# PLCS, a strategic enabler for Enterprise Through Life-cycle Interoperability
## by
## Yves Baudier (Airbus)

# Content
## TLCI: Through Life-Cycle Interoperability

- TLCI: Business needs

- ASD strategy to turn TLCI challenge to reality

- PLCS: towards a key TLCI enabler

# TLCI: BUSINESS NEEDS

# TLCI: a programme perspective

| Pre-Phase A | Phase A | Phase B | Phase C | Phase D | Phase E | Phase F |
|---|---|---|---|---|---|---|
| Concept Studies | Concept & Tech Dev. | Prelim. Design | Final Design & Fab. | Assembly, Test, & Launch | Ops & Sustainment | Closeout |
| Conceptual Models and Simulations, especially MBSE<br><br>Cost Estimation | Requirements<br><br>Functional Flows<br><br>Models and Simulations, especially MBSE | CAD Designs<br><br>Analysis Models<br><br>Prototype Test Data<br><br>Refined Costs<br><br>Models and Simulations, especially MBSE | Models and Simulations, especially MBSE<br><br>GD&T<br><br>PMI<br><br>Inspection Data<br><br>Change Orders<br><br>Effectivities | Integration<br><br>Models and Simulations<br><br>Verification<br><br>Certification<br><br>Change Orders<br><br>Effectivities | Operations<br><br>Anomalies<br><br>Simulations<br><br>Science Data<br><br>Change Orders<br><br>Effectivities | Decommissioning Simulations<br><br>Data Archiving<br><br>Final Costs |

Source: NASA-HDBK-0008, NASA PRODUCT DATA AND LIFE-CYCLE MANAGEMENT (PDLM) HANDBOOK
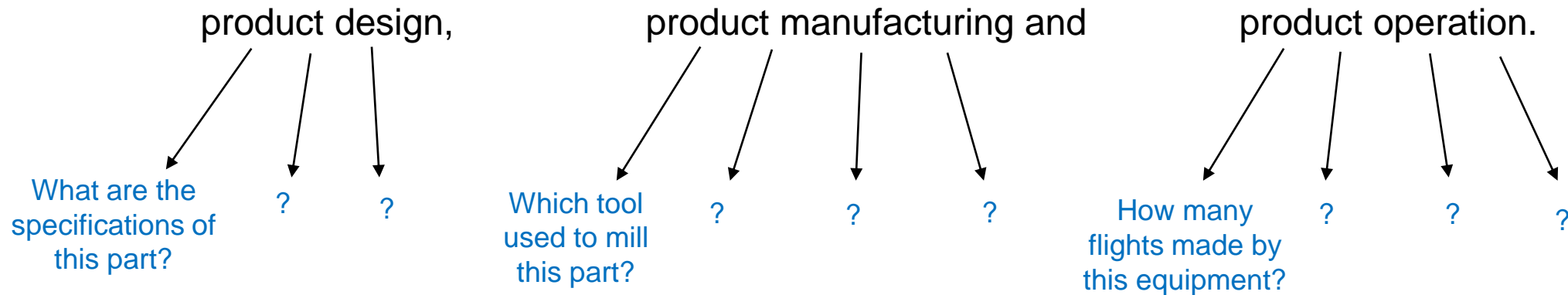
Questions:
- How to maintain consistency between these work products through the time?
- How to enable the loops and feedbacks between Phases?
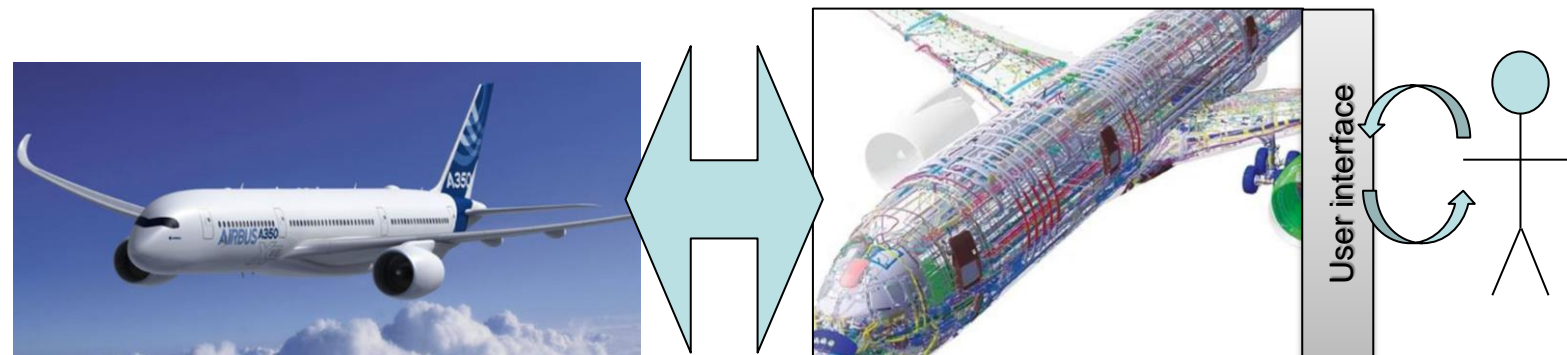
→ **The PLM Grand Vision**

