3D Work Instructions and Automated Data Validation with xCompare

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The Boeing Company &
Transcat PLM GmbH

Iterations of Drawing Data used by ME

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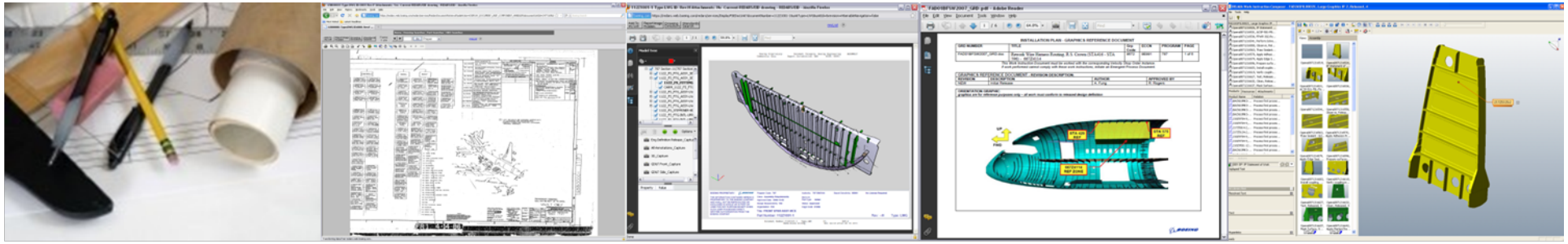


Hand Drawings | CAD Drawings | 3D MBD | Graphics Reference Documents | Configurable / Authoritative 3D Plans

BCA Manufacturing Engineering Graphics Capability Vision

Develop and implement a solution that allows Manufacturing Engineering the ability to create, annotate graphical views and associate them to Process plans. ME would have the ability to associate manufacturing context, and build exceptions to the graphical views.

- The graphical data would meet the necessary levels of accuracy required to allow the views to be considered derived authority; allowing the MT/QT to use the graphical views on the shop floor for build buyoff and inspection.

- This provides the downstream users a single source of data, and minimize touch time by eliminating the need to use multiple systems to interpret and buyoff of the engineering data requirements.

