MEMKO Aviation Aerospace & Defence

DIGITAL GAP - DESIGN, MANUFACTURING & MAINTENANCE

Miro Miletic, Managing Director

memko

Overview

- About MEMKO
  - Presenter
  - Business Streams
  - Certifications and Accreditations

- Digital Gap, Design, Manufacturing & Maintenance
  - The Journey and Current status

  - Design to Manufacturing
    - Engineering Assets
    - Manufacturing Derived Assets
    - The Supply Chain

  - Design to Maintenance
    - Engineering Assets
    - Maintenance Derived Assets
    - The Supply Chain

- Conclusion and Recommendations

Presenter – Miro Miletic

Extensive record of leadership and achievement over 30 years in the global aerospace industry recognised by the award of an Honorary Doctorate in Engineering (Aerospace) by RMIT University, Melbourne Australia.

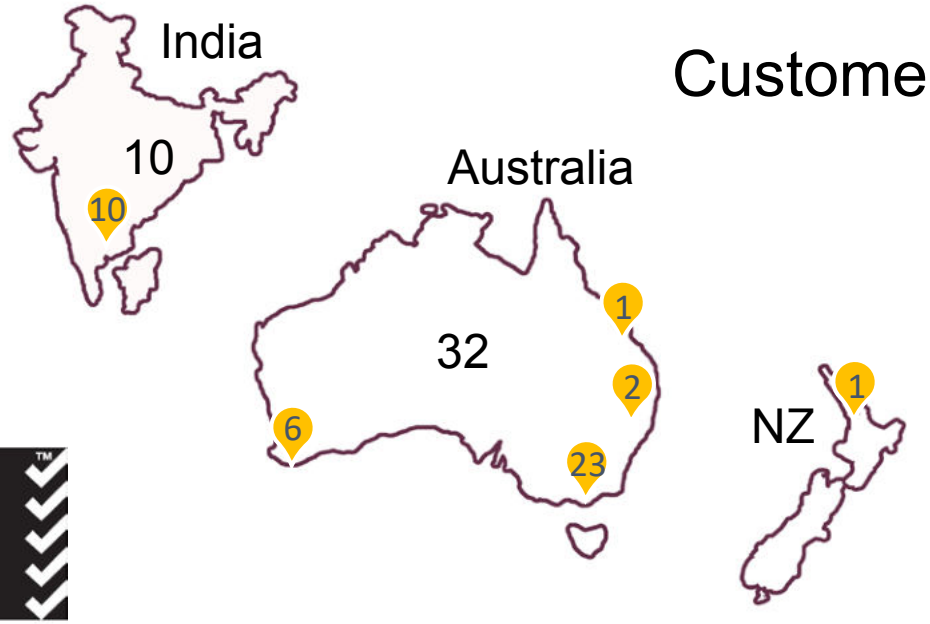
Worked on large commercial and military aircraft projects:

- Boeing 737, 747, 757, 767, 777, 787, F/A-18, 737AEWC, JDAM-ER
- Lockheed C-130 and F-35
- Airbus A320, A330, A340 and A380

Active involvement in aircraft design, manufacturing, maintenance and support of aircraft entry into service.

About MEMKO

10th Anniversary
May 2007 – May 2017



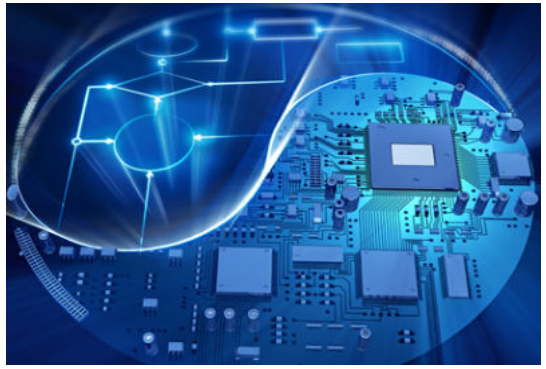
Customers

Certified System
Aerospace
AS 9100
SAI GLOBAL

Business Streams

Aviation, Aerospace & Defence

- Consulting and Regulatory Support
- Design, Analysis, Test and Certification
- CAMO Services
- Part 21.M Engineering
- Aircraft CoA
- R&D



Systems

- Software Products
- Deployment Services

Training

- Aviation & Aerospace
- Product Life Cycle Management (PLM)

Certifications and Accreditations

CASA Instrument of Appointment for CASR Subpart 21.M

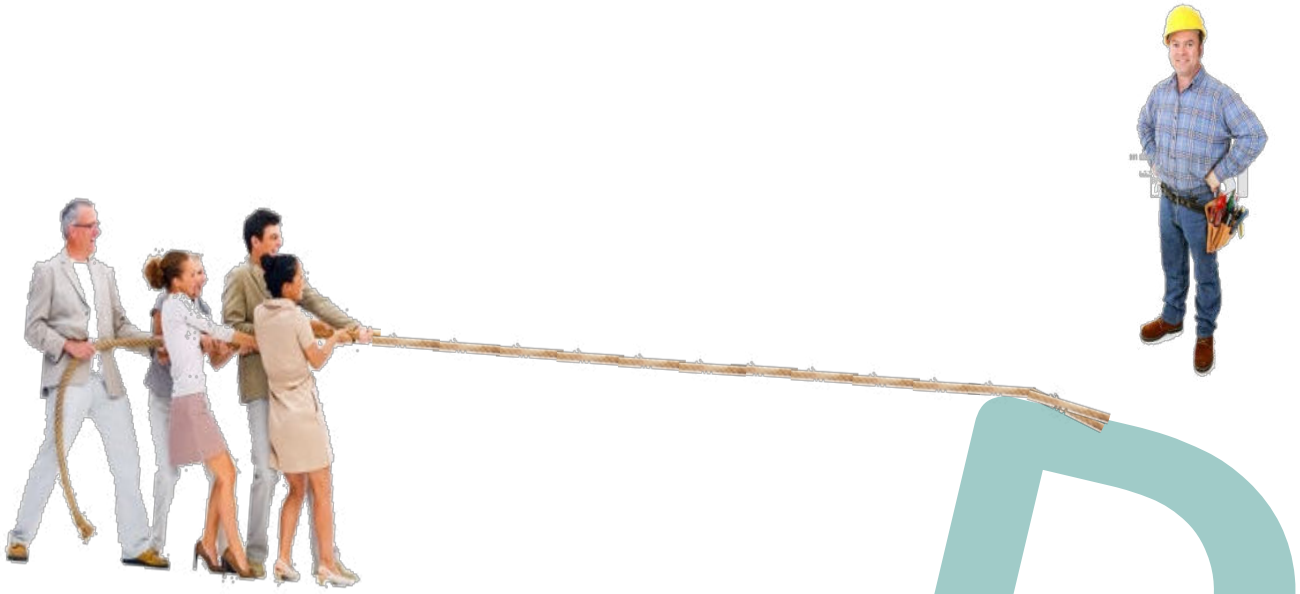
- Repair and Modification Subpart 21M
- FMS CASR Reg 21.006A
- Tech Data CASR Reg 21.009
- Type Data changes CASR Reg 21.095
- Weight & Balance Authority CAO 100.28 (A319/A320/A321)
- MRB authority under affiliation with local manufacturers

