PLM Connect2011

product lifecycle management

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Product Lifecycle Management

Investigating and adopting a PLM Solution

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Antonov Automotive Technologies Limited

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Introduction

- Antonov moved onto the PLM path over a year ago and are ideal to answer some of the initial questions companies need to ask when considering PLM adoption.
- We will describe where the company stood when we decided for PLM and where we want to be in the next 5 years.
- The presentation will describe the initial implementation process and the experiences we gathered.
- You will hear how the change has helped the products and what our future plans are in the areas of workflows, Change Management and BOM control with additional users to be added to the process for workshop, finance, purchasing and extended enterprise customers in 2011.

Introduction to Antonov

- Antonov is a transmission specialist located in Warwick, UK.
- Providing a complete engineering capability from concept through to production design and development.
- In-house control system expertise
- China office (WOFE) based in Chongqing
- Manufacturing 50/50 JV with Landai Industries, China.

THE Manufacturer

Transmission Design & Analysis

Full design capability from concept to detailed production design:

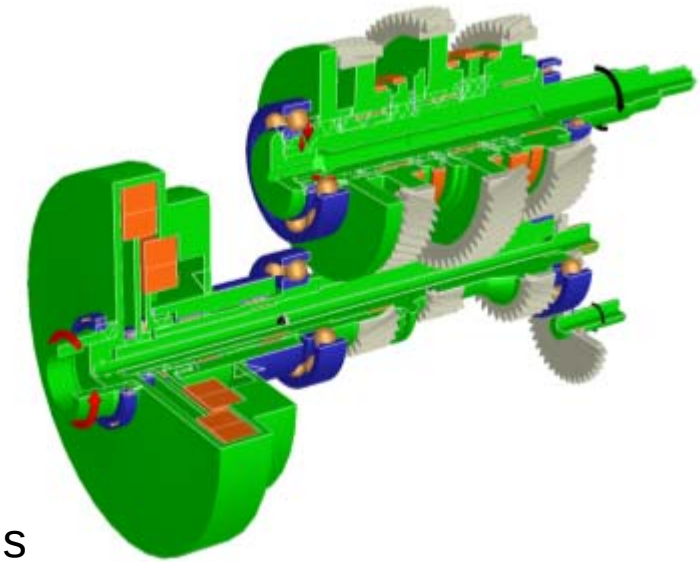
- Conventional torque converter planetary automatic transmissions
- Single and multi-speed transmissions for electric vehicles
- Manual gearboxes for passenger car and motorsport applications
- All Wheel Drive systems and torque vectoring differentials
- Hydraulic and electronic actuation and control systems

Product optimisation and volume production launch:

- Engineering risk analysis and design FMEA's
- Cost-down, modularity and part count reduction
- Weight optimisation
- Design for manufacture and ease of assembly
- Bill of Material and volume costing
- Vehicle packaging and installation requirements
- Transmission torque upgrades

Analysis led design process:

- Optimal right first time solutions
- Reduced need for hardware testing
- Durability analysis of shafts, gears and bearings
- Finite element analysis
- NVH analysis, mis-alignments, micro-geometry
- Dynamic simulation



Analysis tools:

- Romax Designer
- Hyperworks –
    - HyperMesh
    - Optistruct
    - Radioss – linear/non-linear finite element analysis
    - MotionSolve – multi-body dynamics
- Matlab Simulink

Controls, Electronics & Calibration

- Proven capability to develop algorithms, electronic systems and calibrate
- controllers for automated transmissions from concept to production.
- Accelerated process development using bespoke CAE toolsets.
- TCU application development
- Series production controller test, DVP
- Rig system development
- Rapid prototyping / HiL testing
- Concept to Job #1
- Calibration tools, e.g. Canape
- Automated simulation based process
  - Drive cycle/Driveability/Performance
- Gear shift quality
  - Objective /Subjective assessment/development

Transmission Test & Development

Prototype procurement and assembly
• Clean rooms, wash facilities, supplier selection, purchasing, prototype assembly.

