PLM Harmonization Center

EADS SSC
(“Strategic Standardization Committee”)

Overview of NAS/EN 9300 LOTAR standards and ISO STEP AP 242 "managed model based 3D Engineering"

Example of use of LOTAR and STEP AP 242 within Airbus

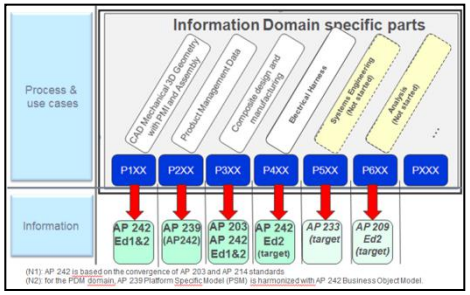
ISO /TC 183 /SC 4 workshop, Paris

Afnor Industry Day – 5th of June 2013

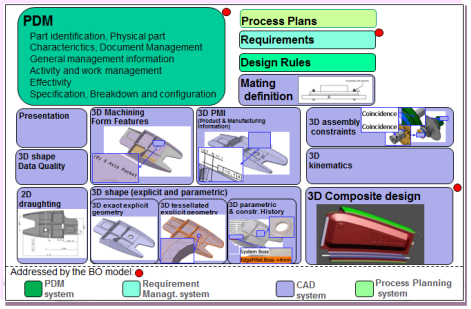
Presented by
Jean-Yves Delaunay : EADS Airbus

Table

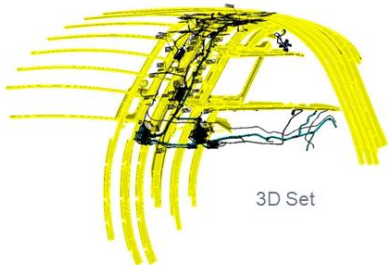
- Overview of NAS / EN 9300 LOTAR standards



- Overview of ISO STEP AP 242 standard
  - Introduction about the STEP AP 242 project
  - AP 242 Overall process
  - AP 242 information model overview
  - AP 242 public web site : overview
  - AP 242 public web site : Summary of AP 242 interoperability functionalities
  - Preparation of STEP AP 242 edition 2



- Example of use of LOTAR and AP 242 standards in Airbus for LT Archiving and Retrieval of A350 3D electrical harness installation



Introduction

- End of the 1990ies: different initiatives are launched in USA and in Europe for L-T Preservation of Aerospace and Defence Definition Dossier based on CAD 3D and PDM information
- 2005: convergence of the US PDES Inc - AIA LTDR project and of the ASD Stan - ProSTEP iViP LOTAR project, under the IAQG
  - IAQG: International Aerospace Quality Group
- 2008: creation of the LOTAR International project
- 2012: publication of the NAS9300 / EN9300 standards
  : 2-ed2, 5, 7, 100, 110, 115, and sending for ballot of the part 120
  : foundation for LT Preservation of CAD 3D PMI “graphic presentation”
- 2012-2015: preparation of the standards for L-T Preservation of:
  - CAD 3D PMI “semantic representation” and 3D light visualization,
  - CAD 3D composite design ,
  - PDM information (priority 1 : “As design” product structure),
  - CAD 3D Electrical harness
  - Possible extension to Analysis

LOTAR International project
A&D companies members in 2013

LOTAR
LONG TERM ARCHIVING AND RETRIEVAL

Members (Americas)

- BAE Systems
- Boeing
- Bombardier
- Embraer
- General Dynamics
- General Electric
- Goodrich
- Honeywell
- Lockheed Martin
- Sandia National Labs
- Spirit Aero

Potential Members (Americas)

- Cessna

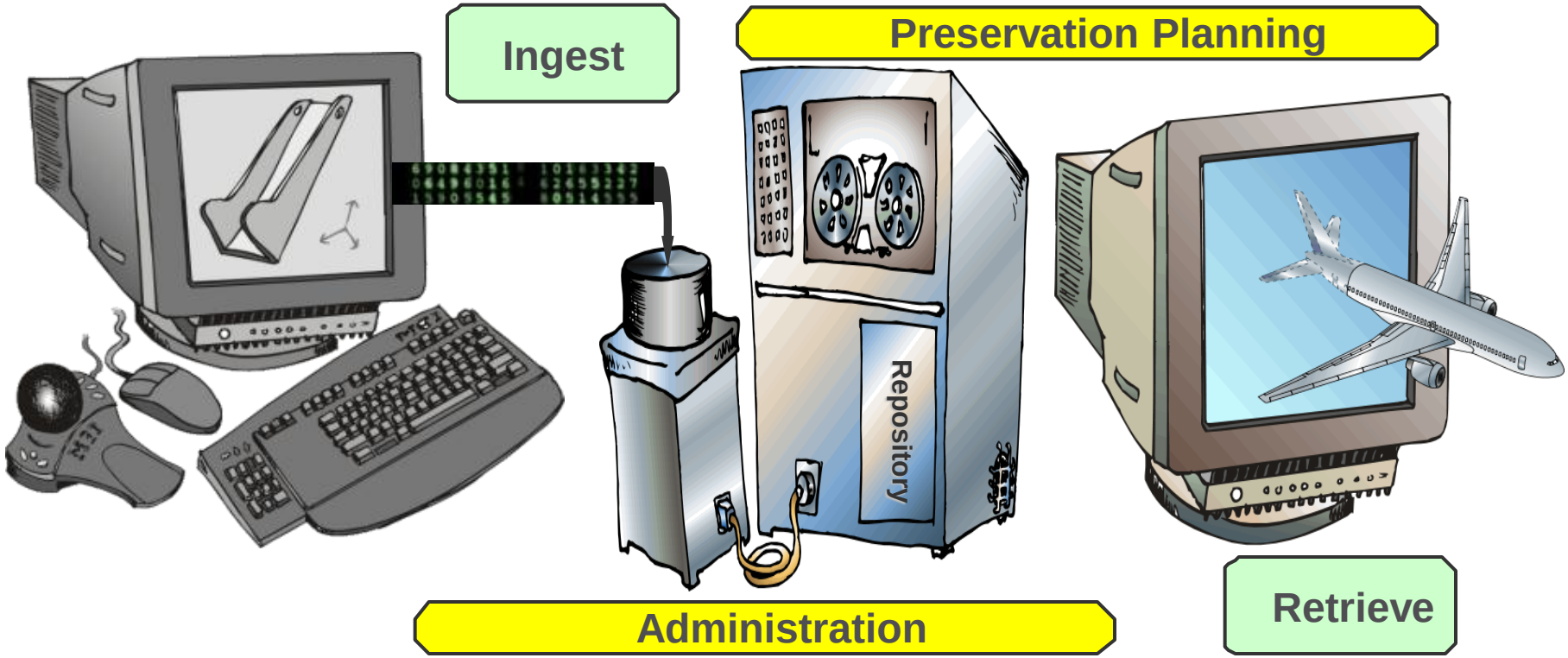
Members (Europe)

