evolution

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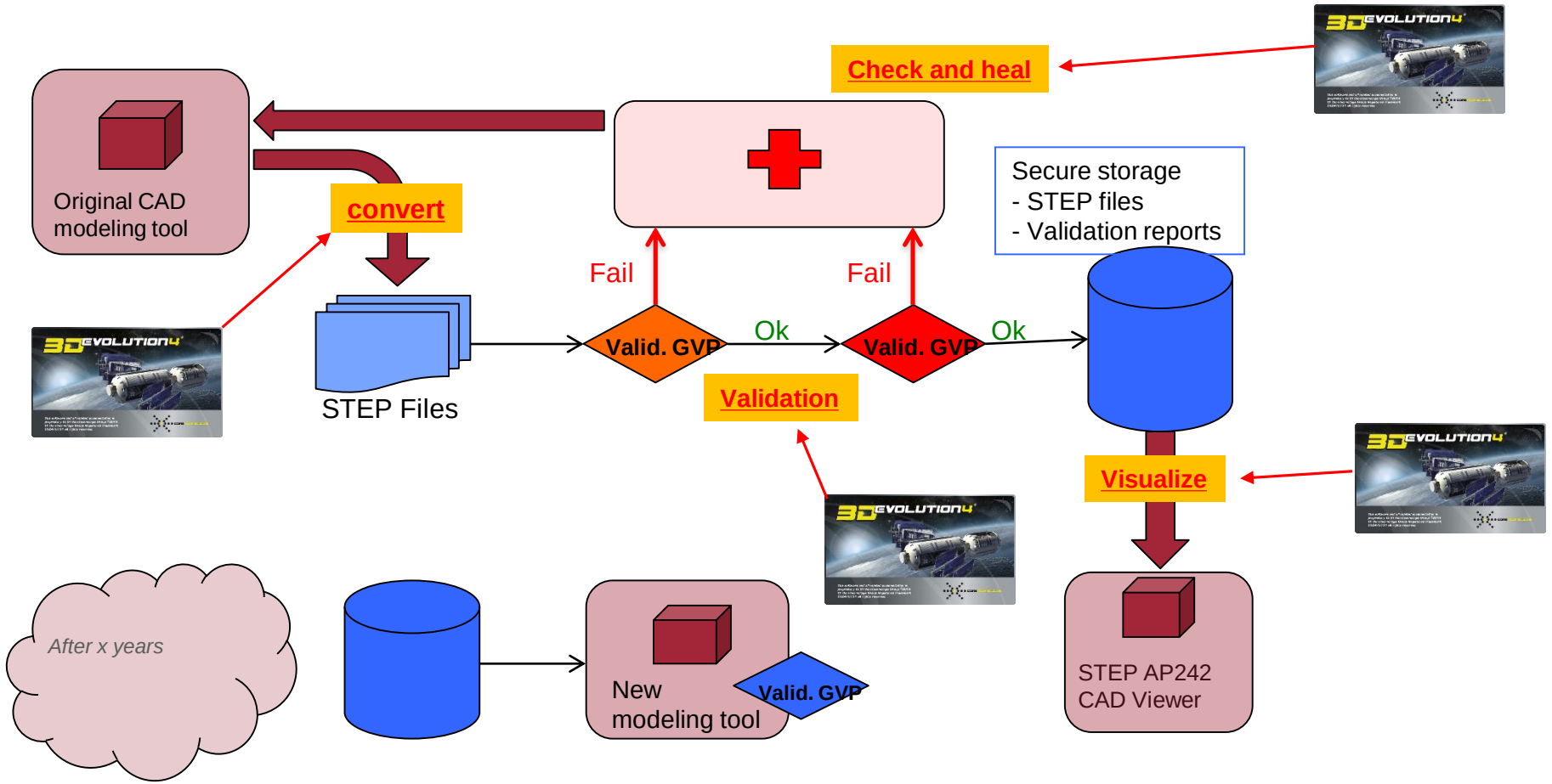

How are the industries addressing the obstacles to Model-Based Enterprise?