Enable derived authority for 3DVIA in Velocity

Multiple User interfaces
For ME, MT and QT

Current

Design Engineer
CATIA /
ENOVIA

Manufacturing Engineer
DPE
CATIA
ENOVIA
MS word
EID
Adobe
IVT

Shop Floor Mechanic
Velocity
Adobe
EID

Quality Technician
Velocity
Adobe
EID
ENOVIA
CATIA

Feb 2012

Engineer
CATIA /
ENOVIA

Manufacturing Engineer
DPE / WKC / 3DVIA

ENOVIA and CATIA
No longer needed for ME

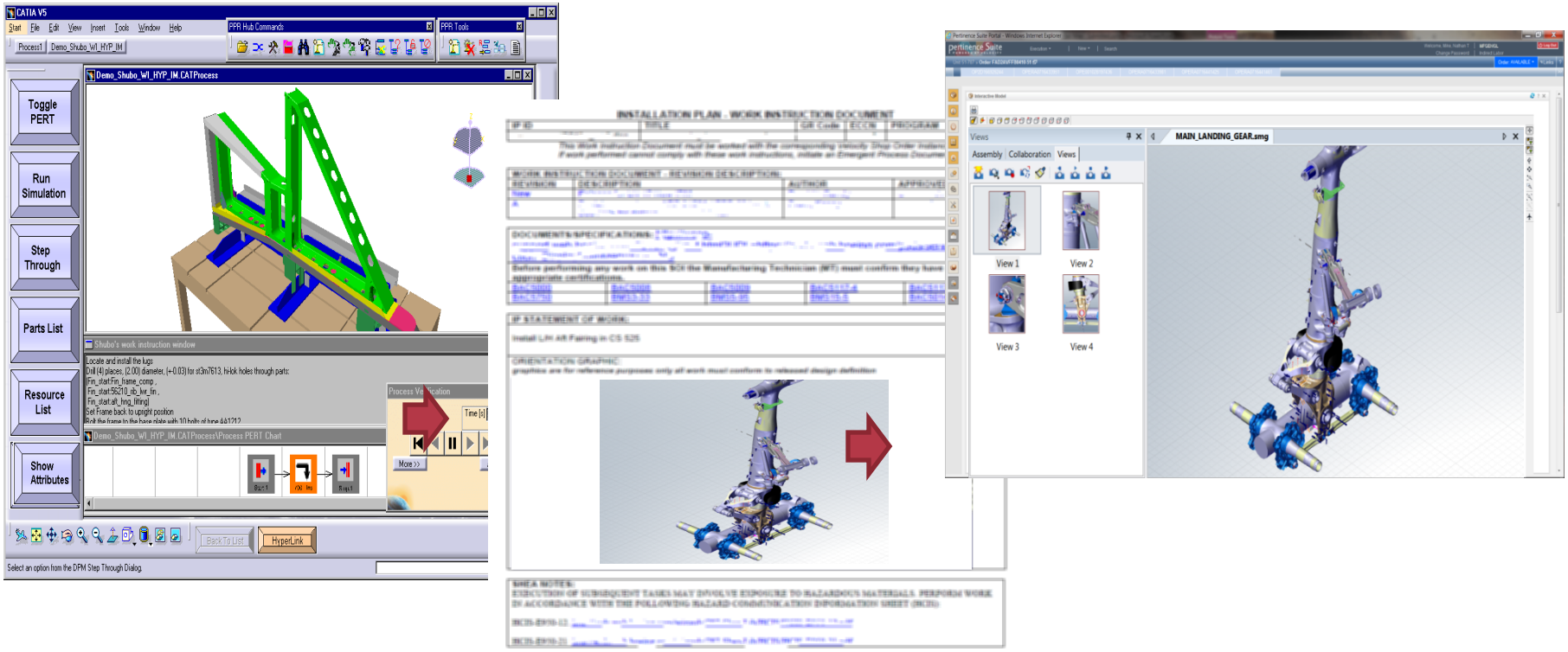
Shop Floor Mechanic
VELOCITY /
3DVIA

Single User interface
For MT and QT

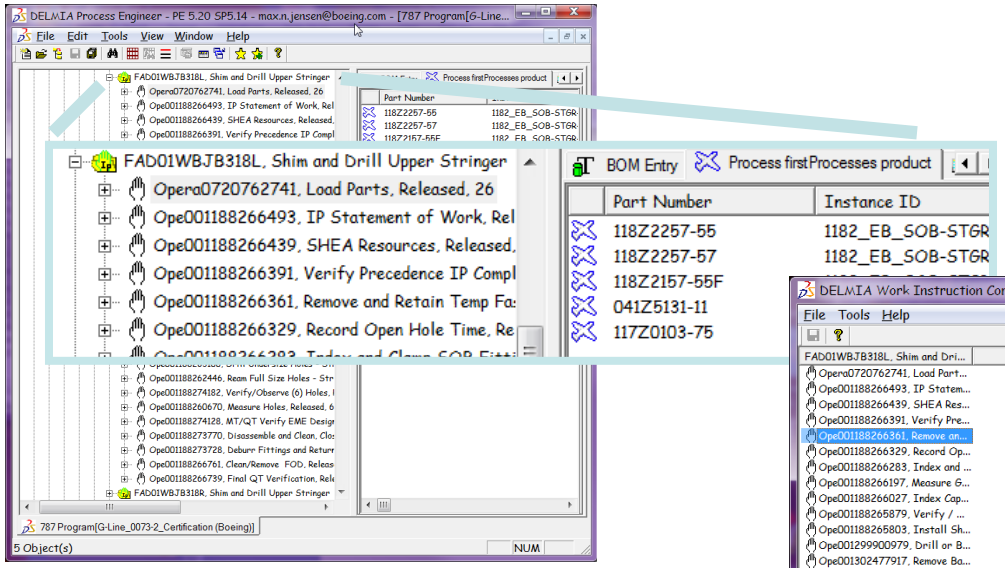
Quality Technician
VELOCITY /
3DVIA

787 Early 3D Manufacturing

- DPM Shop – View of consumed parts in V5 product
- 2D Captures in PDF – reference to authority 3D models
- 3DVIA Plan and Geometry integrated in Velocity

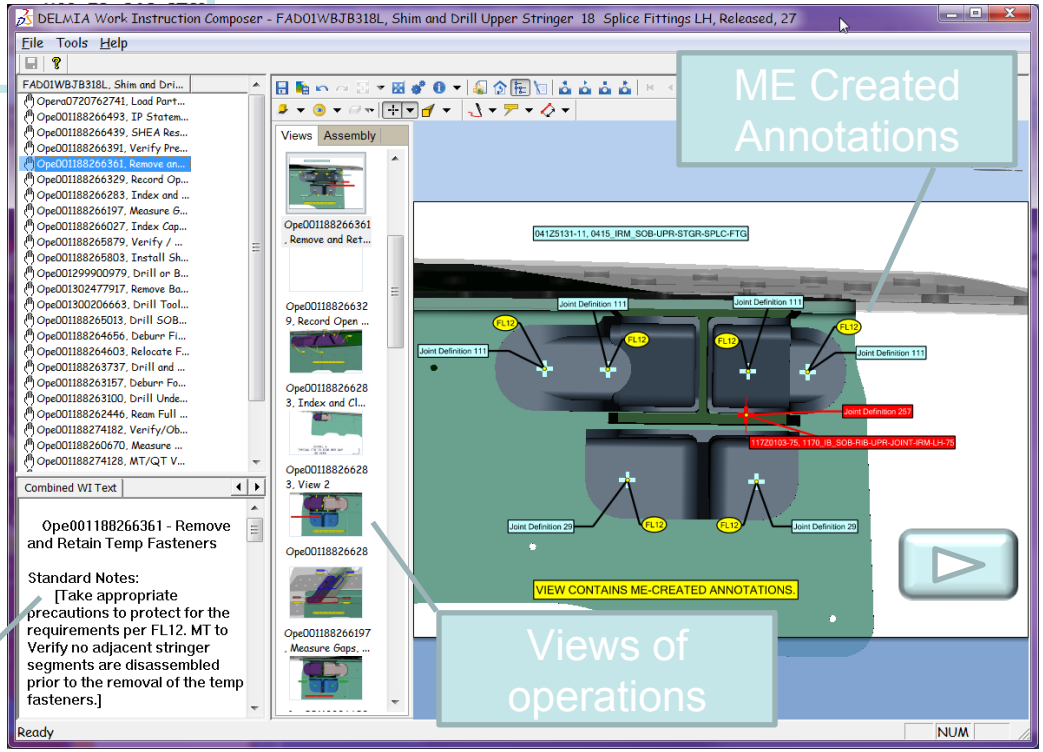


787 3D Planning & Work Instructions



- DELMIA process engineer is used to create the manufacturing bill of material, create plans, add standard work instructions and drive part demand

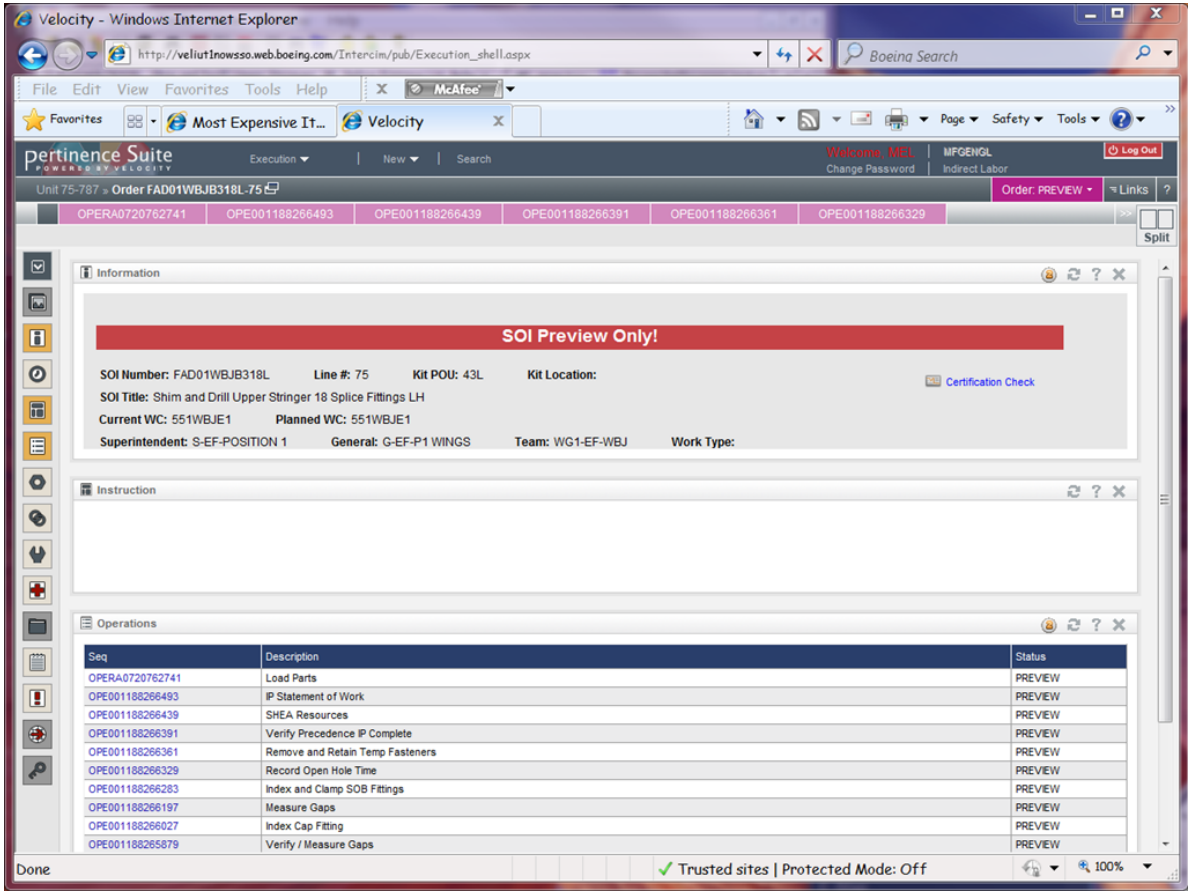
- WKC / 3DVIA is integrated with Process Engineer allowing the ME to build instruction based on the verified and reconciled manufacturing bill of material