- *Airbus*
- *CASSIDIAN*
- *Dassault Aviation*
- *Eurocopter*
- *IAI (Israel Aerospace Industries)*
- *SAFRAN Labinal*

The LOTAR project: To support the **longevity** of Aerospace & Defense 3 D Model based definition

LOTAR
LONG TERM ARCHIVING AND RETRIEVAL

- CAD S/W versions change every **6 to 12 months**, CAD generations change every **10 years**.
- Aircraft lifecycle of **70+ years**
- The Lifecycle of software & hardware is short compared to the lifecycle of an aircraft or a defence system (nuclear missile, ...)



NAS/EN 9300 Fundamentals and concepts N°1 : Use of ISO OAIS (Open Archive Information Model)

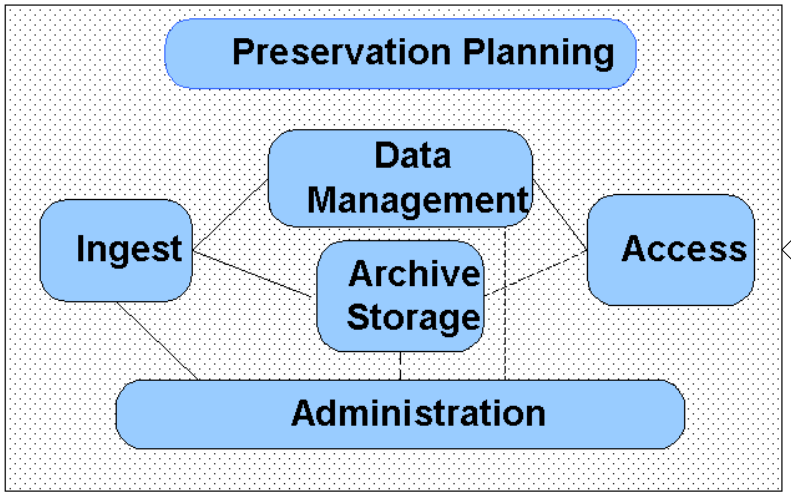
LOTAR
LONG TERM ARCHIVING AND RETRIEVAL

Producers

Design

Manufacturing

Support



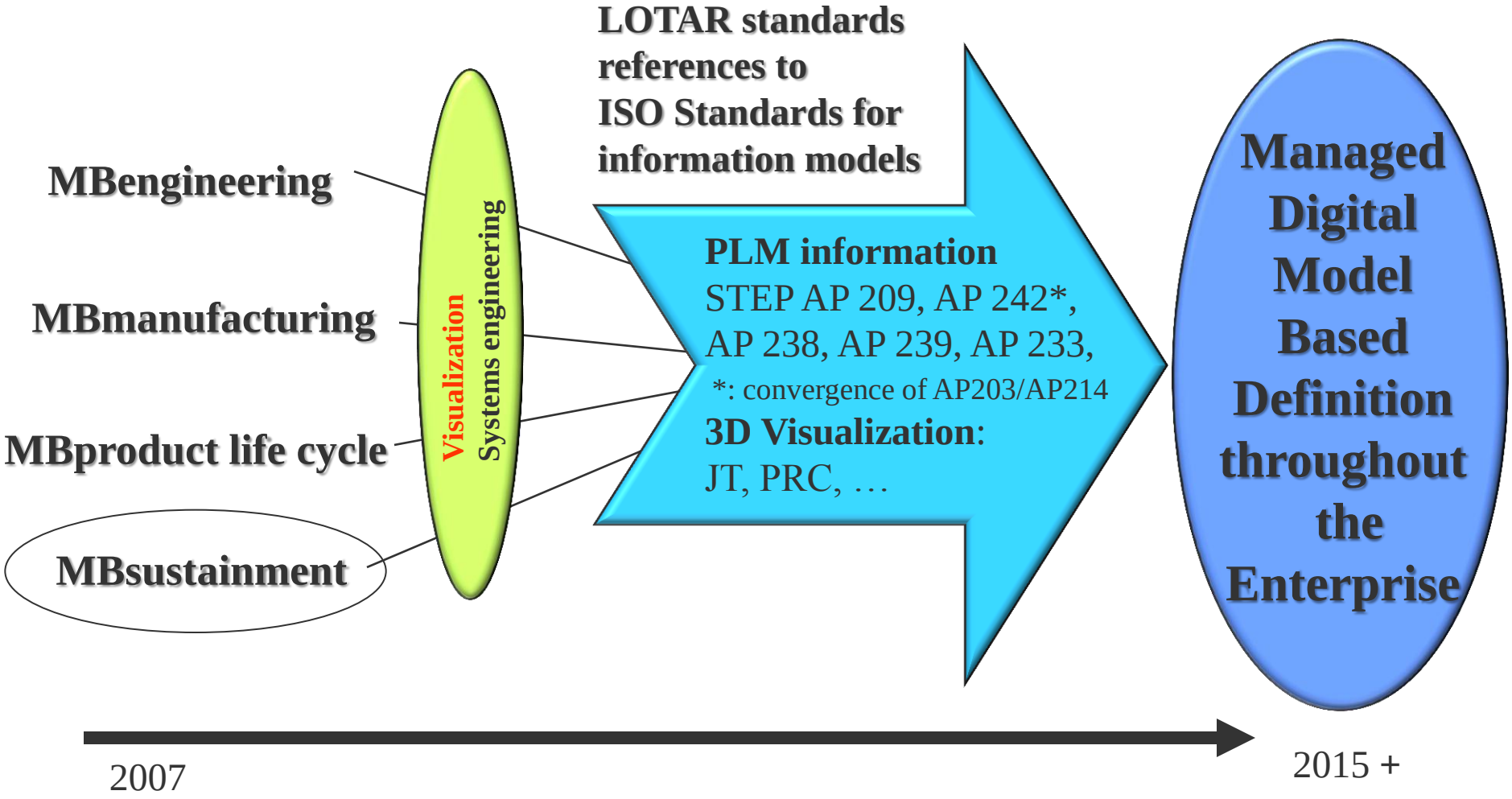
Consumers

Regulatory Agencies

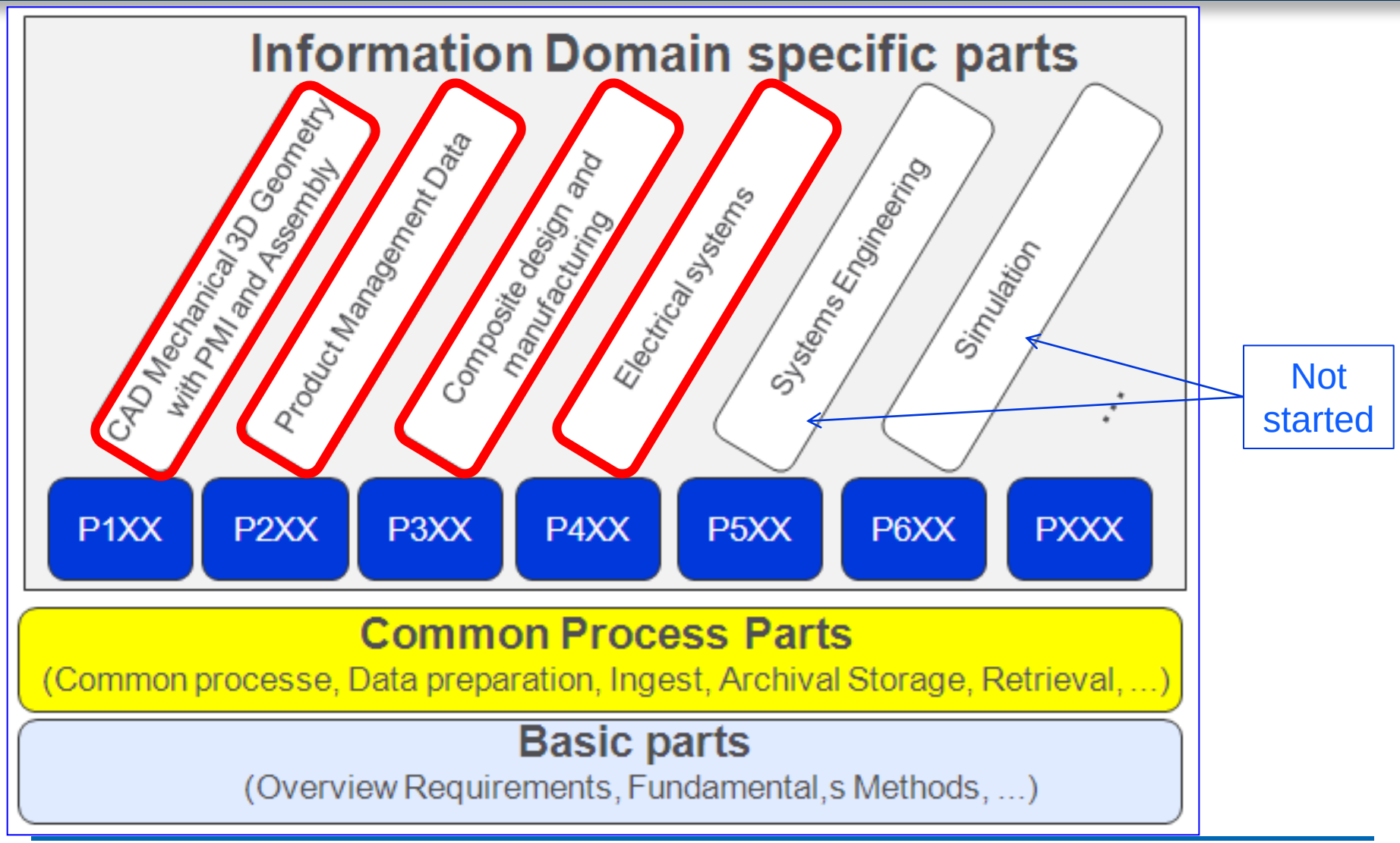
Customer Support

Design Re-use

NAS/EN 9300 Fundamentals and concepts N°2 : Use of the suite of ISO STEP standards and related 3D light visualization standards



Overview of NAS / EN 9300 LOTAR standards
An architecture for extensions according to business needs