Transmission testing
• Transmission functional testing
• Friction drag loss and efficiency measurements
• Spin rig and Tilt rig development
• In-vehicle transmission calibration and testing

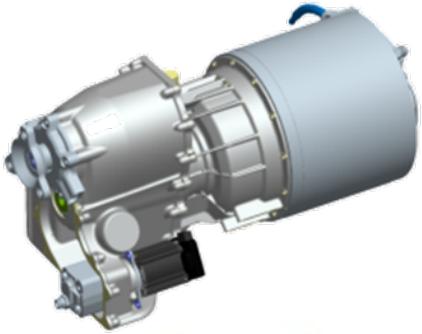
Hydraulics development
• Dedicated hydraulic flow bench for full system development
• Optimisation of pump, manifold, control system, cooling system
• Minimising oil churning and clutch drag losses

Transmission vehicle integration
• Installation of transmissions into donor vehicles
• Full workshop facilities to support multiple vehicle installations

Transmission Benchmarking

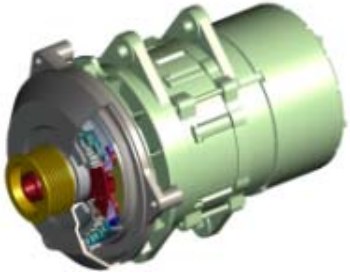
Current Antonov Projects:

Electric vehicle transmissions



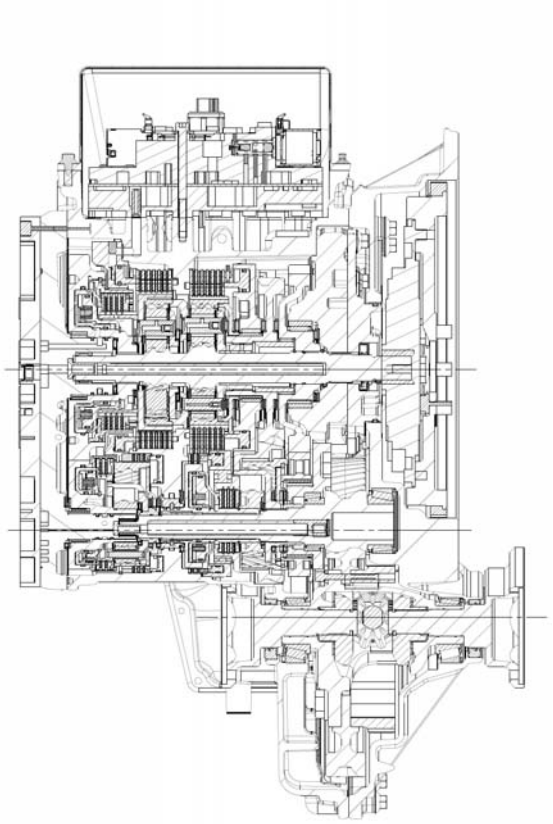
TX6 (6 Speed Auto)

2-speed accessory drives



18 Months ago

- One Main project
  - TX6 Auto Transmission for China
- Commercial Engineering Projects gather pace with 3 new projects about to commence



Status then:

- Pro-Engineer Wildfire 3 used for TX6
  - Design Team of 6 people (20 people total)
  - TX-6 Design at CAD only stage
  - Team size begins to grow
- Manual generation of drawing data for suppliers/purchasing tasks
- Pro-Intralink used as Data Manager
- Excel based BoM
- FE Analysis server separate to CAD
- Manual documentation for Change control of CAD data
- Meta Data manually transferred from Intralink to stand alone (web based) drawing storage server

Selection of PLM

- Positive feedback from existing engineering team based on previous experience of Windchill PDMLink with ProEngineer
- Ease of implementation was considered to be a significant factor.
- Commercially Driven decision based on upgrade paths available through PTC considering Pro-Engineer packages already owned by Antonov.
- Windchill PDMLink was selected.