787 3D Shop Floor

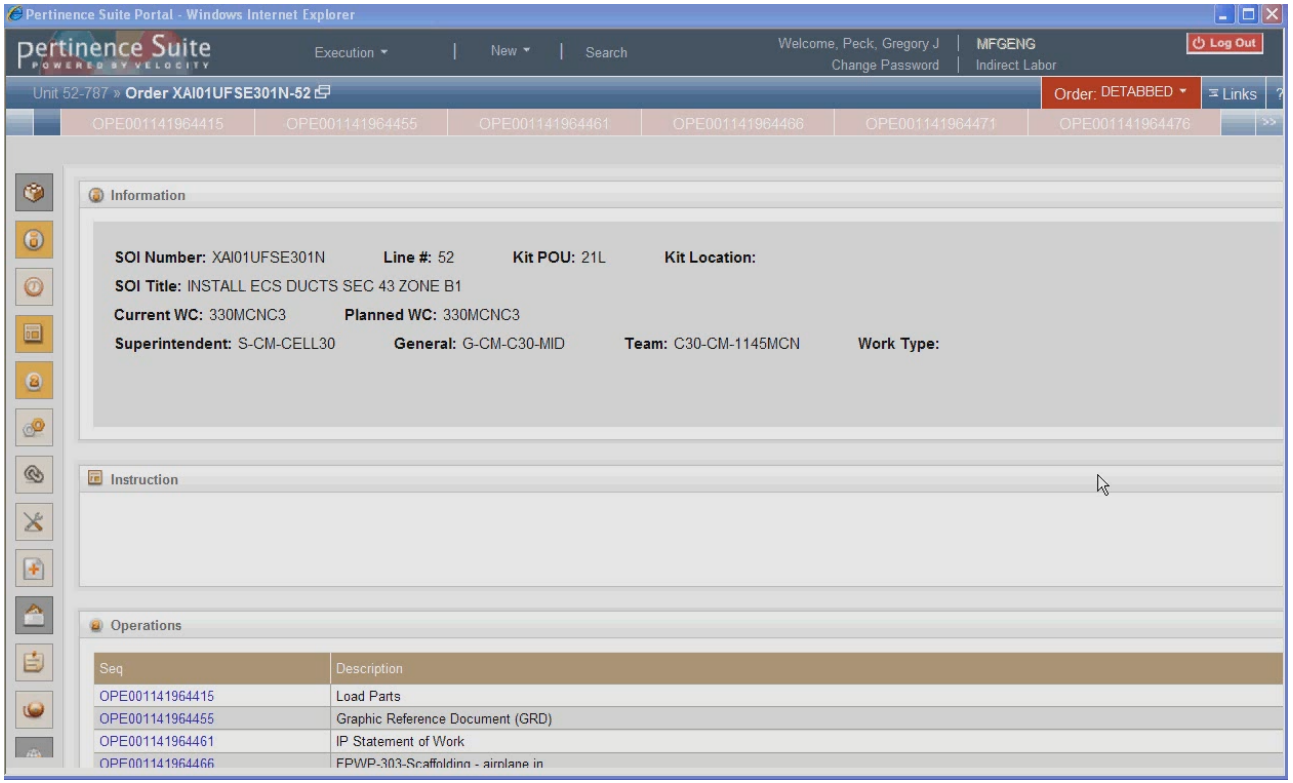
How the mechanic sees the Process Plan

- Only 3D models that are valid for the line number being built are shown
- Position changes of parts for derivative airplanes are handled automatically
- All information except for standard processes are contained in the plan
- Standard process can be retrieved via a hyperlink in the plan