# TLCI: a physical product perspective

- Individual products have their own life-cycle, with several modifications over their operational life.
- How to maintain a representative & consistent set of data, representative of the
  product design,                    product manufacturing and                    product operation.

What are the specifications of this part?          ?          ?

Which tool used to mill this part?          ?          ?          ?

How many flights made by this equipment?          ?          ?          ?

→ **The Digital Twin**

# TLCI: a legal/regulation perspective

Access to data over time Legal and

Business requirements:

- Legal and certification rules

  e.g. need to be able to demonstarte conformity of a part or product with the associated documentation → requirement for data access throughout product life

- Regulations on long term archiving of technical documentation

- Reuse

- Support in operation

→ Long term archiving
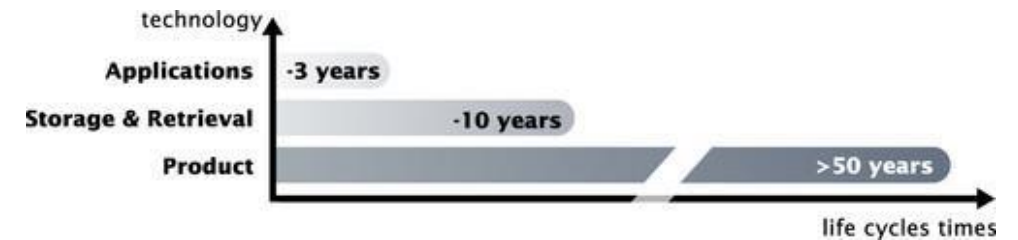
# TLCI: a Big Data perspective

- Huge quantities of data generated along a programme.
  - OEM & Equipment providers / Operators / Maintenance centers
- Big data and Data analytics: data seen more and more as a business asset
  - New business services

*Smart data analytics requires understanding of data in the right context and format, and adequate linkage of data based on configuration management.*

→ Need to maintain relationship between data and related product configuration through life.

Ewample: Airbus Skywise platform

# ASD STRATEGY TO TURN TLCI CHALLENGE TO REALITY

# ASD SSG "Through Life Cycle interoperability" report
## A critical strategic lever for competitiveness



**ASD** AeroSpace and Defence Industries Association of Europe

**ASD STRATEGIC STANDARDISATION GROUP**

Through Life Cycle Interoperability

A critical strategic lever for competitiveness

Rev 1.0, 9/05/2014

Ref: ASD/TLCI/01

*The objective of this document is to **develop a vision of Through Life Cycle Interoperability for Aerospace & Defence** and to propose recommendations.*

**Executive Summary:**
- Vision
- The business challenge
- Benefits
- ASD SSG answer

**Table of content**
1. Introduction
2. The interoperability challenge
3. Status of interoperability standards
4. Required standards architecture
4.1 Global requirement
4.2 Interoperability Framework
4.3 Envisioned standards backbone
4.4 Proposed recommendations

## Approach:

1. **Identify the business requirements** for A&D digital information interoperability, and analyze gaps with existing standards and practices,

2. **Identify** a **set of coherent standards** to use or to develop in order to cover the full spectrum of needs for interoperability,

3. Propose and **apply governance tools at strategic and technical level** (e.g. radar screen, interoperability framework, assessment process),

4. Develop a network of experts,

5. **Develop liaisons with all relevant standardization organizations**,

6. Identify and communicate the business benefits,

7. **Seek the widest exploitation of these standards** to maximise global benefits.