Technology

CAD Software
- PMI support increasing

CAD Translation
- NIST results available publicly

Cost

Parallel processing
- Will recapture with efficiency gains up to 50%[1,2]

Implementation
- Can leverage technologies across the enterprise

Culture

Resources
- Keep resources informed

Approach
- Organizations need to be more flexible

CoreTechnologie 3D Data Translations

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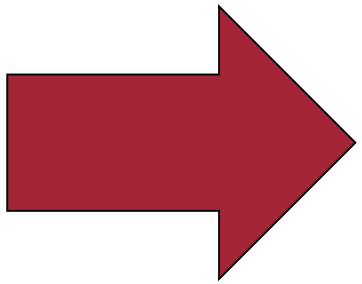
- **CATIA V4**
- **CATIA V5**
- **CATIA V6**
- **PRO/E/ CREO**
- **Siemens NX**
- **IDEAS NX**
- **SolidWorks**
- **Inventor**
- **STEP**
- **ACIS**
- **XT – Format**
- **JT – Format**
- **IGES**
- **DWG**
- **Rhino**



STEP AP242

Semantic PMI:

- CATIA V5
- CATIA V6
- NX
- CREO

CoreTechnologie AP242: Implementation Details

Data Type	Implemented	Validation Properties	Implemented
Assembly structure (single file)	YES	Geometric	YES
Assembly structure (multiple files)	YES	Annotations	YES
3D exact geometry	YES	Assembly	YES
3D tessellated geometry	YES	Saved view	YES
3D PMI graphical representation	YES	User defined attributes	YES
3D PMI semantic	YES	Color	YES
Composites	YES	Visibility	YES
Kinematics	NO*	Conversion and validation reports	YES
Functional machining features	NO*		
3D parametric data	NO*		
Construction history	NO*		

NO* : Implementation description not available yet

Formats	Implemented
BO model XML	YES
ISO 10303-21	YES
Compressed file	YES

Formats	Implemented
BO model XML	YES
ISO 10303-21	YES
Compressed file	YES

CoreTechnologie STEP AP242 & JT GVP report

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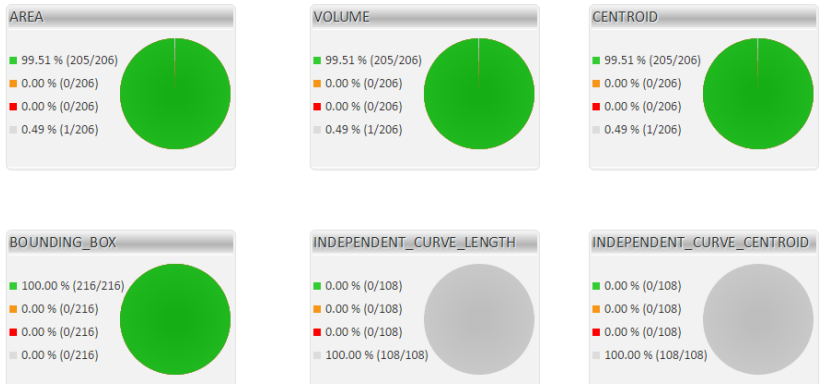
Checker Thresholds

CONFIGURATION:

PROPERTIES	UNIT	DEVIATION		
AREA	in2	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
VOLUME	in3	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
BOUNDING_BOX	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
INDEPENDENT_CURVE_LENGTH	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
INDEPENDENT_CURVE_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
INDEPENDENT_SURFACE_AREA	in2	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
INDEPENDENT_SURFACE_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
COPS	in	D ≤ 0.010000 %	0.010000 % < D < 0.100000 %	D ≥ 0.100000 %
INDEPENDENT_POINT_CENTROID	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
POLYLINE_CURVE_LENGTH	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
POLYLINE_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
AFFECTED_AREA	in2	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
AFFECTED_CURVE_LENGTH	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
TESSELLATED_PMI_CURVE_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.393701 in	D ≥ 0.393701 in
TESSELLATED_PMI_CURVE_LENGTH	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
TESSELLATED_PMI_SURFACE_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.393701 in	D ≥ 0.393701 in
TESSELLATED_PMI_SURFACE_AREA	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
TESSELLATED_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
SURFACE_AREA	in2	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
LENGTH_OF_SEGMENTS	in	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
TESSELLATED_POINT_SET_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
TESSELLATED_CURVE_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
NOTIONAL_SOLIDS_CENTROID	in	D ≤ 0.039370 in	0.039370 in < D < 0.196850 in	D ≥ 0.196850 in
SEMANTIC_AFFECTED_AREA	in2	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %
SEMANTIC_AFFECTED_CURVE_LENGTH	in2	D ≤ 1.000000 %	1.000000 % < D < 10.000000 %	D ≥ 10.000000 %

Summary of Results



DETAILS:

Z001207-2

Part Details

PROPERTIES	DEVIATION	READ	COMPUTED
AREA	0.000617 %	2303.134772290000	2303.120568388262
INDEPENDENT_SURFACE_AREA	NONE		
VOLUME	0.000760 %	292.653887057000	292.656112617450
CENTROID	0.000010 in	1.969681618410	1.969690810155
		3.240787289340	3.240789701630
		0.011103364982	0.011103520306
INDEPENDENT_SURFACE_CENTROID	NONE		
INDEPENDENT_POINT_CENTROID	NONE		
INDEPENDENT_CURVE_LENGTH	NONE		
NOTIONAL_SOLIDS_CENTROID	0.000000 in	9.316876640420	9.316876640420
		2.864348834500	2.864348834498
		1.593760925900	1.593760925896
TESSELLATED_CENTROID	NONE		
SURFACE_AREA	NONE		
LENGTH_OF_SEGMENTS	NONE		
TESSELLATED_POINT_SET_CENTROID	NONE		
TESSELLATED_CURVE_CENTROID	NONE		
BOUNDING_BOX	0.000000 in	-4.960677623750	-4.960677623749
		-3.341401815410	-3.341401576996
		-2.871023654940	-2.871023654938
BOUNDING_BOX	0.000064 in	9.044874191280	9.044874191284
		9.728346824650	9.728346824646
		2.859606266020	2.859670639038
INDEPENDENT_CURVE_CENTROID	NONE		

PROPERTIES	CHECK	READ	COMPUTED
NUMBER_OF_INDEPENDENT_POINT	OK	0	0
NUMBER_OF_CHILDREN	OK	30	30

CoreTechnologie Validation – Model Compare

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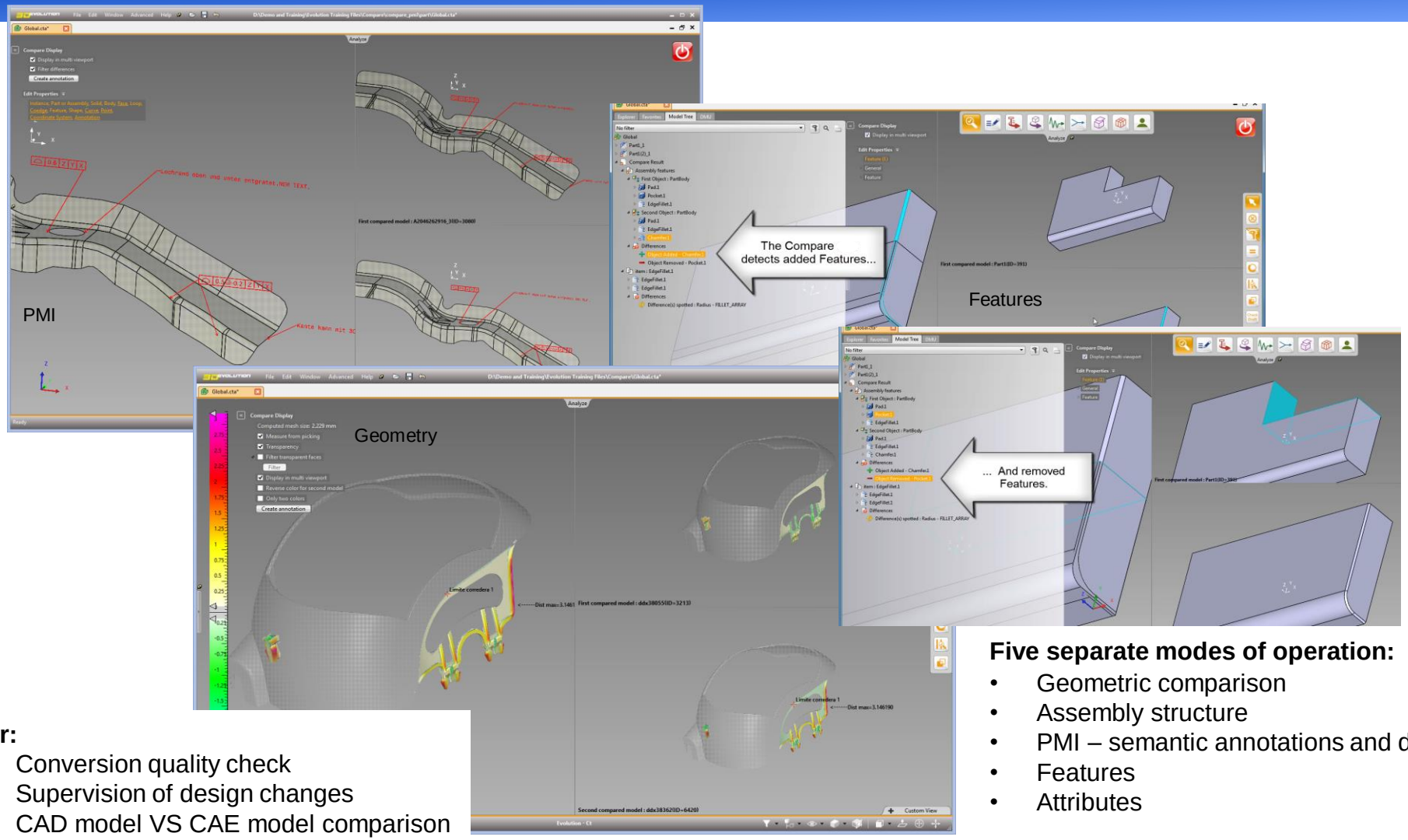