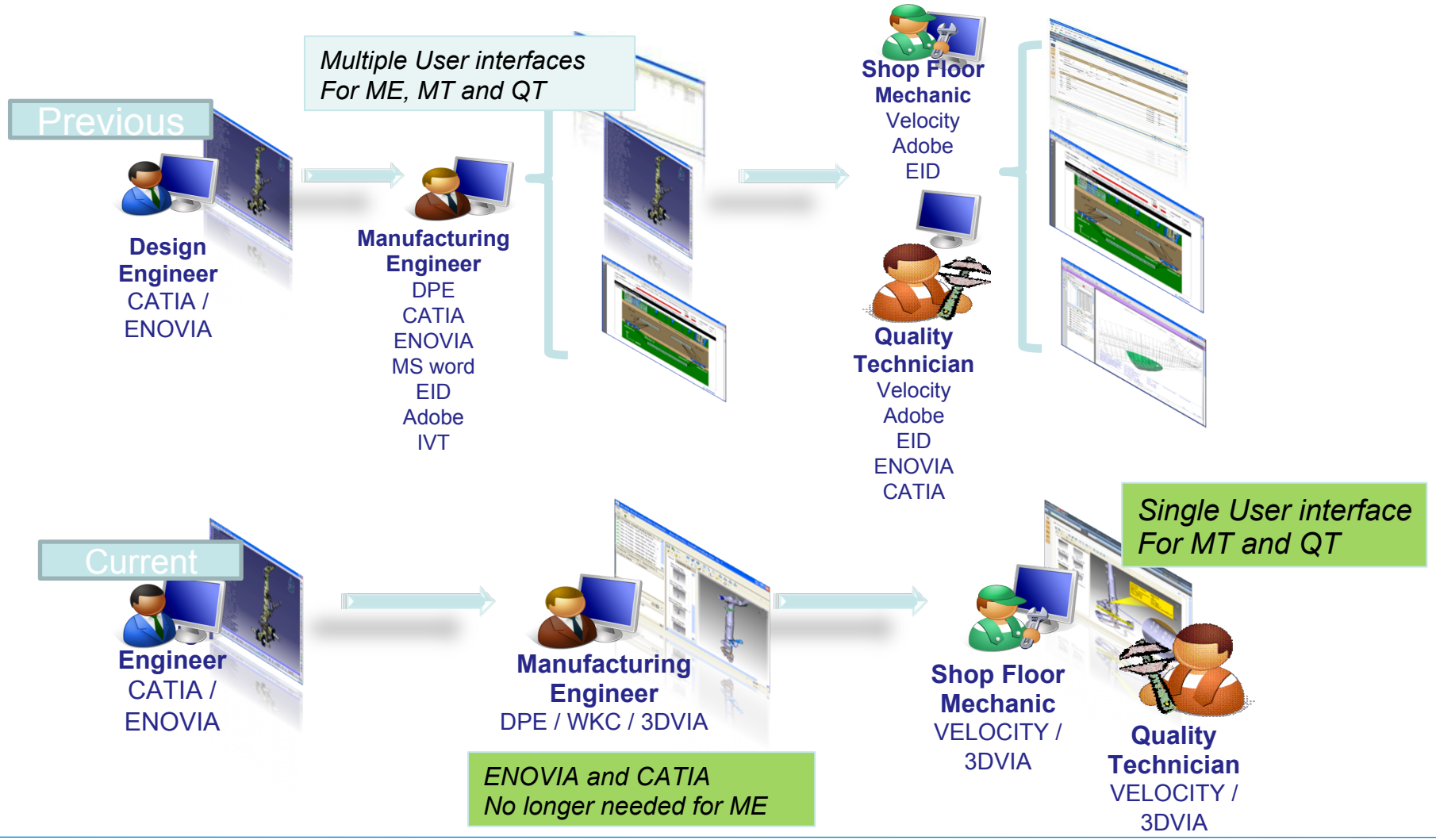


787 3D Shop Floor Larger Example

- Ability to display large amount of geometry with tablet hardware
- Airplane grid can be toggled on to help orient the mechanic on location of job
- Authoritative measurements are possible
- Ability for the QT to deselect ME overlay



3D Derived Authority



787 3D Manufacturing Specifications

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June 2012 – Delivered 3DVIA based Specifications in a PDF container. Configuration is maintained in DELMIA Process Engineer by Manufacturing Engineer

Use of 3D to detail the agreement to the condition of assembly and exceptions to engineering as required and received by Boeing from the supplier.

Constraints with Implementation

- Various ways to do graphical views through the numerous 787 commodities.
  - Created ME drafting standards with checklist.
- Some Process plans have a large amount of graphical views which makes the monolithic files too large for downstream viewing.
  - Created a file limitation standard and put systems measures in place that warns the user of file limit.
- Some Tablets on shop floor were not able to handle some of the commodity graphical views.
  - Worked with vendor on hardware compatibility list and did the necessary hardware refresh.
- Shop Floor users commented that the training did not provide the clarity necessary to use 3DVIA within their job role, but did teach them how to click the buttons. Most of the shop floor users had taken the training, training was not detailed enough.
  - Revised training basis and updated 3DVIA training to support customer needs.
- MT Users commented that the tool did not give them the information that they needed, but after asking for examples, all the information was there, they just didn't know how to find it.
  - Created e-tip sheet and provided folded handouts.
- Most noted that they thought 3DVIA was "cool" and had potential to save them time, but that they weren't comfortable with it, and generally reverted to EID which they knew how to use.
  - Removed EID link out of the process plans.

Benefits

Single source provider for production software and integrated solution from PDM to Shop Floor Delivery

Allows DE to create a product model and ME to define build views without re-release of the engineering MBD

Significant reduction in ME authoring time for graphics per new IP

- Concurrent product definition

Significant job savings of Mfg time on research and integration of the ME graphics and the Engineering authority graphics.

- Single source of data, no more need to check multiple sources and systems
- Sequential graphics in build plan context

Significant recurring per job savings Quality time on research and integration of the ME graphics and the Engineering authority graphics.

- Single source of data, ability to filter-off Mfg Engr annotations, no more need to check multiple sources and systems
- Inspection Graphics in as-built context

Transcat Company Profile

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- **More than 2,000 global customers**
- **200+ employees at 7 locations**
- **Founded 1987**
- **Transcat PLM**
  - DS Business Partner
  - Germany & Austria
- **Transcat Software**
  - Software Development Division
  - Germany & Slovakia
- **June 2012: Management buy out from Dassault Systèmes**

SOLUTIONS PARTNER

EDUCATION PARTNER Gold Certified

SOFTWARE PARTNER V5 gold partner

2011 Preferred Partner GOLD

Workstations Specialist

IBM Business Partner

QUALITY MANAGEMENT Certificate
Voluntary participation in regular monitoring according to ISO 9001:2000

ELYSIUM Parker NORTHROP GRUMMAN BOEING

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2014

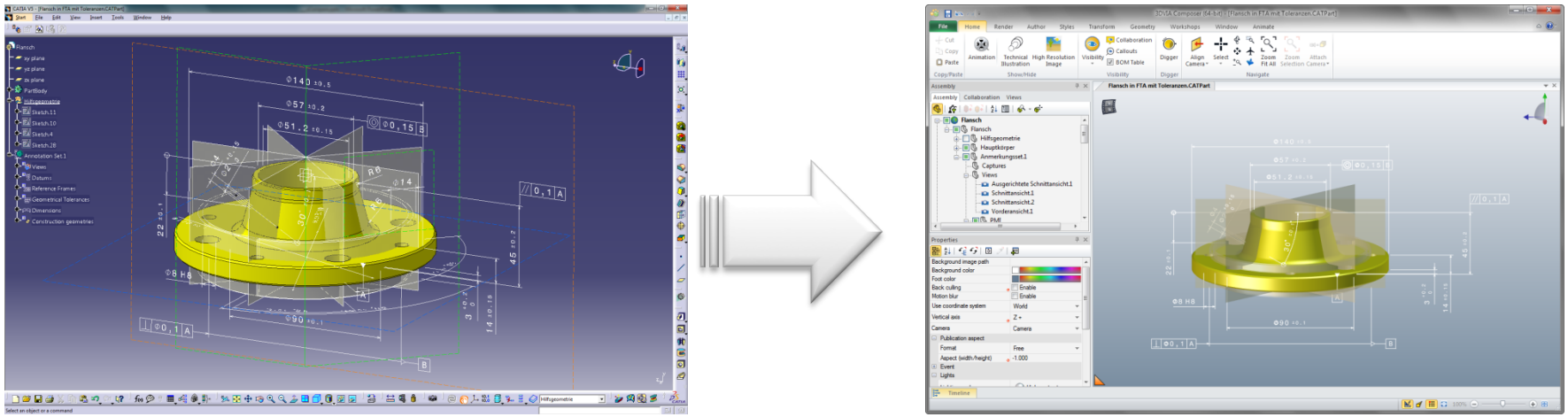
Transcat Software Positioning

- **Process Assurance with CATIA, ENOVIA and JT**
- **Standard solutions and customer-specific software**
- **Lite3D portfolio**
  - Data exchange, MBD, archiving, viewing, multi-CAD
  - JT, PLMXML and STEP XML
- **Individual and global**
  - Direct relation to international customers
  - 50 partners to address 2.000 global customers