CASA Instrument of Appointment for CASR Subpart 21.H

- Certificate of Airworthiness Reg 21.178
- Export Certificate of Airworthiness Reg 21.324
- Special Flight Permit Reg 21.200

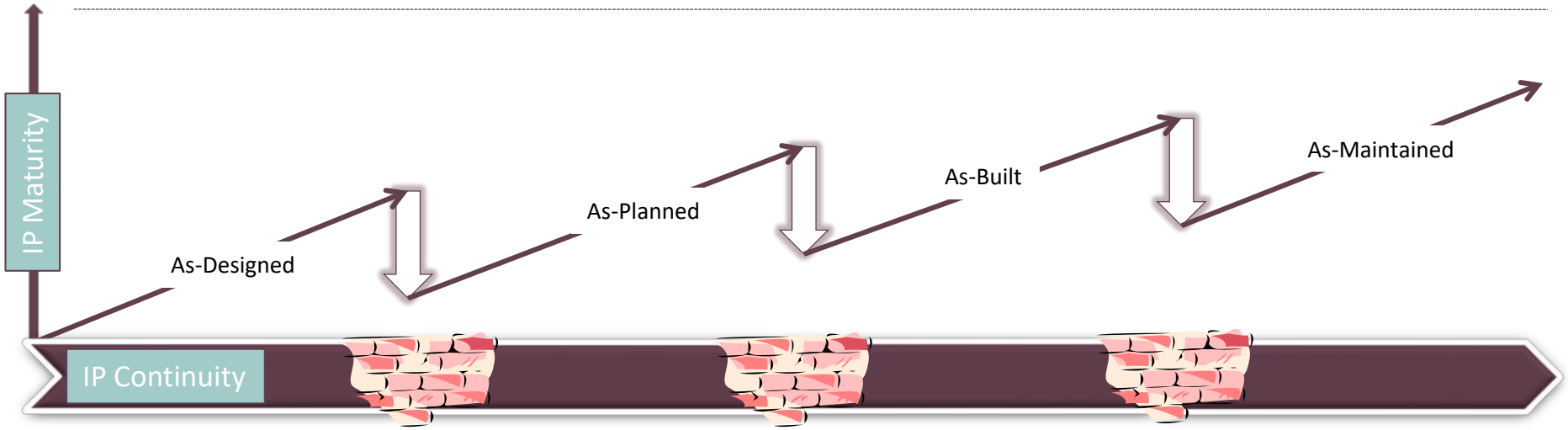
Quality Management System AS9100 Rev D and ISO9001:2015