For:

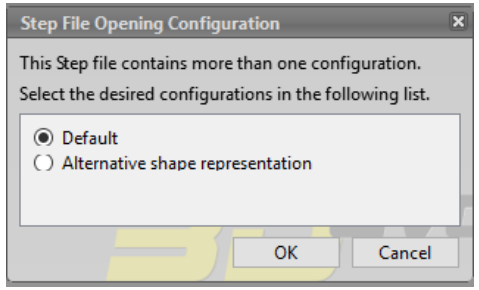
- Conversion quality check
- Supervision of design changes
- CAD model VS CAE model comparison

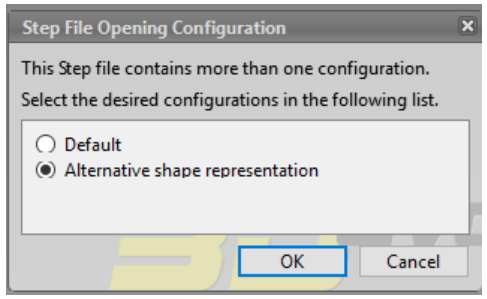
Five separate modes of operation:

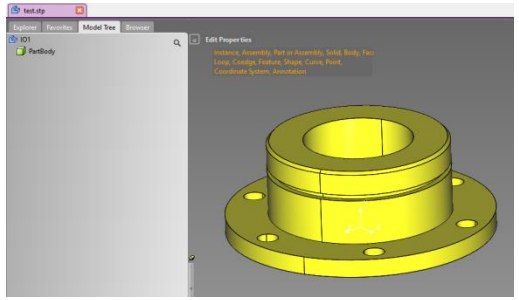
- Geometric comparison
- Assembly structure
- PMI – semantic annotations and dimensions
- Features
- Attributes