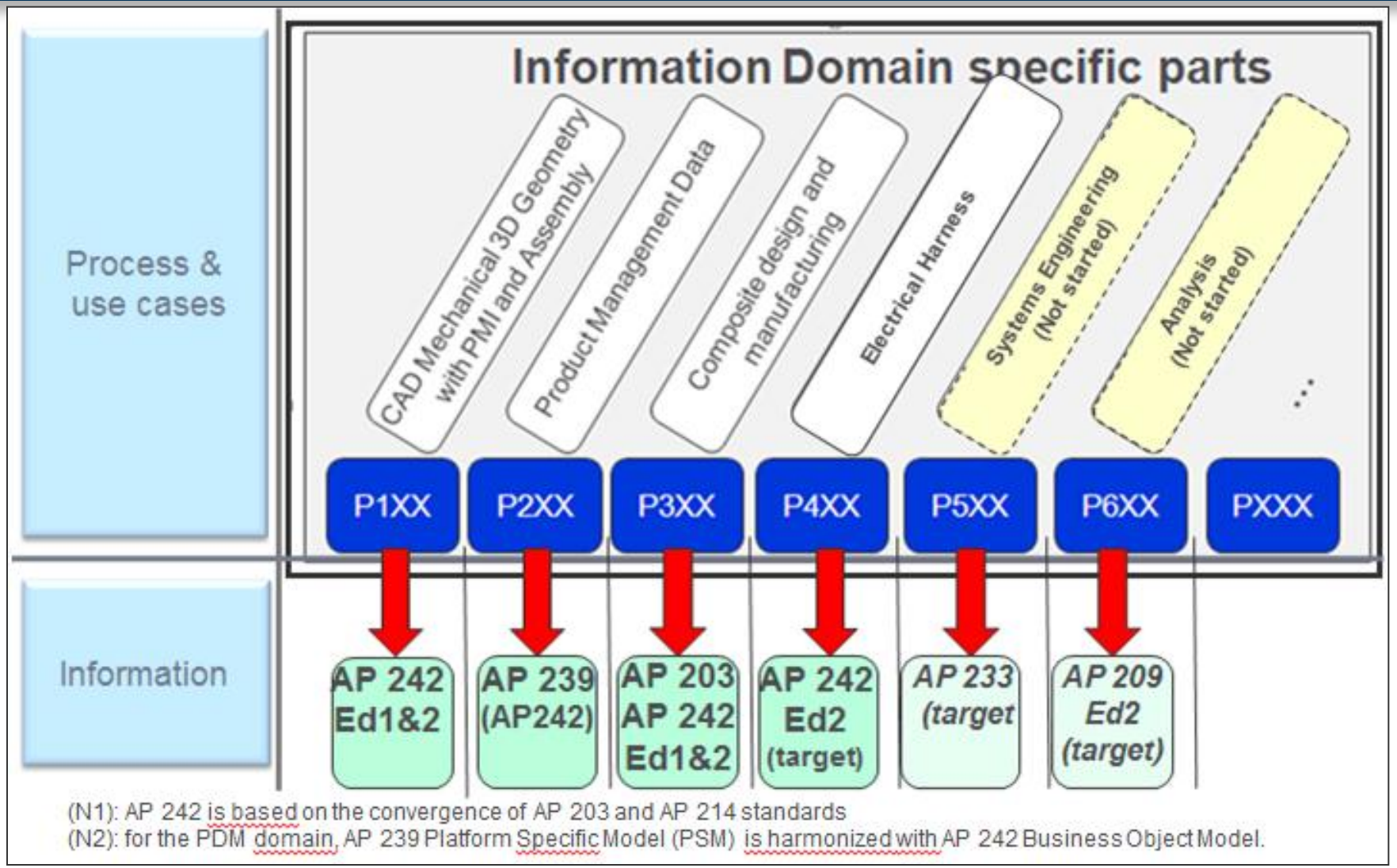
LOTAR International public web site : Overview

- **Why Lotar?**
  - ►Mission, Objectives & Scope
  - ►Hosting Organizations
  - ►Legal & Business Motivation
- **LOTAR organization**
  - ►External View
  - ►Internal View
  - ►Working together
- **LOTAR Workgroups**
  - ►3D CAD with PMI
  - ►PDM
  - ►Composite
  - ►Electrical Harness
  - ►3D visualization
  - ►(Meta data for archive packages)
- **Communication**
  - ►Public presentations
  - ►Progress Reports
  - ►Dates
- **LOTAR standards**
  - ►Overview on parts
  - ►Industry use
  - ►Next steps
- **News**
- **Links**
- **Contact**

http://www.lotar-international.org/home.html

?

Dependancies between the LOTAR standards and the ISO STEP standards



(N1): AP 242 is based on the convergence of AP 203 and AP 214 standards
(N2): for the PDM domain, AP 239 Platform Specific Model (PSM) is harmonized with AP 242 Business Object Model.

Summary of implementation of the LOTAR standards in Europe

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

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

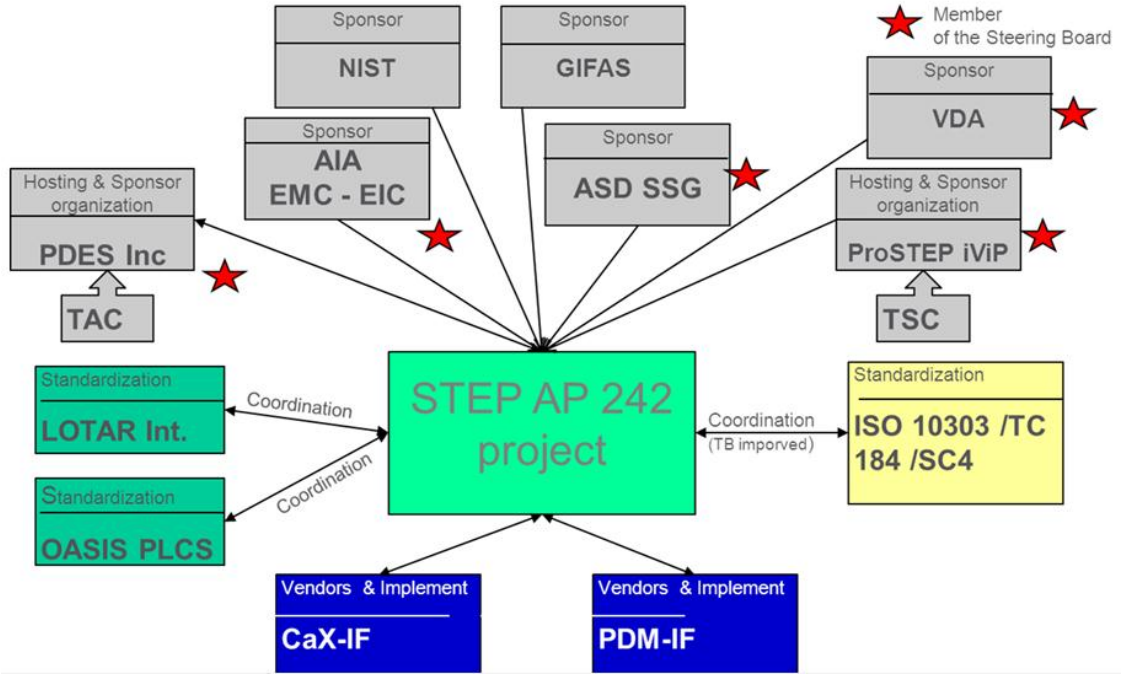
(*): Plan to migrate to STEP AP 242 ed1 when possible