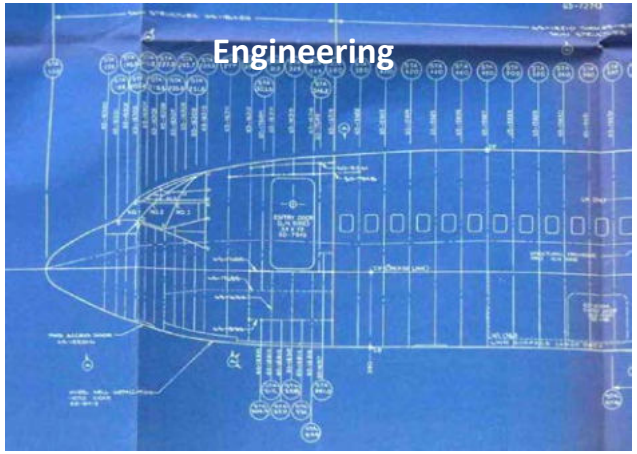
Closing the Digital…



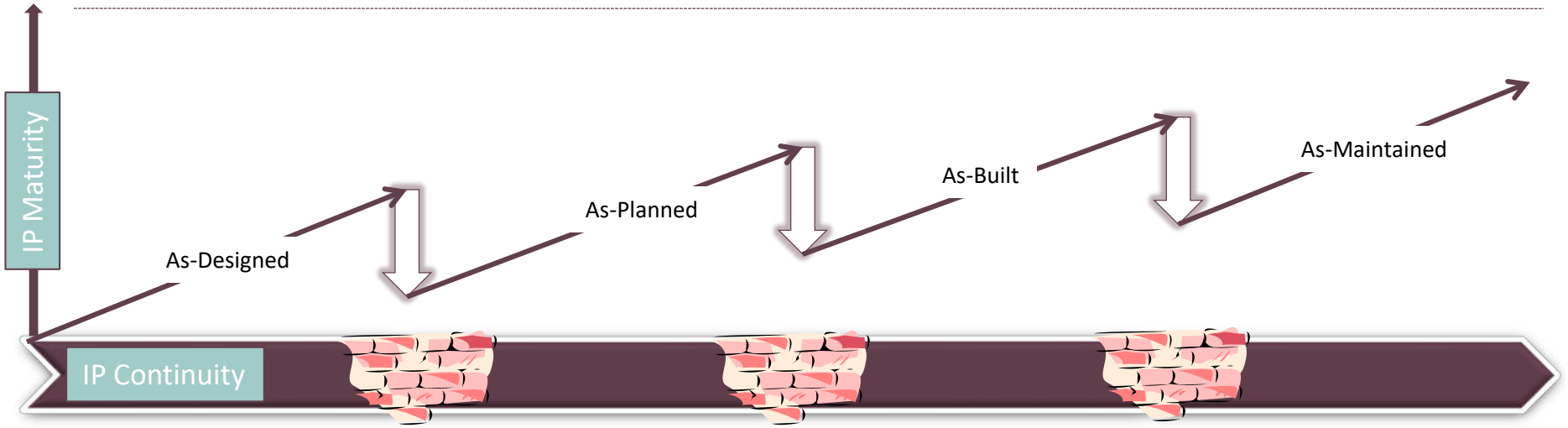
GAP

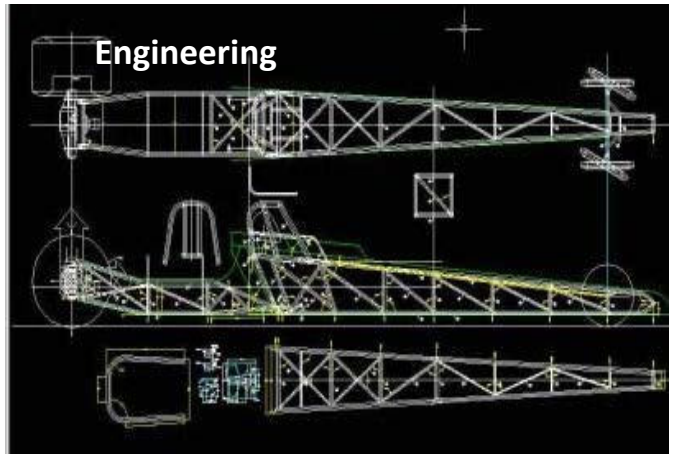
1950’s



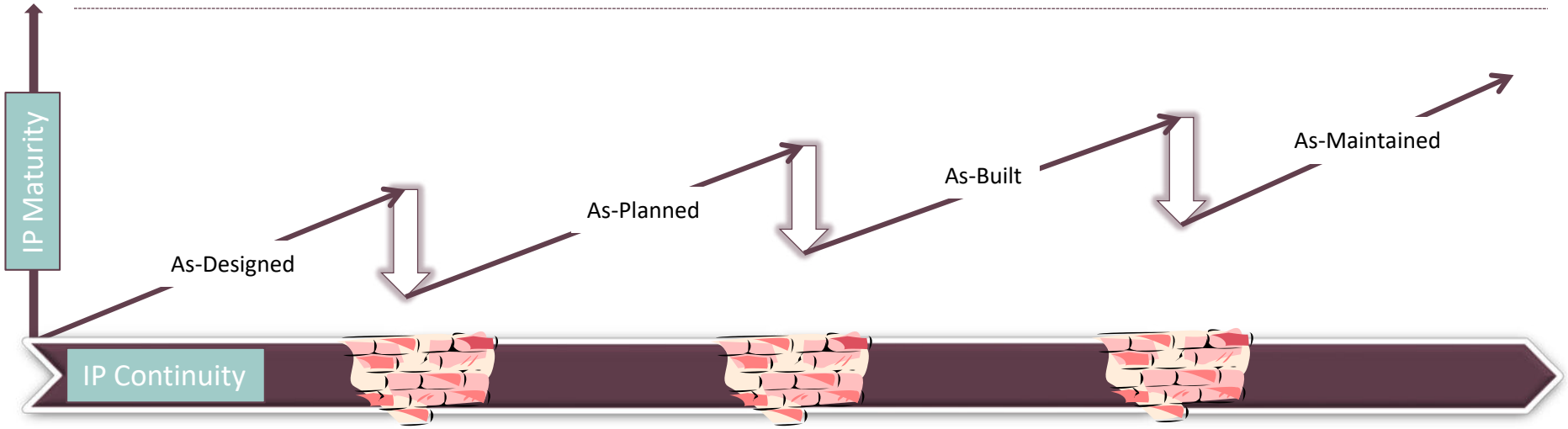


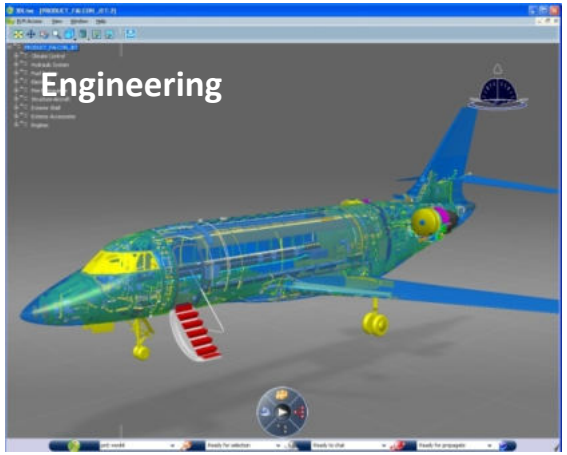
1970’s





2000’s

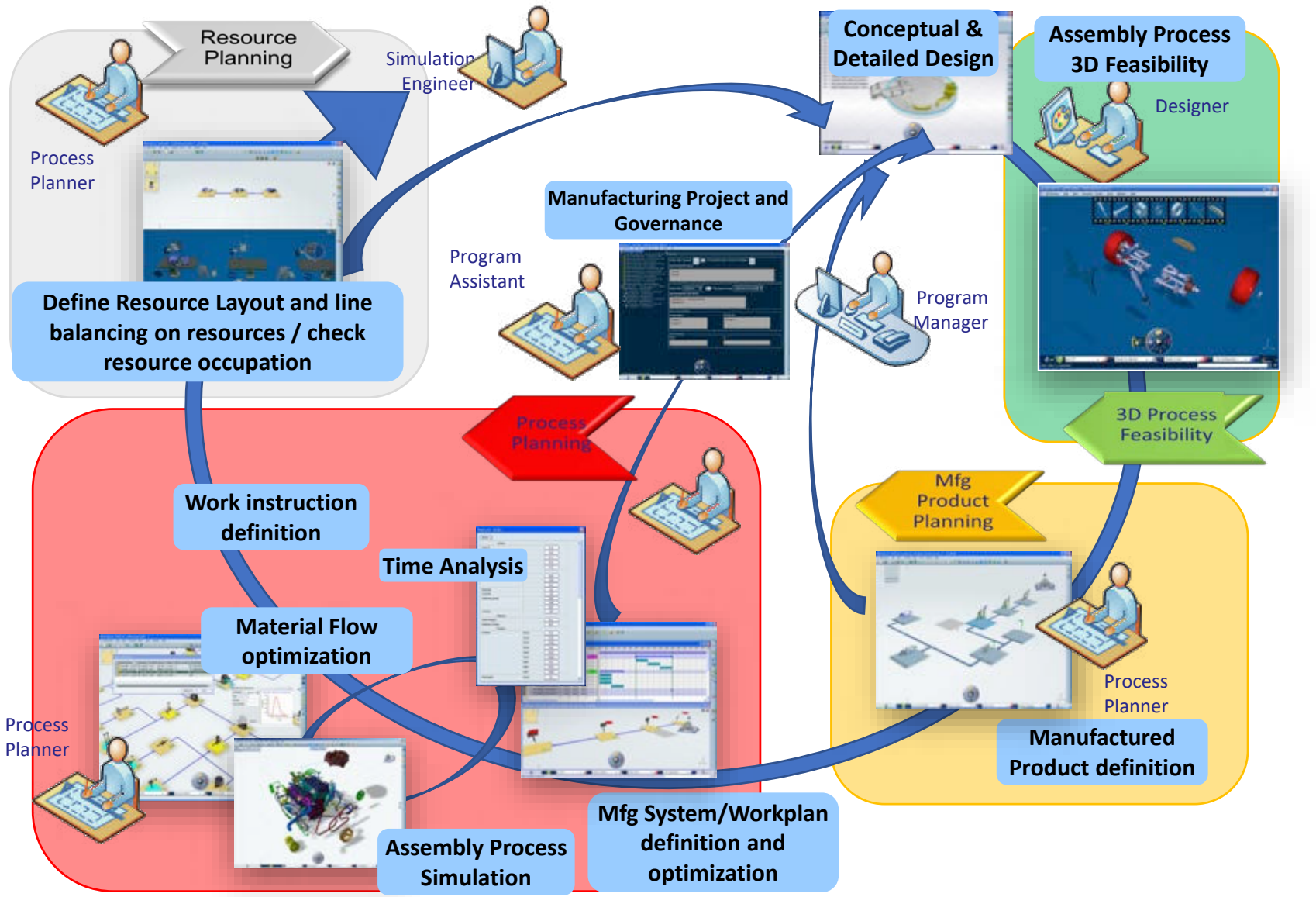




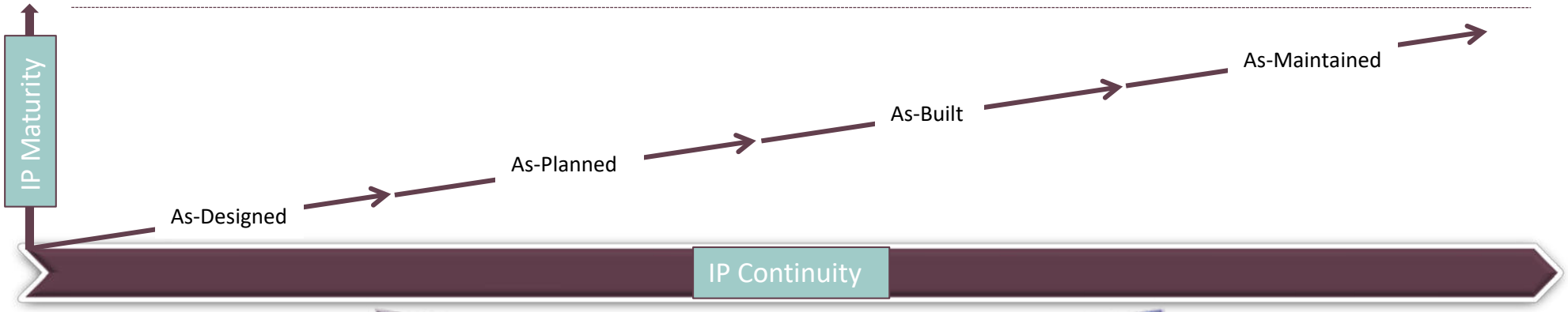
Engineering and Manufacturing Derived Assets

Master Data	Derived Data
Data created by OEM in order to manufacture the aircraft	Data created by the OEM and supplier
Model Based Definition – 3D Process Specification Materials Specification Standards	Project Plan Manufacturing Plan Quality Plan Work Instructions NC Data Tooling Data

Process, Quality and Resource Planning (OEM)