**Download the report on ASD SSG web site**

# ASD SSG "Through Life Cycle interoperability" report
## A critical strategic lever for competitiveness
# Proposed recommendations



1. **Strengthen the STEP architecture approach** to 1) ensure interoperability between STEP standards and 2) provide unambiguous implementation methods (including for new information technologies, e.g. OSLC).

2. Ensure that **3D visualisation format standards** used in the industry are **consistent with STEP standards**

3. Ensure the **common data model** for the **ILS specifications** is **consistent with STEP AP239**.

4. Promote the **ASD-AIA ILS suite of specifications** and seek to manage **coherence with ATA specifications** where needed by the industry.

5. Participate in the development, and interoperability testing of the **next generation of PDM/PLM web services**.

6. Facilitate **data interoperability in the Aerospace and Defence Supply Chain** and align business process between Supply Chain stakeholders.

7. Supports the setting-up of **implementer forums** (e.g. PDM implementer forum) to test and validate the implementation of the standards-based solutions.
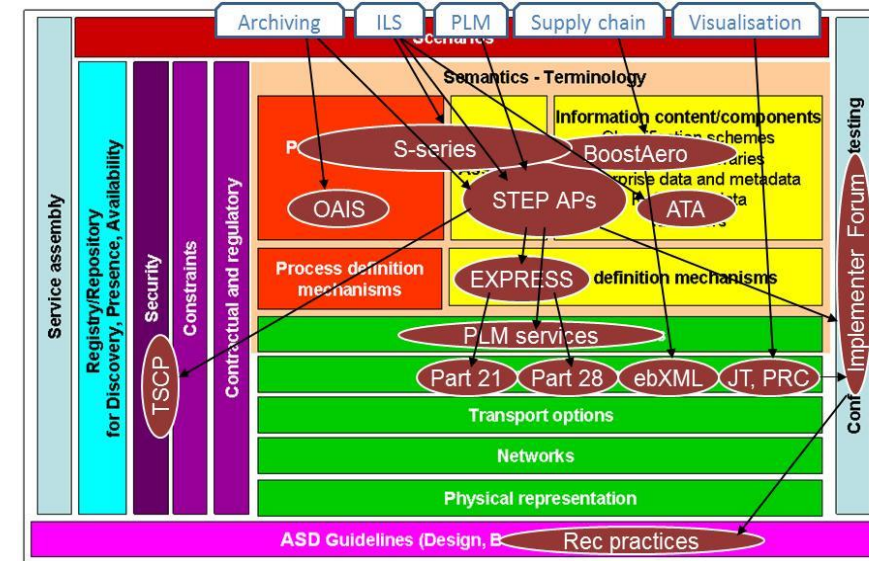
# PLCS: TOWARDS A KEY TLCI ENABLER

# PLCS: current status

*Current:*

    ISO 10303-239 edition 2        *Link*

    OASIS PLCS              *Link*



**ISO 10303-239:2012**

Industrial automation systems and integration --
Product data representation and exchange --
Part 239: Application protocol: **Product life cycle support**

*In development:*
ISO 10303-239 (AP239) edition 3

# Content of PLCS

The following are within the scope of ISO 10303-239:2012:

- information for defining a complex product and its support solution;

- information required to maintain a complex product;

- information required for through life configuration change management of a product and its support solution;

- the representation of product structures, assemblies and breakdowns;

- the representation of a product through life;

- the specification and planning of activities for a product;

- the representation of the activity history of a product;

- the representation of the product history.

# AP239 edition 3 technical objectives vs edition 2

- Same **functional perimeter** (ref activity model)

- **Redesign of the information model** based on the new STEP architecture (specific ILS Core Technical Capabilities and shared CTCs)

- Integration of **requested updates** (ISO process, S5000F updates, PLCS PSM issues collected by OASIS PLCS)

- Improve/extend **implementation methods** (P28/XML and openness to new methods like web services and linked data)

- **Multi-layered information model**: based on DEXlib and PLCSlib experience, a template mechanism will be proposed to map customised business objects to the AP239 core information model.