Summary

- The LOTAR project has **delivered standards now used** by the US and European Aerospace and Defences manufacturers
- The LOTAR project **prepares new LOTAR standards** in order to extend the current capabilities :
  - CAD 3D PMI «representation », then with 3D machining form feature
  - PDM « As design » product structure with configuration management
  - CAD 3D composite design,
  - CAD electrical harness
  - recommandations for LT Archiving and Retrieval of 3D visualization
  - Planned extensions to Analysis in the next years
- Fundamental concepts for LOTAR standards:
  - ISO OAIS « Open Archive Information Systems »
  - ISO 10303 STEP standards information models

Introduction
about the ISO STEP AP 242 project

- The standard AP 242 “Managed model based 3D engineering" is the merging of 2 ISO standards:
  - Aerospace's STEP AP203 "Configuration controlled 3D design", and
  - Automotive's STEP AP214 "Core data for automotive mechanical design processes
- Project managed by the International Aerospace & automotive industries



STEP AP 242 edition 1 information model overview

PDM

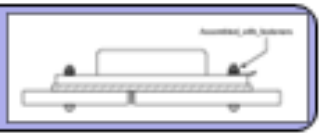
Part identification, Physical part
Characterictics, Document Management
General management information
Activity and work management
Effectivity
Specification, Breakdown and configuration

Process Plans

Requirements

Design Rules

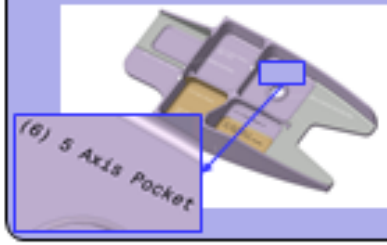
Mating definition



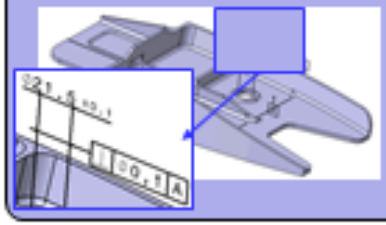
Presentation

3D shape Data Quality

3D Machining Form Features



3D PMI
(Product & Manufacturing Information)



3D assembly constraints

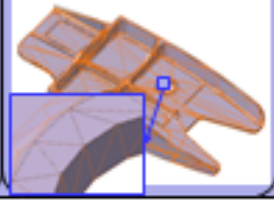
3D kinematics

2D draughting

3D shape (explicit and parametric)

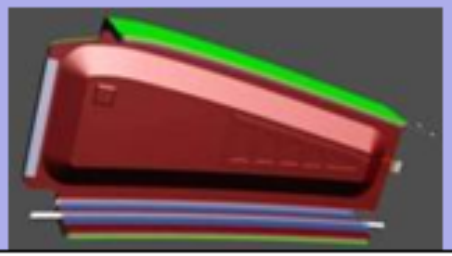
3D exact explicit geometry

3D tessellated explicit geometry



3D parametric & constr. History

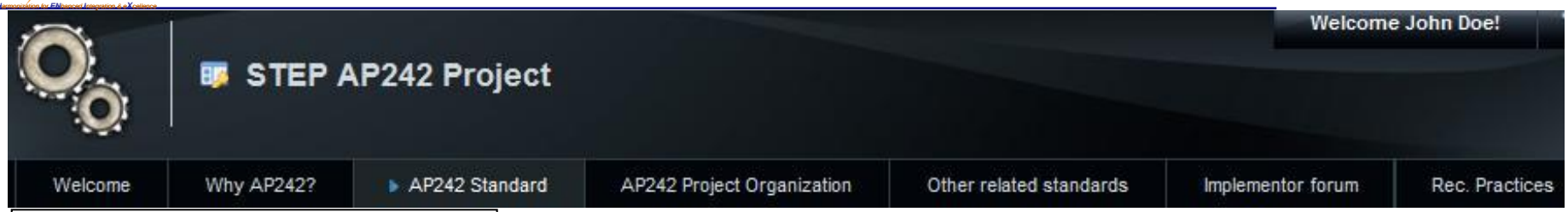
3D Composite design



Addressed by the BO model:

- PDM system
- Requirement Managt. system
- CAD system
- Process Planning system

STEP AP 242 public web site : overview and web adress



- Welcome
  - Site map
  - Contact
- Why AP242?
  - Use Cases
- AP242 Standard
  - AP242 Ed1
    - AP242 on a page
    - CAD 3D interoperability
    - Machining Form Features Interoperability
    - Composite Design Interoperability
    - Kinematics Interoperability
    - PDM Interoperability
    - Requirement Interoperability
  - AP242 Ed 2 preparation
- AP242 Project Organization
  - AP242 Ed1 project
- Other related standards
- Implementor forum
  - CAX-IF
  - PDM-IF(in preparation)