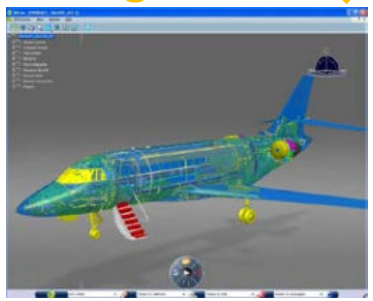


Future – Design, Planning, Manufacturing



Design, Engineering Simulation and Analysis

Design Intent



CAD/PLM MBD/MBSE

Planning, Offline Programming, Simulation and Validation

Various tools with limited integration and functionality

Work Instructions, Condition of Supply, Technical Publications

Shop Floor Operations

MES/ERP/MIS

Manufacturing – The Supply Chain

- Manufacturing supply chain is evolving from a tiered structure to one aligned to commodities
  - Machined components and sub assemblies
  - Composite components and sub assemblies
  - Systems

- Digital continuity between OEM's and suppliers is limited
  - Cyber security and export control requirements
  - Use of multiple CAD/PLM systems by OEM's
  - Cost of CAD/PLM/MES/ERP software
  - Supplier skills in digital technology

Engineering and Operator Derived Assets – The Earth is Flat

Master Data

Data provided by OEM and Regulatory policies in order uphold the aircraft's airworthiness and provide improvements to reliability of the aircraft.
Due to the extended down time, it is incorporated into a heavy maintenance event

AD – Airworthiness Directives
SB – Service bulletins
ALS – Airworthiness limitations Section
1. Life Limit Parts,
2. Airworthiness Limitation Items,
3. Component Maintenance Requirements,
4. System Equipment Maintenance Requirements,
5. Fuel Airworthiness Limitations

AOT – Alert Operator Transmission
AMM – Aircraft Maintenance Manual
ASM - Aircraft Schematic Manual
AWM - Aircraft Wiring Manual
CMM – Component Maintenance Manual
ESPM - Electrical Standard Practices Manual
IPC – Illustrated Parts Catalog
MMEL – Master Minimum Equipment List
MPD – Maintenance Planning Document
MRBR – Maintenance Review Board Report (Initial minimum maintenance requirements)
NTM - Non-destructive Testing Manual
SRM – Structural Repair Manual
TEM – Tool and Equipment Manual
TSM – Trouble Shooting Manual

Derived Data

Data created by the Operator, usually customised / derived from OEM data is used

AMP – Aircraft Maintenance Program (Operator customised)
OMEL – Operator Minimal Equipment List (Operator customised)
EO – Engineering Orders (Operator customised)
Reliability Report – (Operator produced on quarterly basis as required by regulatory requirement for OEM's fleet reliability record)
WO – Work Order with individual task cards (Operator customised)

Maintenance – The Supply Chain

- Fragmentation of the supply chain between OEM, Operator and Maintainer
- Access to OEM CAD/PLM data is not available
- Cost of re-creating digital 3D assets is extensive
- Evolving business models
  - Engines
  - Airframes
  - Systems

Communication Example

SALZER ELECTRONICS LIMITED

ASSEMBLY – WORK INSTRUCTIONS

NO: FORM NO: QS-06

STAGE ASSEMBLY:-

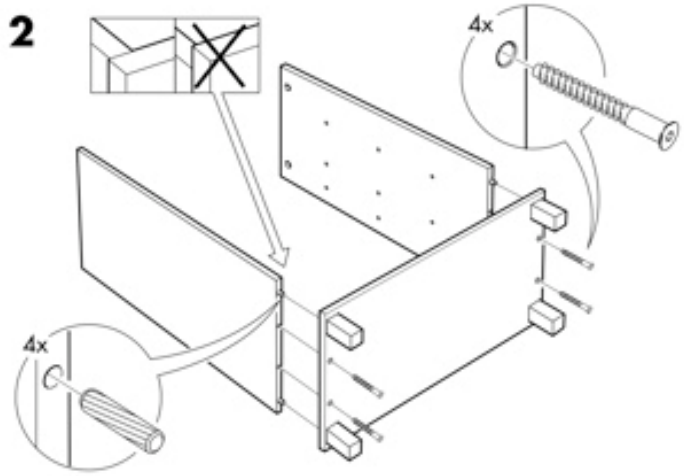
1. TAKE PANEL REF #4520-42 AND PLACE 2 WOODEN ERGOTS AT THE MOST EXTREME HOLES OF THE LOWER SIDE. MAKE SURE THAT HOLES ON INNER SIDE FACE THE INSIDE.
2. TAKE PANEL REF #4520-41 AND PLACE 2 WOODEN ERGOTS AT THE MOST EXTREME HOLES OF THE LOWER SIDE. MAKE SURE THAT HOLES ON INNER SIDE FACE THE INSIDE.
3. VERIFY THAT PANELS #4520-42 and #4520-41 ARE PROPERLY ALIGNED
4. MOUNT LOWER PANEL REF#69303 AND USE 4 SCREWS REF BFT-56 TO COMPLETE ASSEMBLY.