- **Allow mapping** with **S-Series** specifications and **SAE GEIA-STD0007**

- Use of **Reference Data Libraries** : a common mechanism for using reference data shall be defined for being used by all STEP APs based on new STEP architecture

**New Work Item** for the development of PLCD ed3 approved at ISO in January 2016

# Harmonization work objective

- Aim is to ensure consistency between AP242 and AP239 by sharing of the same information models (e.g. product structure and configuration management, requirement, V&V).

- Objective is to develop a set of Core Technical Capabilities (CTCs) shared by AP239 ed3 and by AP242 ed2 – and usable by any other AP.
  - ➤ Move to the STEP Enhanced Architecture (e.g. SysML modelling)
  - ➤ Reuse and complete the first Harmonization work done for AP242 ed1
  - ➤ Start from AP242 ed1 BOM, compare with OASIS PLCS PSM, find shared solutions when gaps identified
  - ➤ Develop a harmonized method to handle Reference Data (RD) and a harmonized set of RD.
  - ➤ Requires agreement from AP242 ed2 team and AP239 ed3 team, then validation from ISO WG12-WG21
  - ➤ Target: main Harmonization results incorporated in AP242 ed2 FDIS and AP239 ed3 CD/DIS.
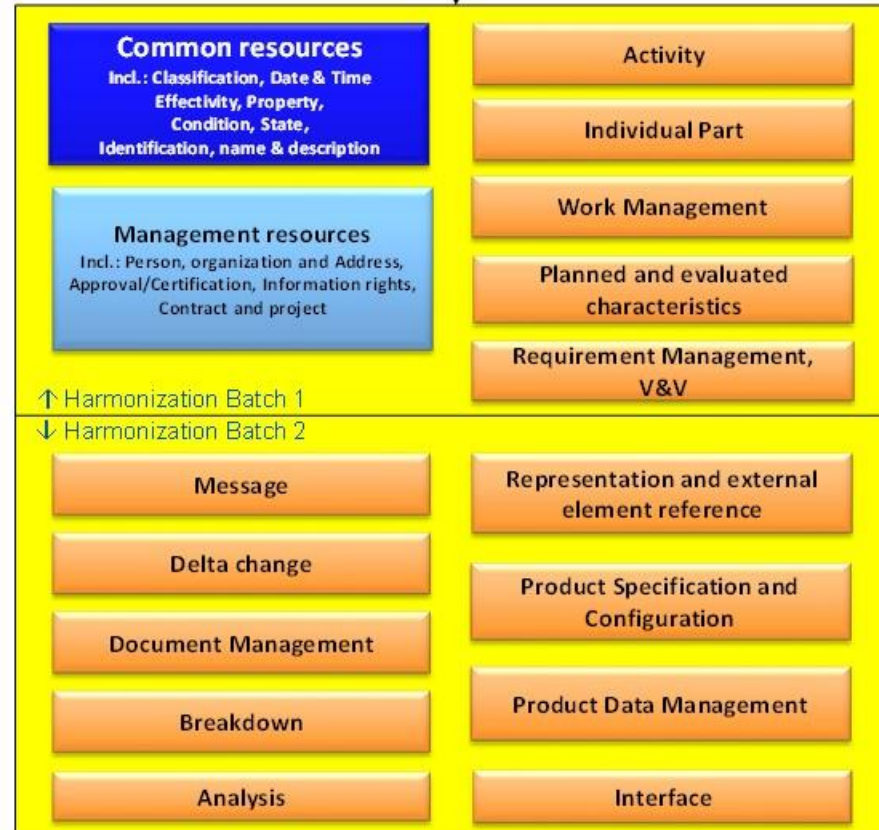
# Harmonisation scope
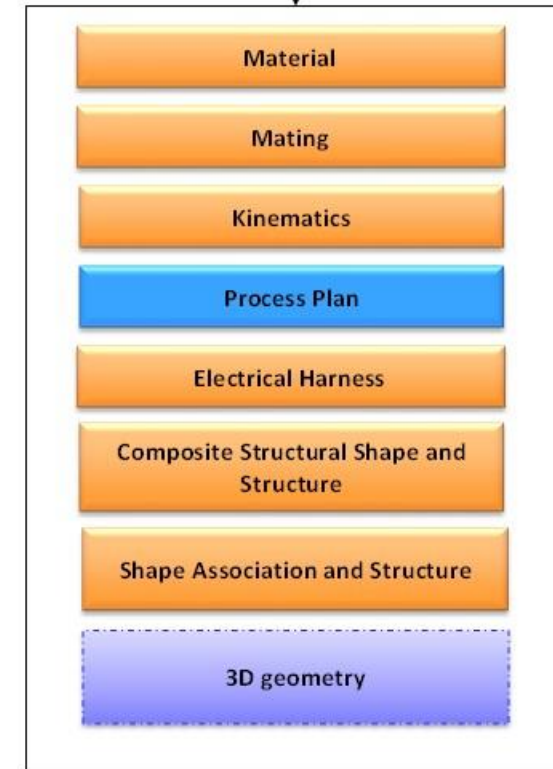