Site map

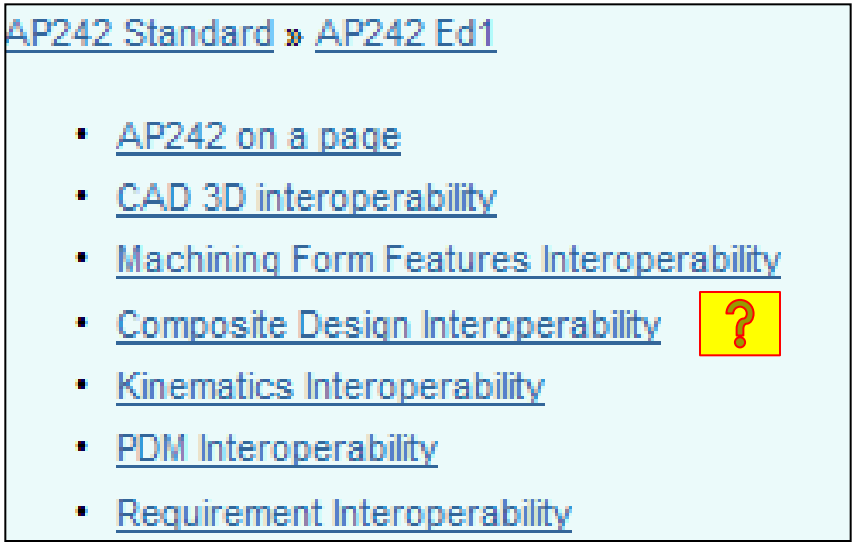
http://www.ap242.org/

Structure of the web site:

- Welcome
- Why AP242?
- AP 242 standard
- AP 242 project organization
- Other related standards
- Implementer Forums
- Rec. Practices

STEP AP 242 public web site
Summary of AP 242 interoperability functionalities

=> Need for the end users to understand easily
the scope & maturity of COTS STEP AP 242 interfaces solutions
for **their business needs**



For each interoperability capability, description of

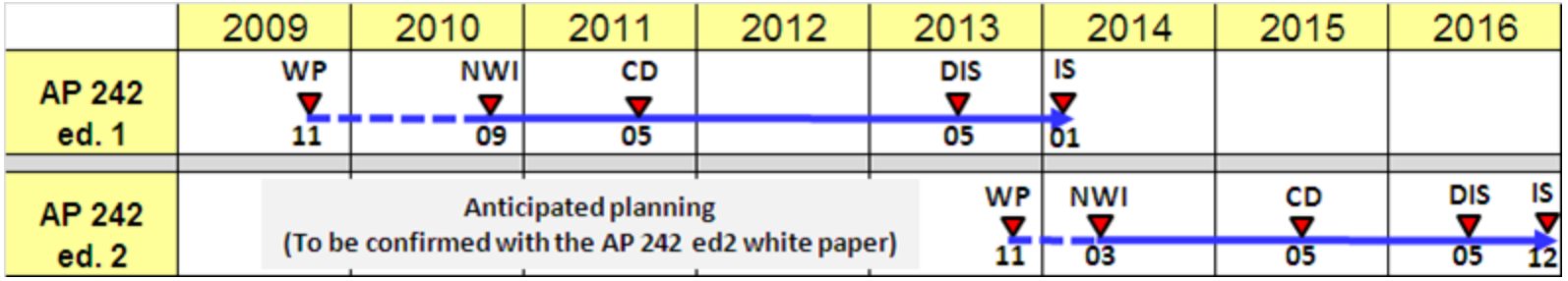
- Overview and illustration of capabilities
- Examples of associated use cases
- Dependencies / related standards
- Status of availability of COTS solutions
- Status of rec. practices / implement. forums

To be updated through the time, with the description of new capabilities

Principles
To avoid duplication of information already presented in other public web sites
- Detailed status of implementation by tools: Cax IF
- Detailed list of use cases: ProSTEP iViP, PDES Inc, ASD SSG, AIA EEIC, LOTAR, …

Preparation of « STEP AP 242 edition 2 » project

- Business requirements for enhancement of AP 242 ed2 to cover new business requirements, such as:
  - extension of CAD 3D Mechanical
    - 3D PMI (update of ISO standards for 3D Geometric Dimensioning & Tolerancing)
    - 3D parametric, 3D tessellated geometry
  - Composite design and manufacturing
  - Electrical Harness
  - Kinematics
- Organization of an international workshop to prepare a **white paper for STEP AP 242 ed. 2 project** on the 18th – 19th of Sept. 2013 in USA, Charleston, PDES Inc,



LTA3D @ Airbus and use of ISO STEP AP 242

Project overview

Prepared by:
Tobias Mueller : Airbus
Jean-Yves Delaunay : Airbus

AIRBUS

Overview of Airbus A350 “LTA3D” project

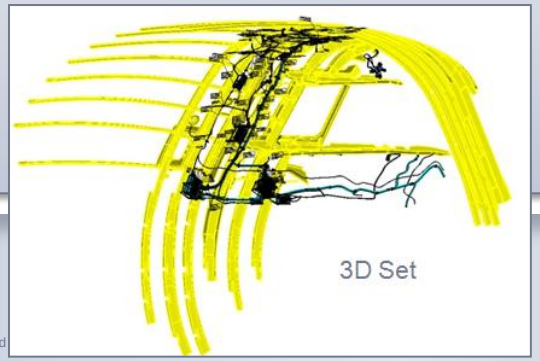
Goal of the project is to provide a 3D archiving solution for the Definition Dossier