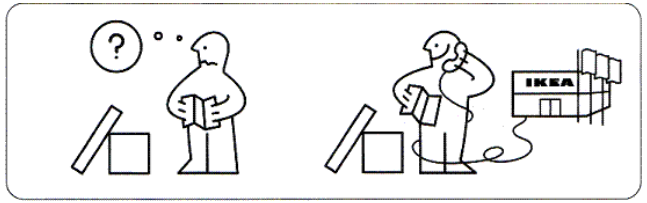
CONTACT SLIDE, MOVING CONTACT, CONTACT SPRING ASSEMBLY

CONTACT PRODUCTION SUPERVISOR IN CASE OF PROBLEM

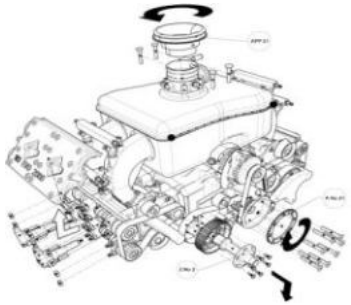
PREPARED: G. Balbamani REV: 3

APPROVED: DATE: 11.10.2006

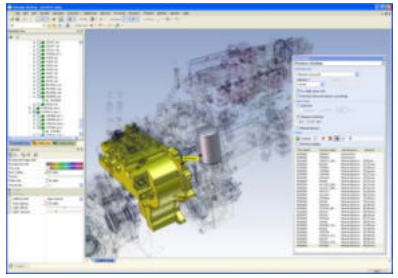




A better way to Communicate



Technical Illustrations

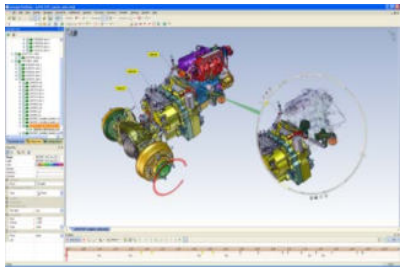


Operation and Training Instructions

Revolutionizing documentation content creation, publishing, and maintenance

Authoring System for creating linked graphical and interactive documentation:

- Traditional 2D images
- Interactive Documents
- 3D On-line Experiences



Maintenance and Service Instructions

Assembly Instructions

Interactive On-Line Catalogs

Product System Modelling

Input Data

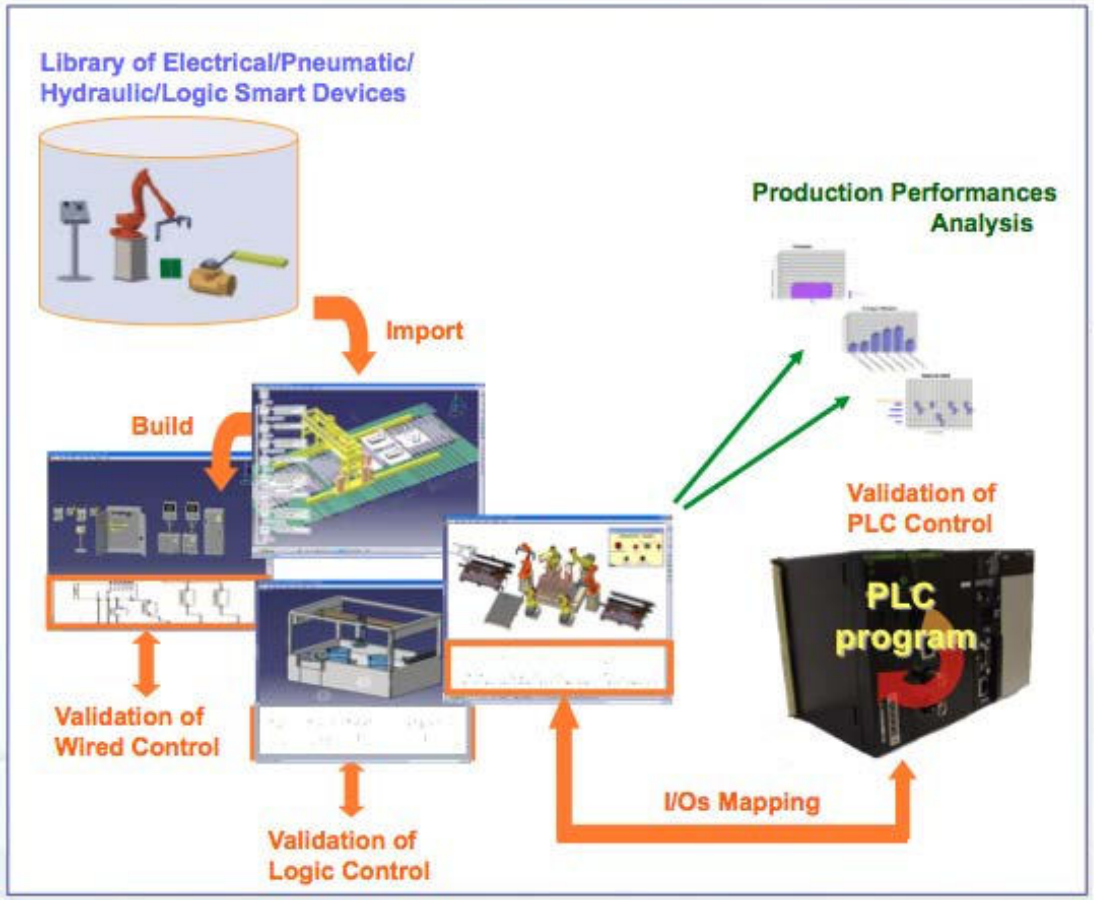
- Parts Lists and Scheduling Data
- Process Flow and Behavior
- Material Flow
- Part Routing Logic
- Labor and Shift Schedule
- Model Duration

Outputs: Complete Analysis

- Capacity Analysis
- Throughput Analysis
- Bottleneck Analysis
- WIP Evaluation
- Labor & Equipment Utilization
- Manpower Requirements & Allocation
- 3D and 2D Graphics
- Dynamic Business Statistics/Graphs

Automation System Design and Modelling

Virtual Control Validation



Objectives

- Validate the Control of a Workcell or entire line (Electrical / Pneumatic / Hydraulic / Logic Control)
- Validate all external PLC Control Programs
- Analyze performances of the controlled system

Project Deliverables & Benefits

- Reduce ramp-up time on manufacturing floor
- Validate the PLC program changes required for a new equipment set-up
- Optimize the performance of your production system