We develop standard and individual software for CATIA, ENOVIA and JT. Our solutions guarantee consistency, quality and legal compliance of the engineering data. Thus we enhance the organization and the governance of the product generation at our global customers.

Why Model Validation?

- **Data translation validation** – Avoid unacceptable differences caused by translation
  - Identify changes introduced while translating a CAD model into another format. Errors can be found easily before the model is moved into downstream
  - Fulfill legal requirements for documentation

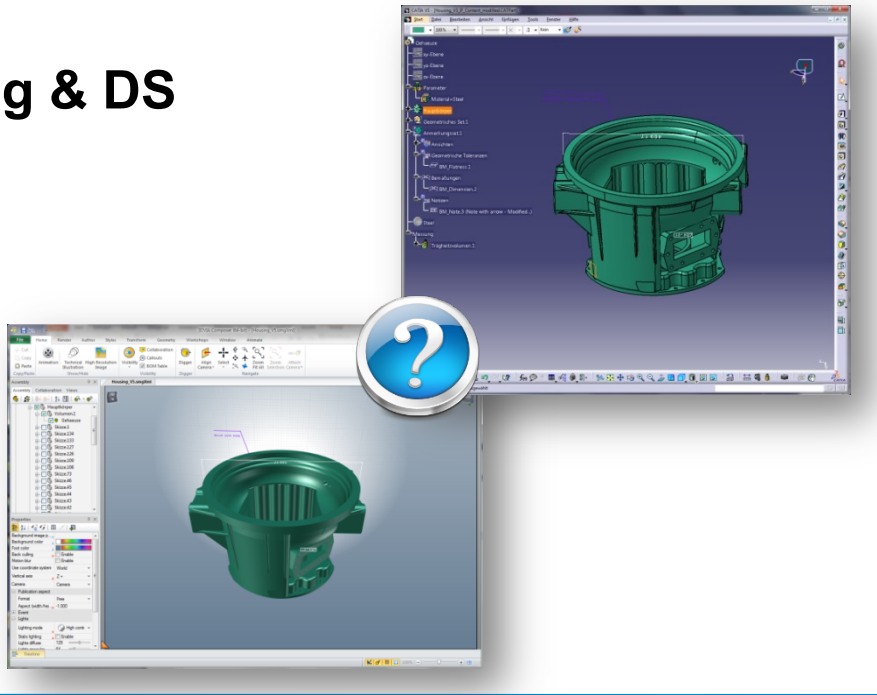


xCompare project at Boeing

- **Comparison between V5 and 3DVIA Composer SMG data**
  - Project with Boeing and Dassault Systèmes in 2012 / 13
  - Target is automated validation of conversion
  - Solution based on existing xCompare V5 / V5 architecture

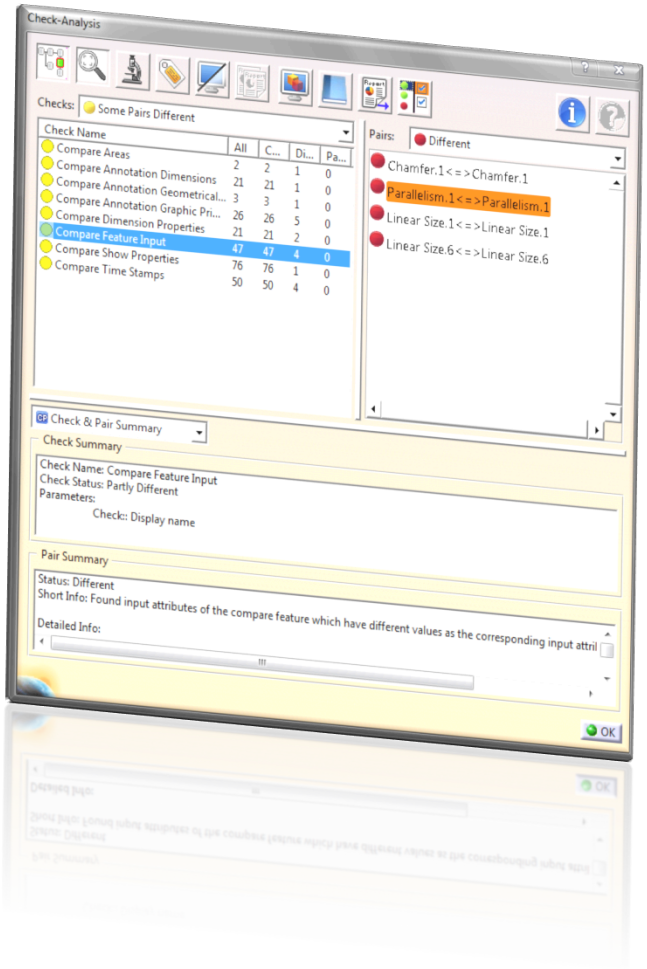
- **Very good partnership with Boeing & DS**

- **Products for**
  - V5 / SMG (3DVIA Composer)
  - V5 / JT
  - V5 / V5
  - JT / JT