Scope & Key Objectives of the phase 1

- *CAD 3D LT archiving for A350 XWB 3D harness installation only*
- *The solution shall be EN9300 LOTAR compliant*
- *The solution shall be fully integrated into the existing release process, and LT archiving shall be done in the existing Airbus corporate archive*
- *ISO 10303 STEP format shall become the used neutral format for LT archiving of CAD 3D PMI and PDM*
- *An external audit shall be performed on the solution implementation*
- *The solution shall be deployed before A350XWB type certification*

Essential information to be archived

- CAD Assembly structure,
- CAD 3D exact geometry,
- CAD 3D annotation,
- CAD 3D tessellated geometry



EN9300 LOTAR standards applied

Basic parts:

- EN9300 part 1, 2, 3, 4, 5, 7

Process parts

- EN9300 parts 10, 11, 12,13,14,15

CAD 3D geometry domain parts

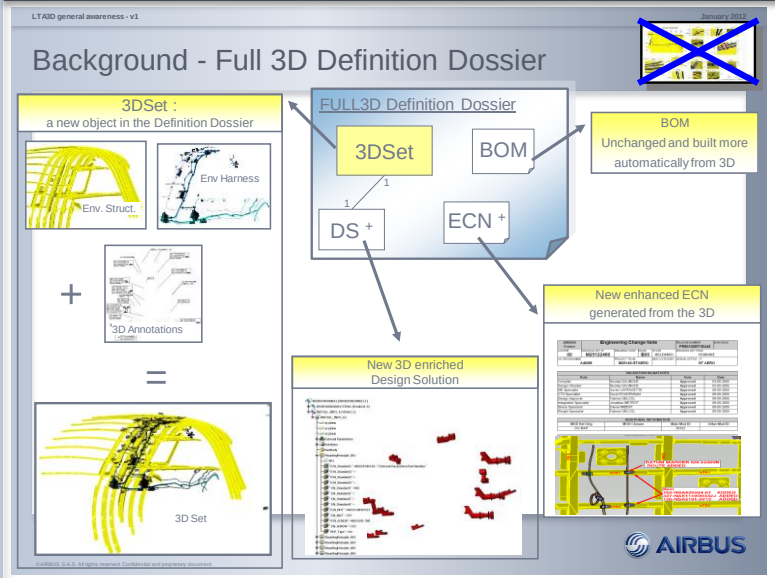
- EN9300 part 100, 110, 115, 120

LTA = Long Term Archiving

AIRBUS

Background & Process of the Airbus A350 “LTA3D” project

Full 3D definition dossier



➔Usage of the “Full 3D” approach requires an implementation of a CAD 3D LT archiving solution to stay compliant with Airworthiness regulation

➔agreement with EASA has been reached on this subject for the A350 3D electrical harness installation scope

LTA3D “high level” process

Ingest

- **Fully integrated in release process:**
  - Conversion from native into to neutral format
  - Quality control of converted data using V&V
- **Transfer to archive**

Archive

- **Fully integrated in corporate LT archiving solution:**
  - Archival checks
  - Archival storage

Retrieve

- **Launched from corporate LT archiving solution:**
  - Retrieval of neutral archived format
  - Retrieval into native CAD format
  - viewing