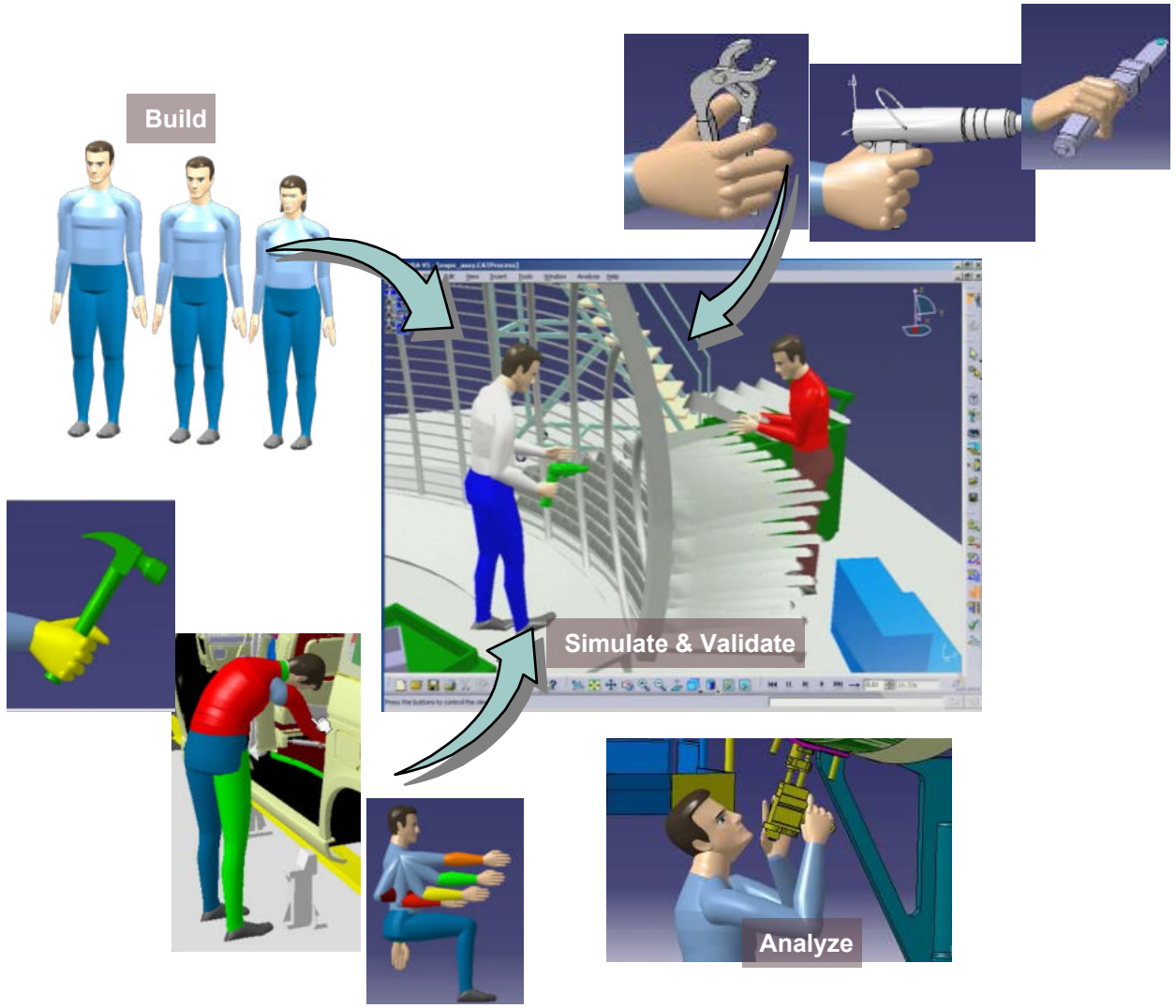
Validate in 3D context all Control Systems
Reduce time to ramp-up and risks of error on the manufacturing floor
Optimize the performance of Production systems

Human Work Analysis

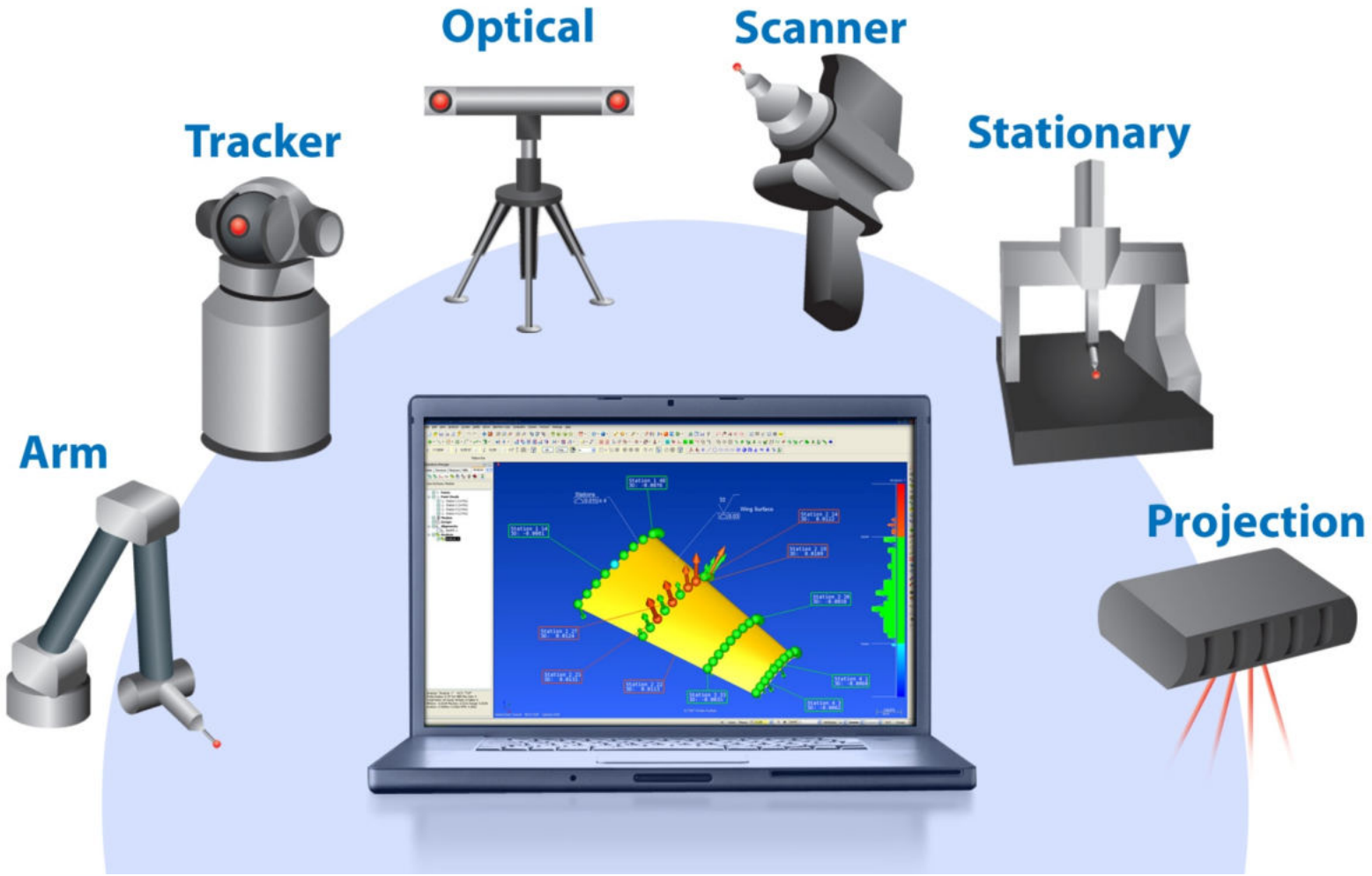
Optimize workplace environment for better worker efficiency