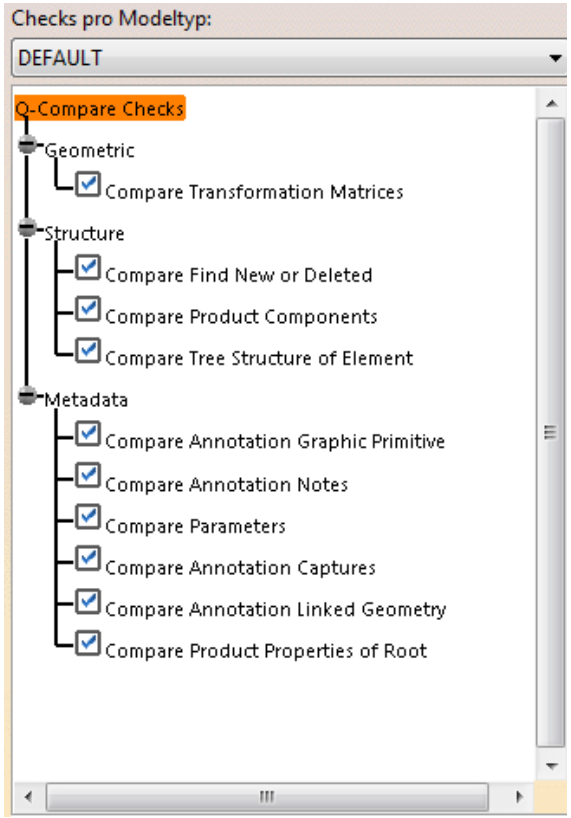
xCompare V5 / SMG Feature

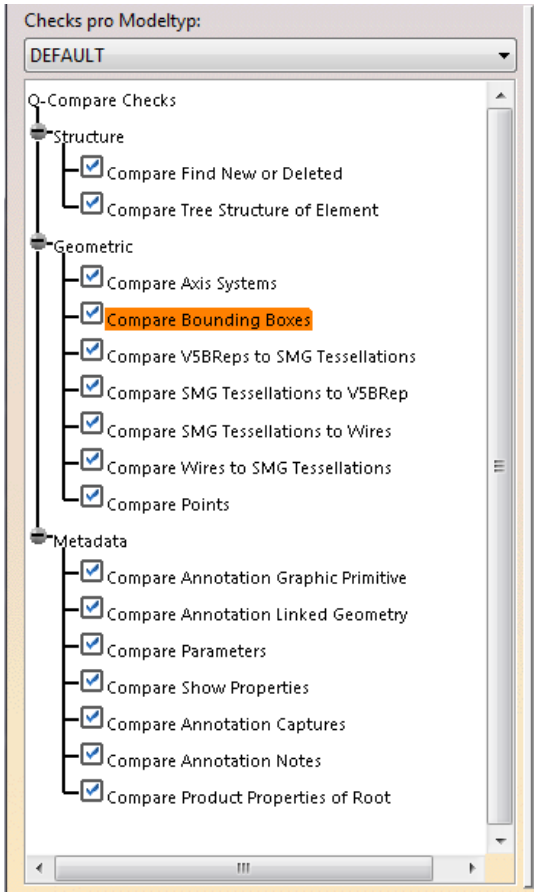
- **Fully integrated with CATIA V5**
- **Feature-based comparison detects ALL design changes, including geometric, topologic and annotation (FT&A)**
- **Support of CATPart and CATProducts**
- **Interactive and batch comparison**
- **Build your own validation set**
  - new / removed / renamed features
  - modified V5 B-REP against SMG tessellation
  - changes in geometrical parameters
    - area, center of gravity
  - modified FT&A features
  - modified parameters
  - differences in properties
- **Detailed xml report**