**AP239 ed3 specific CTCs**
(to be validated)

- Planning, scheduling
- Risk
- Probability
- Task description
- Resources
- Slot
- Observation

**CTCs shared between AP239 ed3 and AP242 ed2**

**Common resources**
Incl.: Classification, Date & Time Effectivity, Property, Condition, State, Identification, name & description

**Management resources**
Incl.: Person, organization and Address, Approval/Certification, Information rights, Contract and project

↑ Harmonization Batch 1
↓ Harmonization Batch 2

- Activity
- Individual Part
- Work Management
- Planned and evaluated characteristics
- Requirement Management, V&V
- Message
- Delta change
- Document Management
- Breakdown
- Analysis
- Representation and external element reference
- Product Specification and Configuration
- Product Data Management
- Interface

**AP242 ed2 specific CTCs**
(to be validated)

- Material
- Mating
- Kinematics
- Process Plan
- Electrical Harness
- Composite Structural Shape and Structure
- Shape Association and Structure
- 3D geometry

# Harmonisation example: TypeQualifier
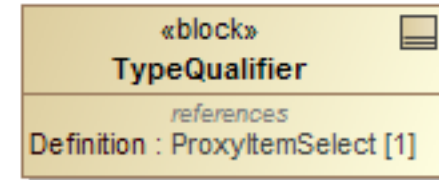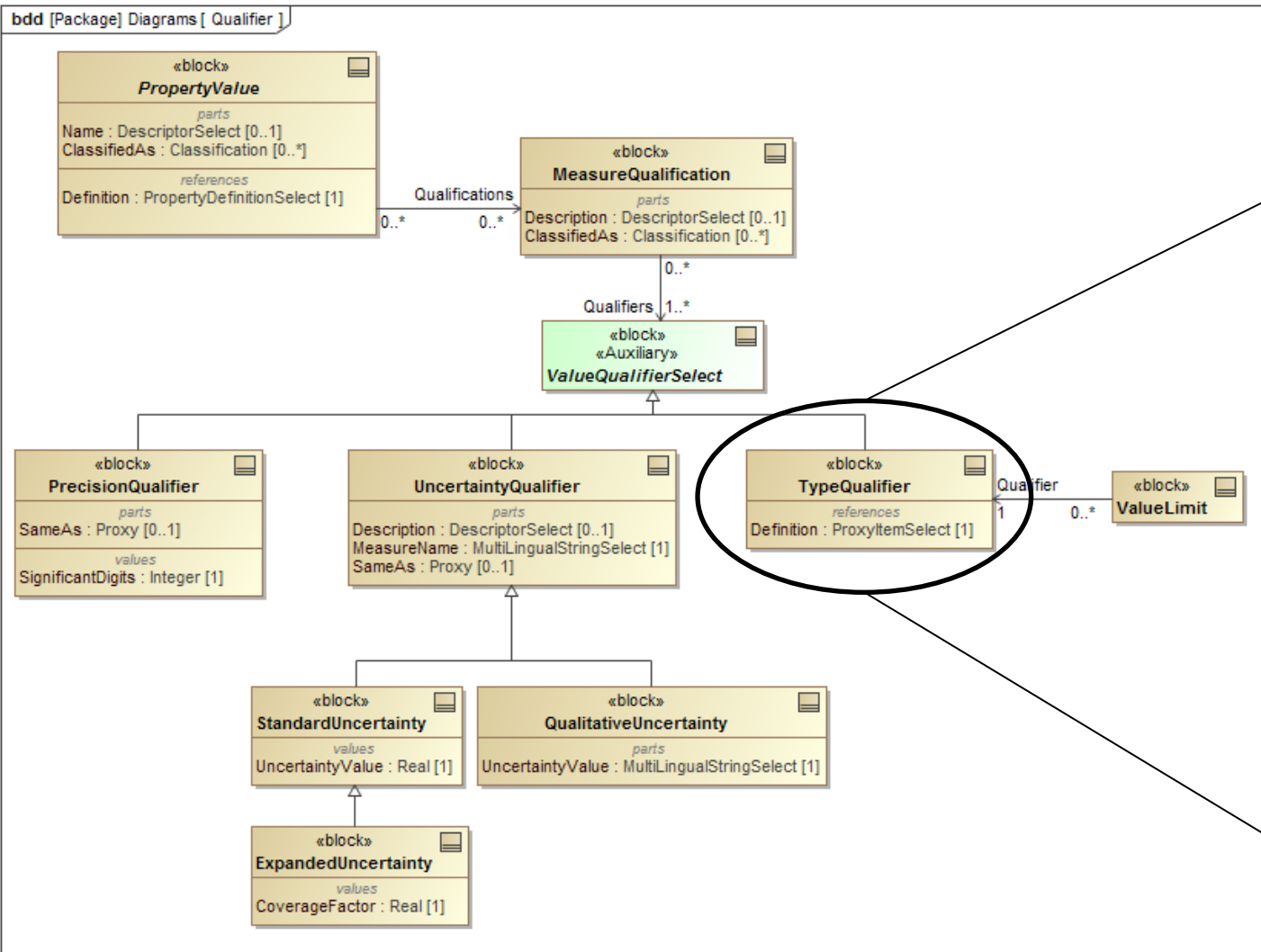
# PLCS edition 3
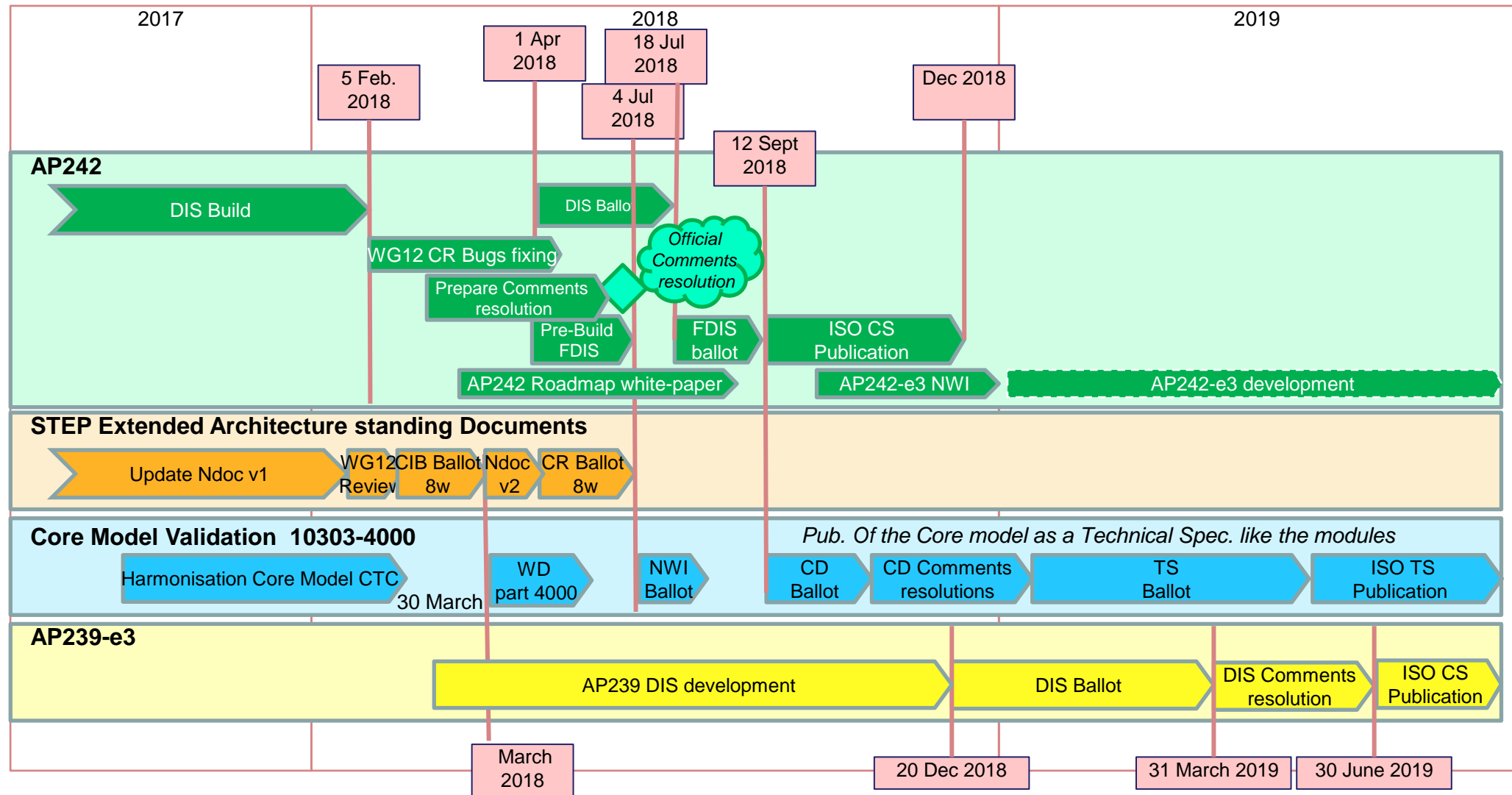
# Targeted architecture
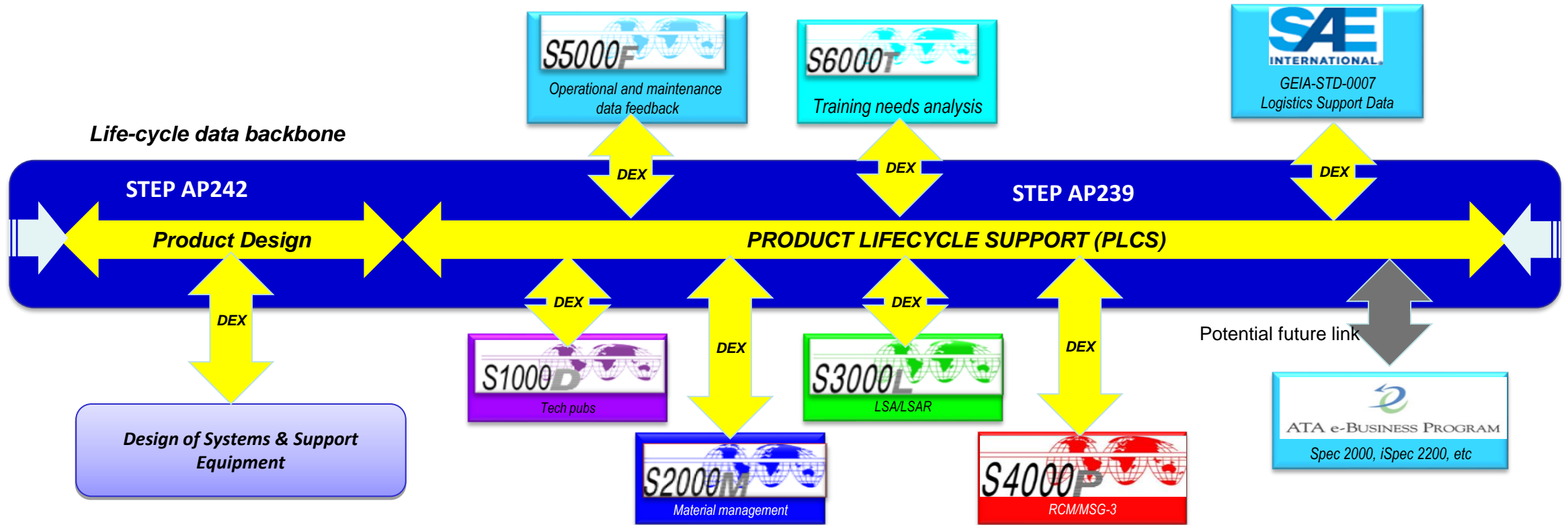


**Goal: a coherent set of standards**

# Thank you
## for your attention!

## Questions?

Contact:
Yves.baudier@airbus.com