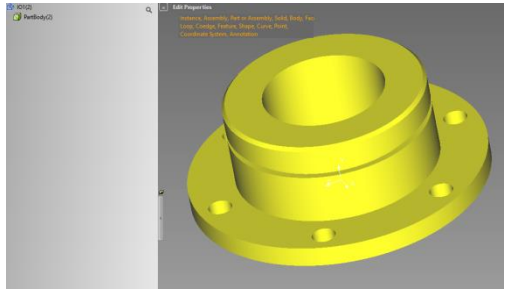
Multiple Configurations support

Alternative Representations in same Geometric Context









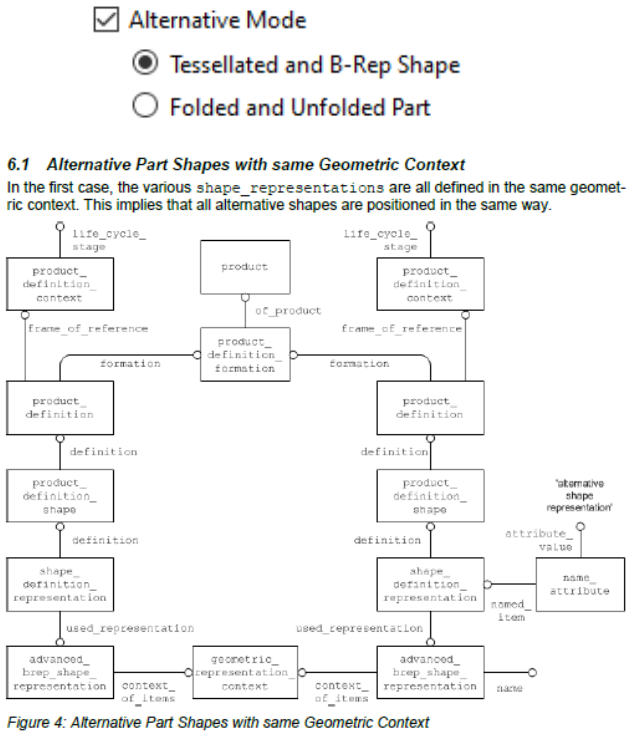
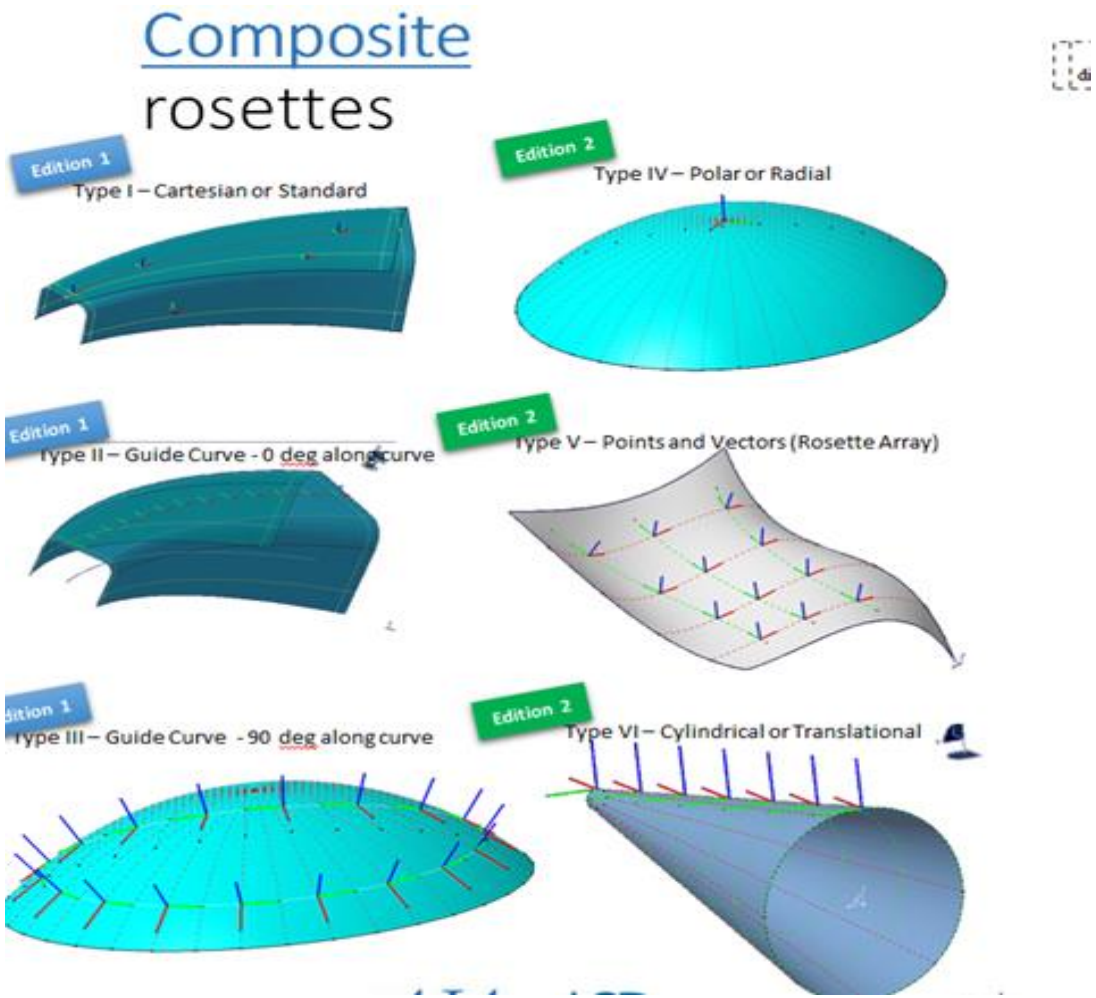


Figure 4: Alternative Part Shapes with same Geometric Context

Composite Rosettes Supported



- Type:

- Edition 1
- Cartesian or Standard
- Guide Cure
- Guide Cure – 90 Deg along the Cure

- Edition 2
  - Polar Radial
  - Points Vectors
  - Cylindrical or Translational

Thank you for your time!

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Jack Harris
General Manager
8013 Tiburon Place
Johnston, IA 50131
(319) 432-3407
harris.jackr@gmail.com
www.pdesinc.org

Rick Zuray
LOTAR International co-chair
The Boeing Company
(206) 778-6730
richard.s.zuray@boeing.com

David A. Selliman,
VP of NA
PDES Board Member
d.selliman@us.coretechnologie.com
Desk: 248.996.8464, Cell: 810.923.6481