Evolution of PLM for Design Integration

Henrik Weimer, Airbus
We are part of Airbus Group

- Total workforce: 138,000+
- Order book: €857.5 billion
- Annual revenue: €60 billion
The most global aerospace player – close to our customers worldwide

The numbers

- 11 Production sites
- 4 Assembly line locations
- 5 Training centres
- 4 Engineering centres
- 3 Customer support centres
- 10 Materials & logistics centres*

Data to end 2014

*Satair Group
Delivering value for airlines and enabling people to connect
The supply-chain & delivery model is evolving

*From a “Built-to-Print” to an “Integrator” model with an RSP strategy*

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**from...**

- Platform Assembly
- Large-scale Integration
- Value-added Parts and Assemblies
- Make-to-print Parts and Assemblies
- Raw Materials

**... to**

- System Integrator
- TIER 1 RSPs

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- **High degree of vertical integration.**
- Development responsibility mainly on Airbus.
- Local sourcing of BtP packages in an “extended workbench” approach.

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- **Acting as an A/C integrator.**
- Focus on overall A/C architecture and requirements for structure, systems & cabin.
- Sourcing of major components from a network of D&B risk sharing partners (“extended enterprise”)

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An efficient collaborative design environment is required!
OEM as Integrator

Challenges

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Most of the design is done outside the OEM

Complex product: ~3,000,000 components represented

Configuration managed by more than 30,000 configuration items

Necessity to manage concurrently different skills like:

- Structure
- Mechanical systems
- Electrical systems
- Manufacturing, …
A complex product:

- More than **3 million** part instances.
- **17 million** links.
- More than **30,000** Configuration Items.

<table>
<thead>
<tr>
<th>Component</th>
<th>A/C</th>
<th>MC</th>
<th>Section</th>
<th>WP</th>
<th>DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instances</td>
<td>1,498,600</td>
<td>999,066</td>
<td>175,544</td>
<td>360</td>
<td>100</td>
</tr>
<tr>
<td>Parts</td>
<td>162,854</td>
<td>108,569</td>
<td>29,111</td>
<td>180</td>
<td>30</td>
</tr>
</tbody>
</table>

Part Instances Parts cDMU review dataset
Today’s world is digital

As Delivered

As Specified

As Designed

As Planned

As Build

As Prepare

As Maintain

Unique DMU (Digital Mock-up)
providing and sharing basic information between all disciplines, partners and sites
Global Design In Context

Extended Dimension of Collaboration

We require an Up-To-Date Digital Mock-Up Context World Wide
PLM Information System “Ten years of evolution”

Facts & Figures

- More than 130 Risk Sharing Partners connected
- PDM: >5,000 active users daily
- VPM: >3,000 active users daily
- 85% users in Extended Enterprise
- 24/7 availability since 2012
- Data doubled every 6 months
- cDMU updated every 60 min EE included – (no exchanges anymore)
- Data management and consistency through one repository
- DMU review of full A/C
- Extended Enterprise connected in real time through a common Digital Mock-up (cDMU)
- Design in context with VPM
- Full 3D process (MBD)
PLM Information System “Ten years of evolution”

A380 IS ("4+1")
One IS by Natco
+ One common IS

A400M IS ("Fourfold")
One IS multiplied by 4
+ One common IS

A350XWB IS ("Single 1")
One central IS
### Product Development Phases

#### PHASE 0
- Concept
- Planning & Specification

#### PHASE I
- Development

#### PHASE II
- Test & Evaluation

#### PHASE III & IV
- Product Release

<table>
<thead>
<tr>
<th>‘A’ Maturity</th>
<th>‘B’ Maturity</th>
<th>‘C’ Maturity and Design for Manufacture (DFM)</th>
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</thead>
<tbody>
<tr>
<td>PHASE 0 - Concept Evaluation</td>
<td>PHASE I - Planning &amp; Specification</td>
<td>PHASE II - Development</td>
</tr>
<tr>
<td>PHASE III - Test &amp; Evaluation</td>
<td>PHASE IV - Product Release</td>
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</tbody>
</table>

- Plateau activity: OEM and Suppliers
- Off plateau activity: OEM integration of Suppliers design and build

Adapted from Wheelwright and Clark (1992)
Integration of System Engineering

Concept phase vs Detailed Design phase

About 80% of a system’s performance and cost is determined by the functional specifications and preliminary architecture.
Integration of System Engineering

Enable earlier global integration loops & smooth transition to detailed design

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Future Projects

1. Enable flexible but clear conf management during concept phase (trade process)

2. Enable early axis reconciliation (keep global view)

3. Enable global / local back & forth analysis (foresee details from global choice, check details are aligned with global decision)

4. Enable multi-disciplinary assessment in extended enterprise context (leveraging simulation capabilities)
Why PLM Interoperability Standards?

Strategic benefits
- Protect our digital information
- Open PLM approach supporting compatible ways of working across the Extended Enterprise & with customers
- More independence from PLM vendors

Operational benefits
- Enhanced collaboration throughout complete product lifecycle
- Optimization of Extended Enterprise efficiency based on increased tool flexibility
- Better integration of PLM principles for development of new products & services

Economic benefits
- Reduction of costs related to product development, product rework, and PLM applications obsolescence (i.e. migrations...)
- Less redundancy in work, data creation and processes
- Less time to market

Quality benefits
- Better product data integrity by reducing rework
- Improved product information robustness by highlighting specific data quality issues

EXCHANGE
SHARING
VIZUALIZATION
ARCHIVING
Examples of Airbus use of STEP AP 214 and AP 242

- **STEP AP 214** for the conversion of legacy 3D CAD models to Catia V5

- Long Term Archiving of A350 “Full 3D” definition in STEP AP 214 and STEP AP 242

- **STEP AP 214** for exchange of PDM product structure

- **STEP AP 242** for CAD exchange with equipment suppliers
Engineering domain interoperability standards

Airbus Group involvement

- STEP AP242 ed1 & 2 development, benchmarks, deployment
- Participation to the ASD Strategic Standardization Group
- NAS / EN 9300 LOTAR standards
  - Recent extensions to the Engineering and Analysis Simulation domain
- Development of MoSSEC (collaborative Systems Engineering)
  - Traceability and re-use of collaborative modelling and simulation
- White paper for the launch of ISO STEP AP 239 PLCS ed. 3 project
  - ISO standard supporting the integration of information models of AIA – ASD ILS specifications,
  - Finalization of PDM harmonization between STEP AP 239 and AP 242 ed2
- Participation in OASIS OSLC, including ALM-PLM WG
Summary & Conclusion

Full value of PLM comes through

- Integration across disciplines
- Covering the complete life cycle of our products & processes
- Integrating all teams globally

We don’t want a monolithic PLM system

- High dependency on one Vendor
- Need to be able to use best-of-breed technology

We have abandoned the holistic approach

- We don’t believe in a monolithic PLM system (no one-for-all solution)
- Impossible to align the product range on one system

Openness & Standards are the key to success

Compete with content, not interfaces & data formats