xCompare V5 / SMG

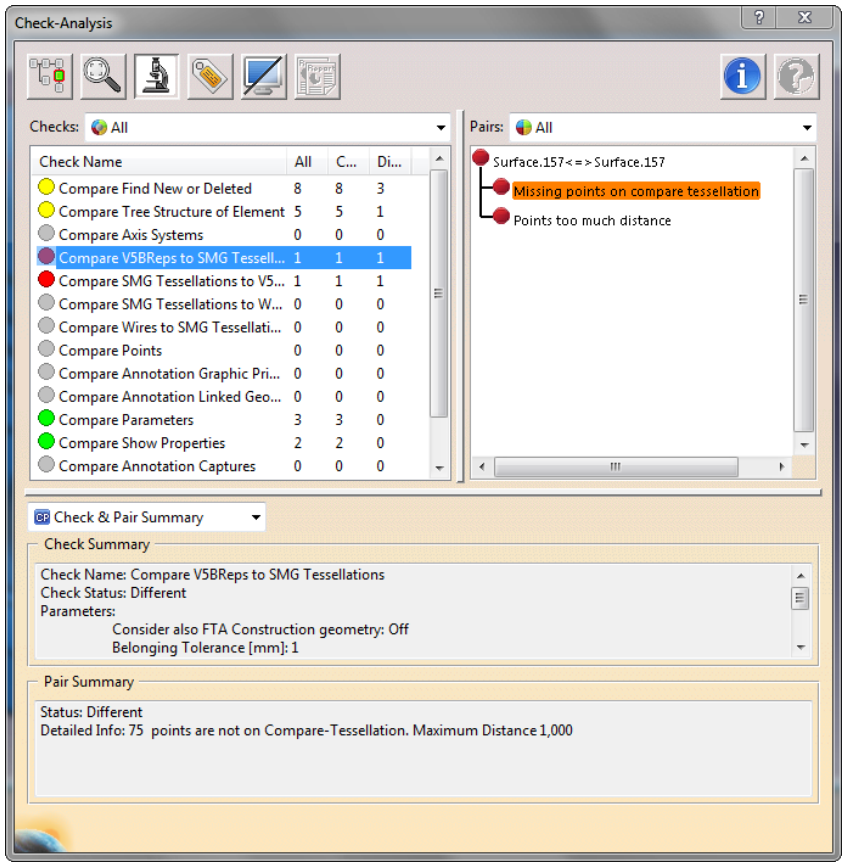
- **Checks can be widely configured**

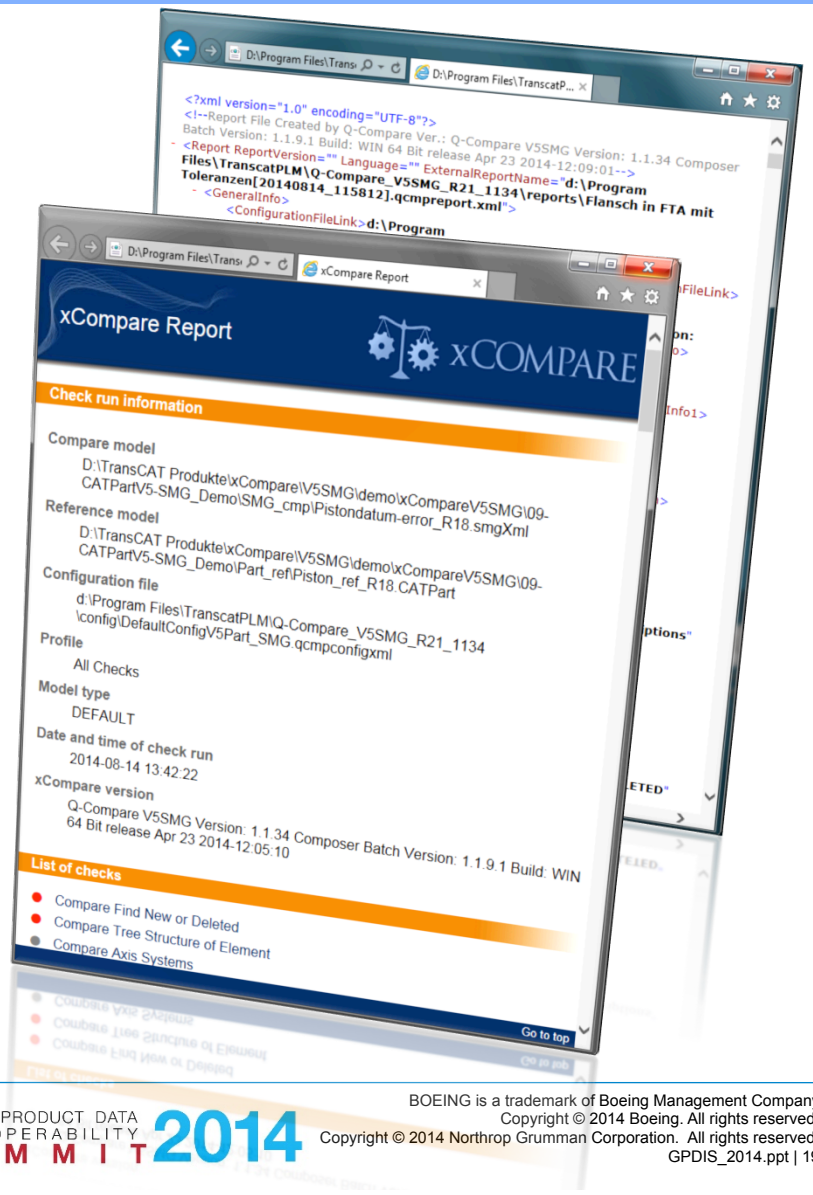




xCompare V5 / SMG

- **Detailed analysis of results**

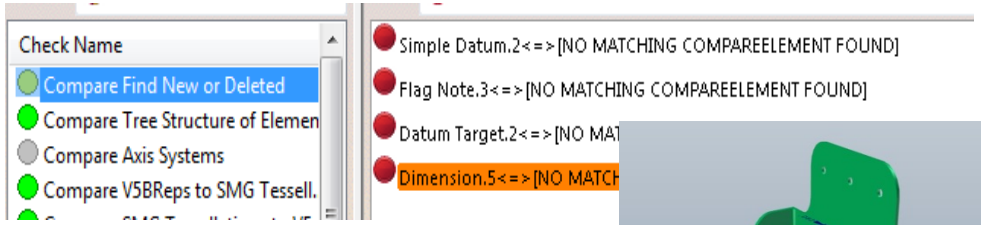


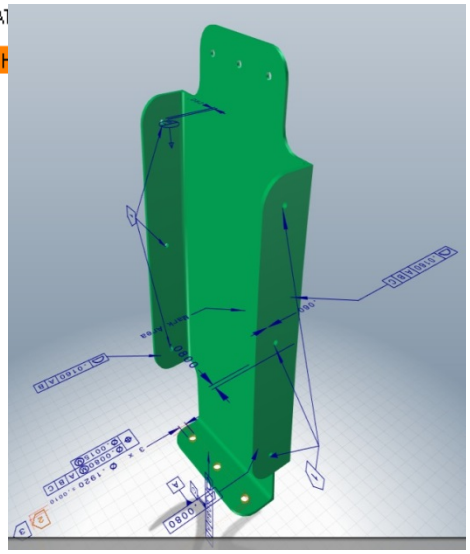


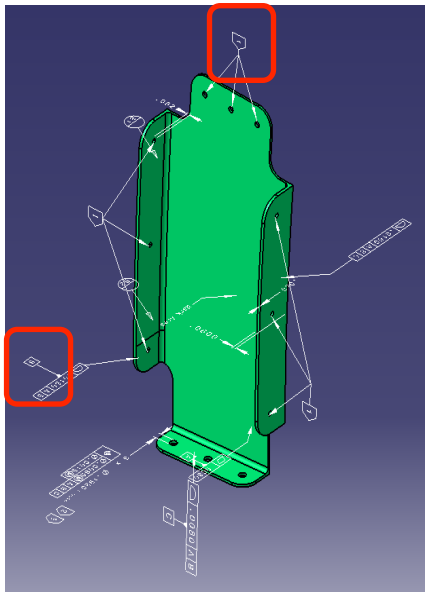
Samples - Verify FT&A / PMI

Differences found in annotations

- **Some of the V5 annotations are missing in the SMG file**



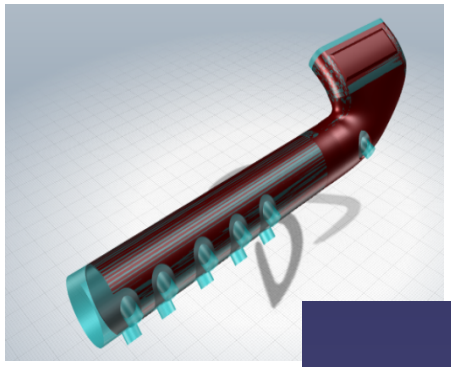


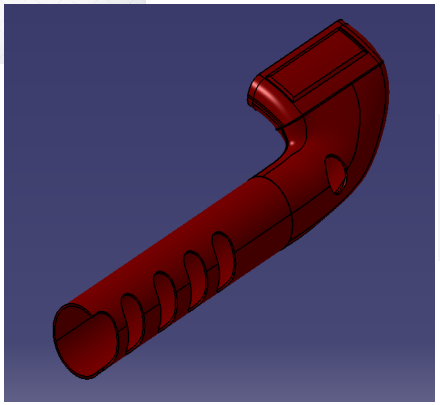


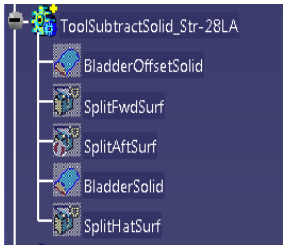
Samples - Differences in show properties

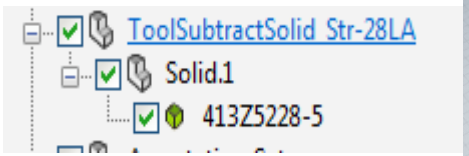
Differences found in show properties

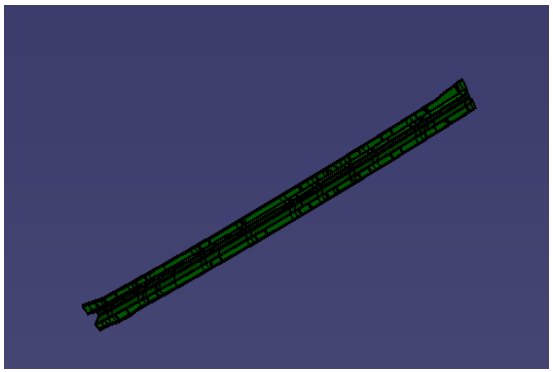
- **Solid bodies are not visible in V5, but in SMG**