Enablers

- Remove the need for costly physical prototypes and real human simulations
- Reduce teach and set-up time by using pre-defend catalog posture
- Optimise human-workplace interactions
- Evaluate/predict human performances
- Perform accessibility, vision analysis
- Layout optimisation
- Posture analysis (RULA / NIOSH)

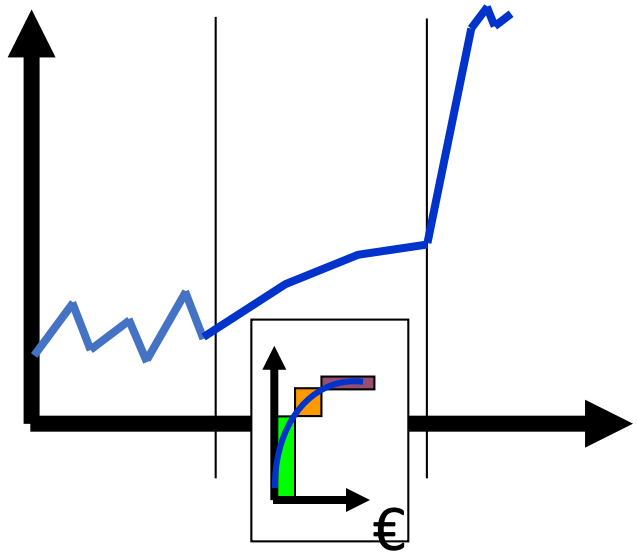


Model-Based Inspection

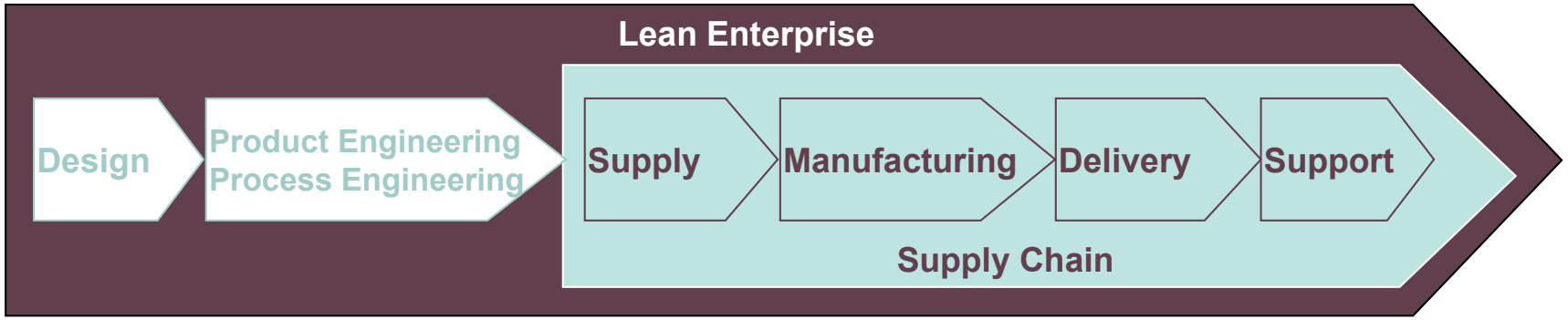


The Opportunity

- Each stage is being optimized:
  - Product Engineering, Design Office
  - Manufacturing Engineering
  - Production
  - Support / MRO



The *New Frontier* lies in tearing down the walls and aligning each stakeholder on a unified value stream



Conclusions and Recommendations

- Digital (3D plus System) design of product, resources and process has been adopted partially by OEM's and larger supply chain partners

- Re-use of digital data for validation and execution of resources and process is significantly lagging behind digital data utilisation for product design validation

- Aircraft operators and maintainers have limited or no digital data access for efficient operation and maintenance

- Key issues to adoption of digital simulation, validation and execution are:
  - Awareness, skills and knowledge
  - Data access, commercial and regulatory constraints
  - Technology readiness

Conclusions and Recommendations

- OEM's
  - Define and adopt technology for process and resource modelling and validation
  - Maintain a digital repository of products, processes and resources
  - Consider supply chain implications during the product, process and resource definition
  - Plan employee skill enablement and skill transfers for suppliers

- Operators
  - Request greater access to digital product, process and resource information
  - Maximise the use of digital assets for the operation and maintenance of aircraft

- Training Organisations
  - Revise curriculum to reflect industry best practice

- Technology Vendors
  - Develop and improve applications to support downstream processes