The requirements 18 months ago

Given that Antonov were mid project:

- Careful Rollout needed to avoid disruption
- Phased approach
- Initial phase aims were to be modest

Phase 1 requirements were as follows:

- TX6 Six Speed Auto project digitally defined within a controlled PDM environment.
- Controlled release of Production data through a business mapped release scheme.
- Standardize product development with business processes and templates.
- Collaboration of digital data with global teams spanning multiple departments and organizations.
- Comprehensive visualization of the digital product.
- Manage and associate other product content. Initially to include the following document types, ECO, Report and Specification with their own unique numbering sequence.
- Antonov TX6 CAD data required by:
  - Purchasing Team
  - TEST & Development team
  - Engineering Partner companies
  - China office + EFA Chongqing

Implementation Process

- Initial Scope of work very modest:
  - Decision taken to replicate Pro-Intralink CAD functionality initially with improved Document control & publishing
  - Improved visibility of CAD data across business imperative via Product View
  - Attributes carried across, Personnel Roles & Document types modified / introduced
  - Product Groups introduced
  - Implementation Partner: INNEO Solutions

Roll-out

- INNEO worked closely with Antonov to define the data model required to achieve the above requirements.
- A test system involving Antonov‘s PLM trained administrator was utilized to view alternative solutions and select the best fit accordingly.
- Once this process was completed, a clean data model specification was configured once only into Antonov's Production system.