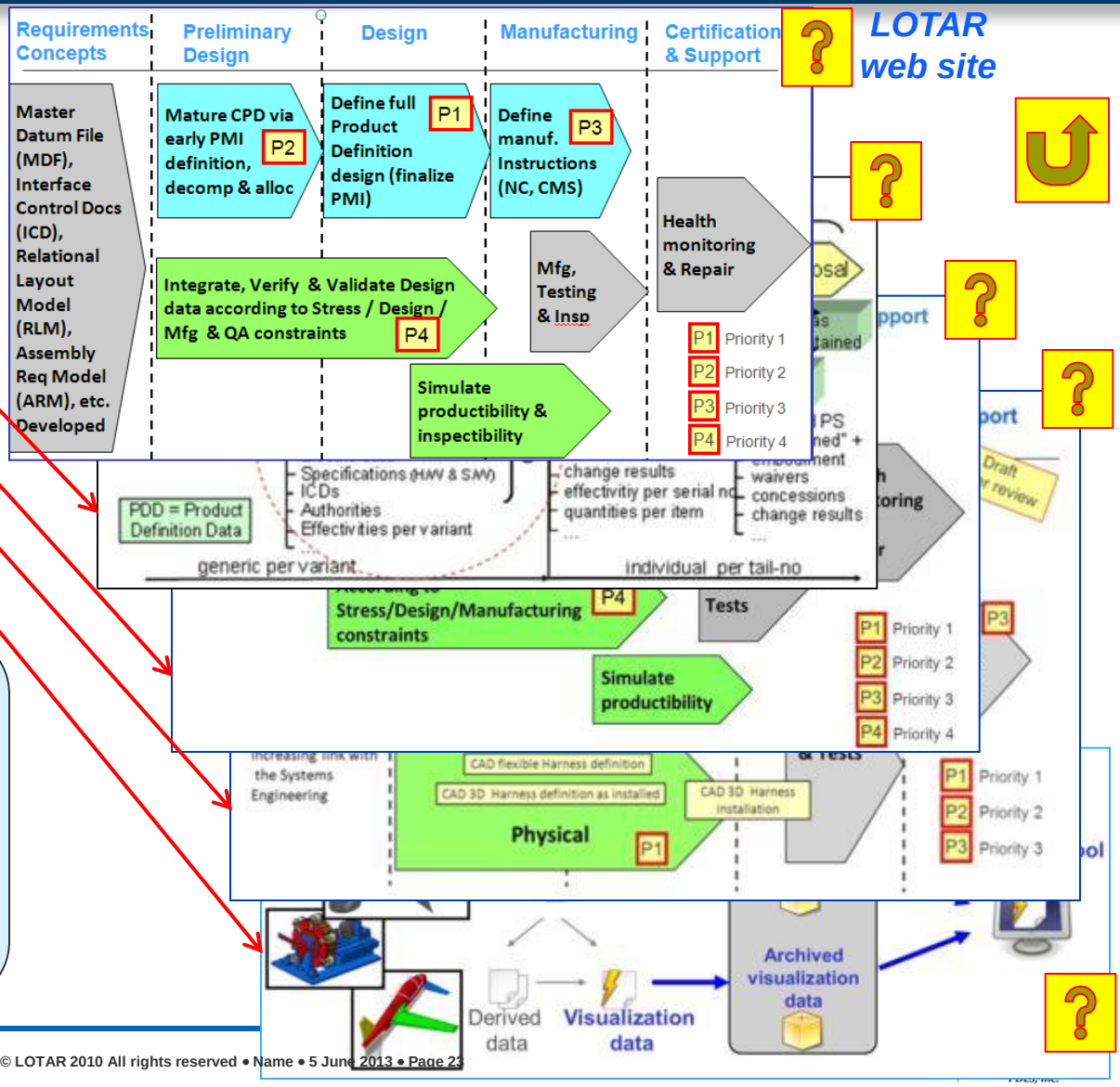
Summary – next actions

- « Full 3D » / 3D model based engineering changes drasticaly the processes, methods & applications within EADS and its supply chain
- The EADS Strategic Standardization Committee, as part of the EADS PLM Harmonization Centre (PHC), contributes to define a strategy for product information interoperabilty along the life cycle
- The involvement of EADS in the development of LOTAR and STEP AP 242 standards are driven by EADS business requirements
- The objective is to have PLM interoperability functionalities available at the right time, with the right level of quality
- It requires to monitor the development and maintenance of PLM open standards in a consistent way, via industry associations
  - EADS involvement in the ASD SSG www.asd-ssg.org
  - EADS involvement in the development of standards (STEP AP 242, LOTAR, …)
  - EADS support to PLM Implementers Forums (STEP Cax IF, future PDM IF, PLCS IF)
  - EADS participations in standardization associations

Back up slides

LOTAR public web site
Summary of LOTAR activities per Working Groups

- 6 Working Groups
  - Mechanical
  - PDM
  - Composite
  - Electrical
  - 3D Visualization
  - *Meta data for archive packageS*



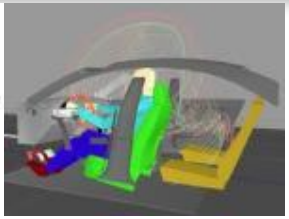
Description of a LOTAR WG web page

- Goals and Objectives
- Associated LOTAR use cases
- LOTAR Family of Standards
- Associated ISO 10303 Information Models
- Meetings & teleconferences
- Accomplishments
- Related standardization projects

AP 242 “Managed 3D Model Based Engineering”
overall process

LOTAR
LONG TERM ARCHIVING AND RETRIEVAL






Preliminary Development
Feasibility study
Market studies
Requirements mngt.

Product Engineering
Part design
Assembly design
Clash detection
Mountability examination

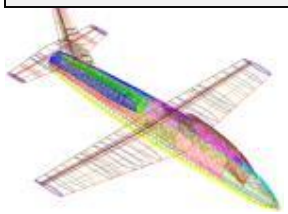
Production planning
Process plans
Production feasibility studies

Tool manufacturing
Tool component production
tool mounting
NC/ RC programming

Sustainment
LT Archiving
Logistics
Product support

Managed Model Based 3D Engineering

Concept development
Concept
Product architecture design
Equipments specification
Packaging layout



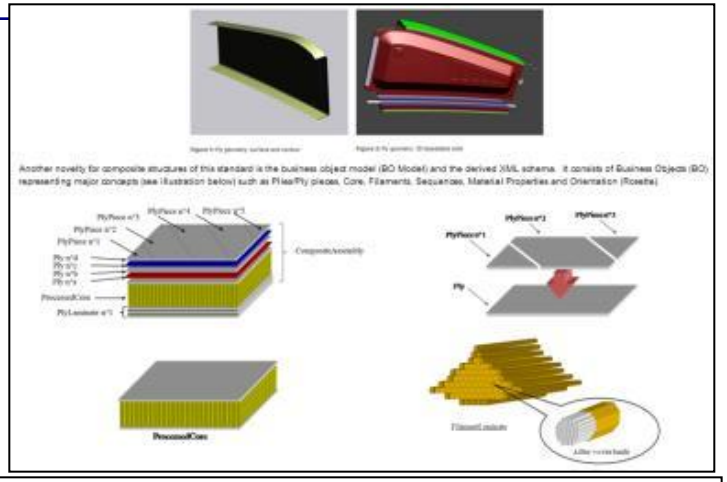

Evaluation
Test plan
Prototype
Crash test

Tool design
Tool assembling
Tool simulation

Quality control
Sample part production
Part measuring

STEP AP 242 public web site :
Example : Composite interoperability

- Overview and illustration of capabilities
- Examples of associated use cases
- Dependencies / related standards
- Status of availability of COTS solutions
- Status of rec. practices / implementers forums



- **Examples of associated use cases**
  - **Interoperability between different systems**

CAD-CAD	CAD 3D composite design exchange with the supply chain
CAD-CAE	CAD 3D composite design to Engineering Analysis
CAD-CAM	CAD 3D composite design to Manufacturing

  - **Long Term Archiving and retrieval (LTA&R)**

  LTA&R of CAD 3D composite design for certification

  LTA&R of CAD 3D composite design for manufacturing and repairs

  - **Visualization of archived CAD 3d composte design information**

List not exhaustive: for more information refer to the CAX IF use cases and the STEP AP 242 use cases described by the respective industry associations

- **Dependencies / related standards**

The data model of AP 242 for CAD 3D composite design is based on STEP AP 203 and STEP AP209.

- **Status of availability of COTS solutions**

Beta version interfaces for CAD composite design are in test for different systems.

More information to be published in 2014.

- **Related recommended practices**

STEP recommended practices for CAD 3D Composit design: draft available: link

Associated CAx Implementer Forum for Composite design: planned to start in 2014.