Initial Product requirements

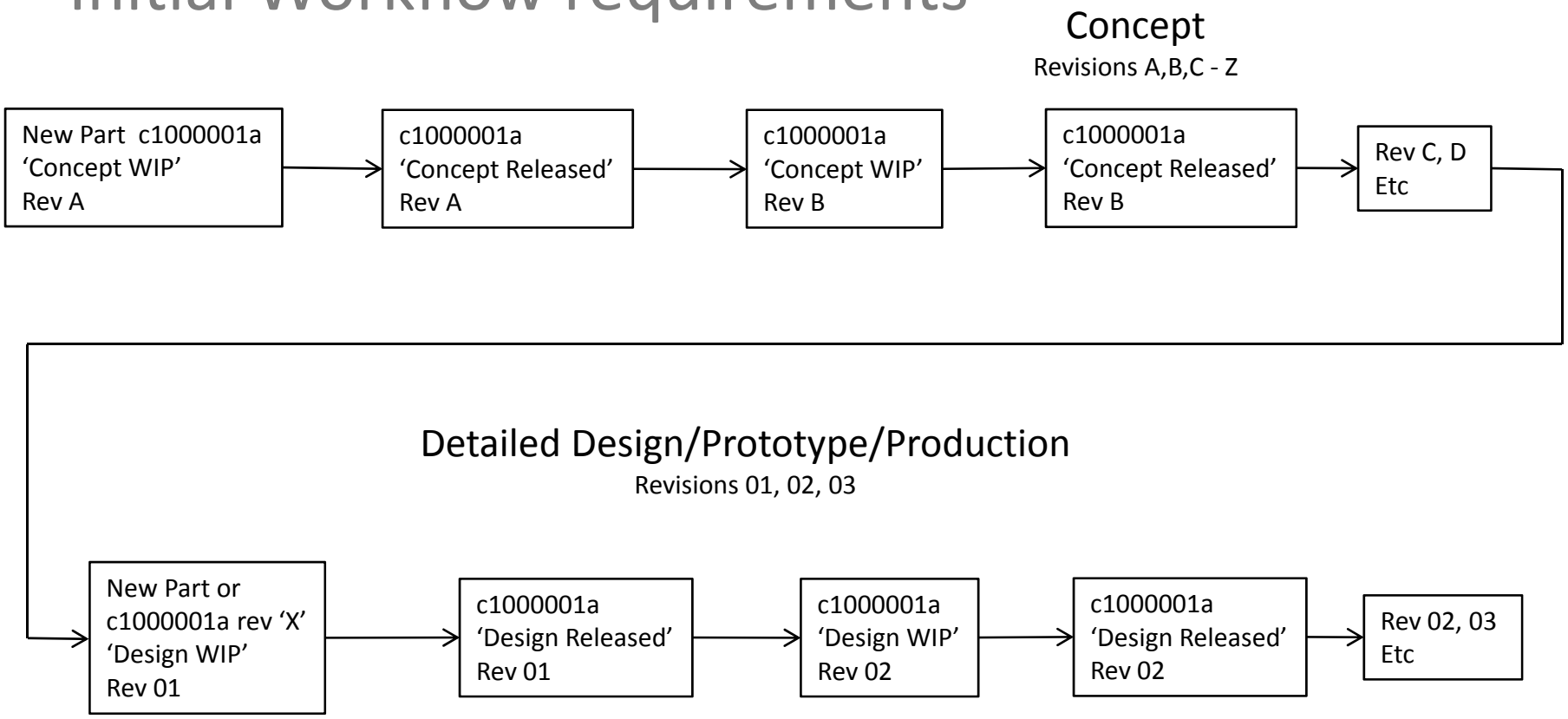
Products

- 6 Speed – project Titles maybe to get access to top level assy's
- 2 Speed

Libraries

- Standard Parts
- Start Objects (CAD only or doc objects also ?)
- Standards (BSxxxxx, DINxxxxx, ISOxxxxx)

Initial Workflow requirements

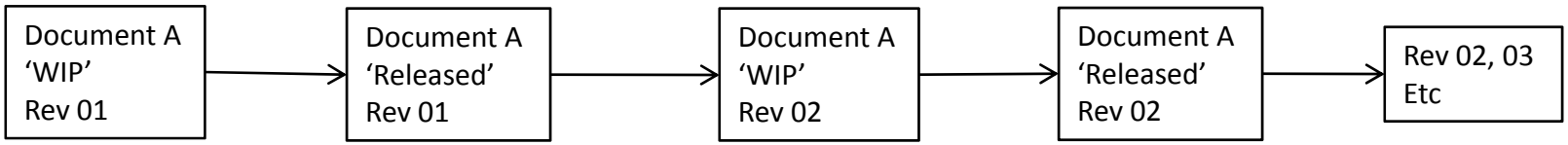


Initial Workflow requirements

3. Lifecycle Scheme / Revision Sequence – All non CAD Documents

Non CAD documents

Revisions 01, 02, 03



- Prior to going live, all relevant users of the Windchill system attended a user training course. The Antonov data model was introduced to the team so they were fully aware of the system and procedures before using the system.

- The production system was rolled out and Antonov personnel began the task of populating the database with their digital content. Regular reviews took place and the system was adjusted as neccessary to accomodate any modifications required.

Post Roll-out

A six month major review took place and the following additions / modifications were required:

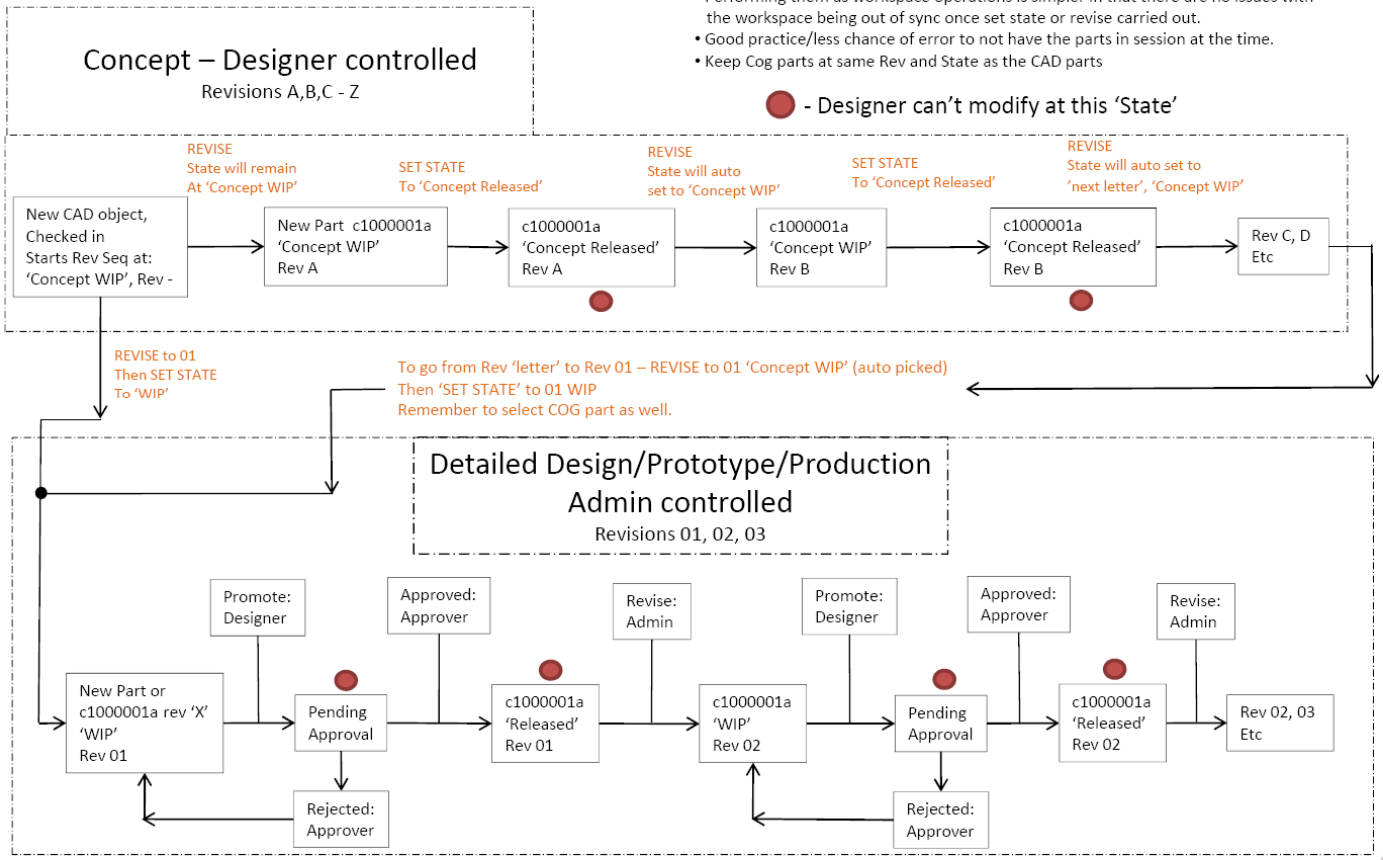
- User/Role authorisations were adjusted to accomodate Antonov's evolving project requirements.
- Product templates were created so that Antonov could easily and quickly introduce new projects to the system whilst maintaining corporate standards and business processes.
- Life Cycle modification was required to accomodate Antonov's evolving business process.
- Once again, a test system was utilized as before to fully qualify the solution before implementation. This ensured a successful roll out of the business model enhancements required from the start.

Post Roll-out

1. Lifecycle Scheme / Revision Sequence - CAD

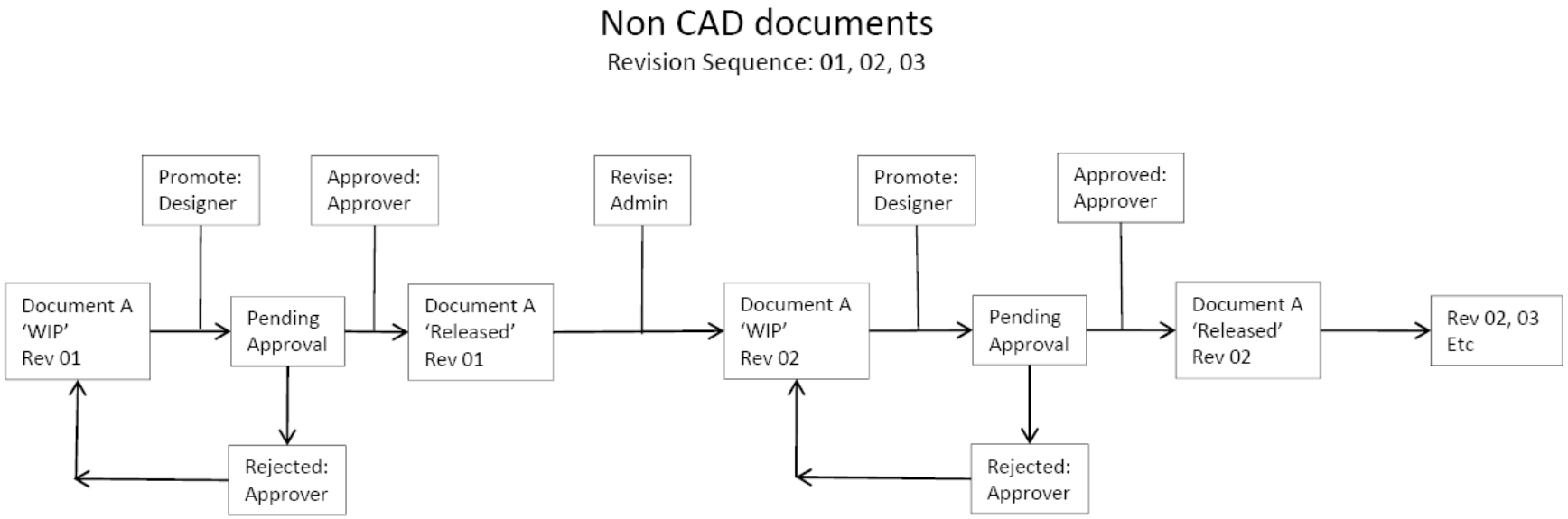
- REVISE and SET STATE are Workspace or Commonspace operations
- The items need to be checked in.
- Performing them as workspace operations is simpler in that there are no issues with the workspace being out of sync once set state or revise carried out.
- Good practice/less chance of error to not have the parts in session at the time.
- Keep Cog parts at same Rev and State as the CAD parts

● - Designer can't modify at this 'State'



Post Roll-out

2. Lifecycle Scheme / Revision Sequence – All non CAD Documents



Achievements

- Minimal disruption to live project (1 day maximum disruption to users between switching from Intralink to Windchill once test system was approved)
- Within one week the competency level of designers on Windchill were at the same level as Intralink
- Product lifecycle visible to Project Managers, Test, Development & Purchasing
- Document control supports Purchasing of Prototypes
- New Products incorporated into Windchill with Inneo assistance. Antonov are now able to self manage this task
- To date Antonov have only used 15 days of support from our implementation partner
- Platform for further expansion

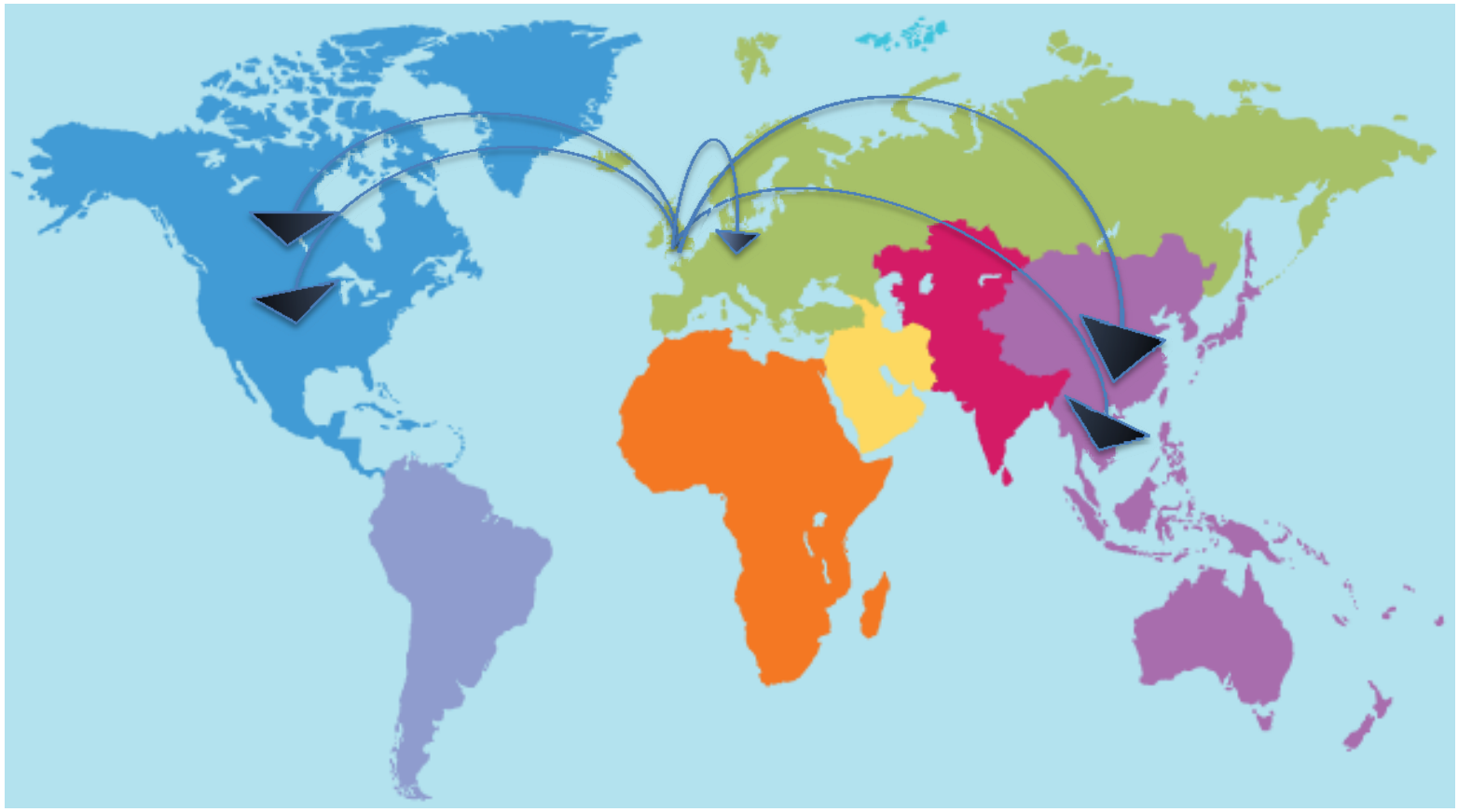
Lessons learnt

- It is essential to understand your business requirements, particularly associated with workflows, prior to embarking on a PLM solution.
- After initial implementation we found that more users wanted access than originally anticipated so more licenses were required.
- After 6 months usage we identified a need to have more robustness within the workflows to eliminate the ability to inadvertently modify data.
- Careful selection of your implementation partner is essential.
- There is a very real need for you to have an administrator capable of liaising with your implementation partner to understand and resolve issues arising.
- To ease the changeover from Intralink to Windchill PDMLink it was found to be advantageous to have a separate server for each installation.

Future Plans

- Now confident to extend PLM system towards
  - Refining Product Lifecycle further to incorporate the needs of our Chinese production Joint Venture.
  - BoM configuration, particularly production.
  - Integration with other systems (e.g. MRP system)
  - All future projects will be implemented within the Windchill PDMLink system
  - External Portal access for Customers

Antonov Engineering Links



Summary

- Initial Phase with modest scope has laid foundations for extending PLM to Joint Venture company and External Companies
- Initial modest scope for introduction allows more flexibility and extended evaluation to determine future steps
- Once a basic understanding of the capabilities of the system is achieved, further refinements can be made (don't run before you can walk).