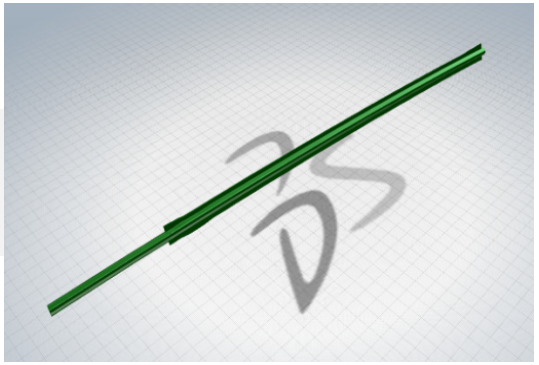












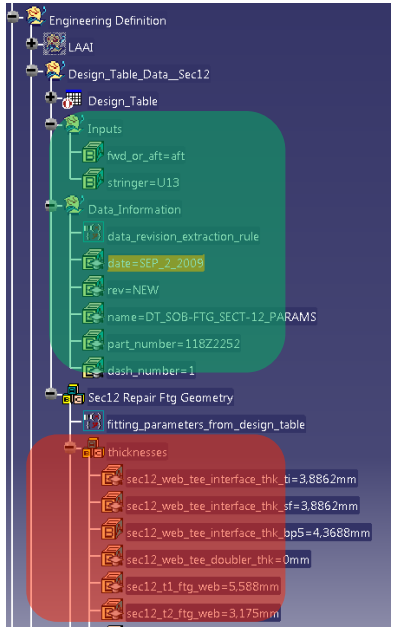
Samples – Differences in parameters

- **Differences in parameters**
  - **The sting “–" is not converted correctly in SMG, instead "-" is used**

`F-14.9815-201` =F-14.9815-201 | APPLY BMS 10–60, TYPE I, GLOSS ENAMEL IN ACCORDANCE WITH BAC 5845

F-14.9815-201	F-14.9815-201 | APPLY BMS 10-60, TYPE I, GLOSS ENAMEL IN ACCORDANCE WITH BAC 5845

- **Parameters in a parameter set located under a geometrical set are not converted to SMG**
  - **Parameters marked in red are missing in SMG**
  - **Parameters marked in green are existing in SMG**



Video of an interactive inspection

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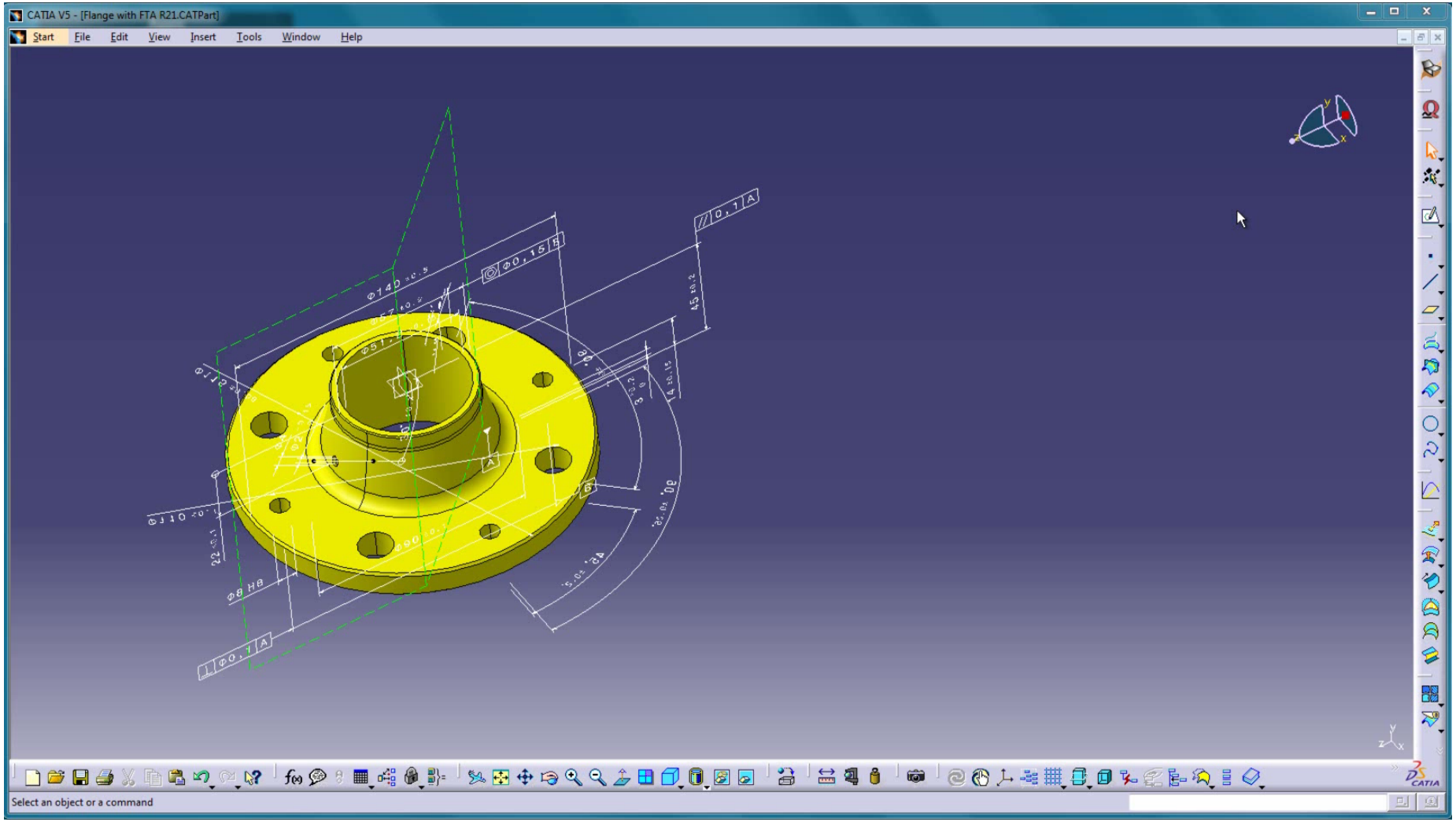
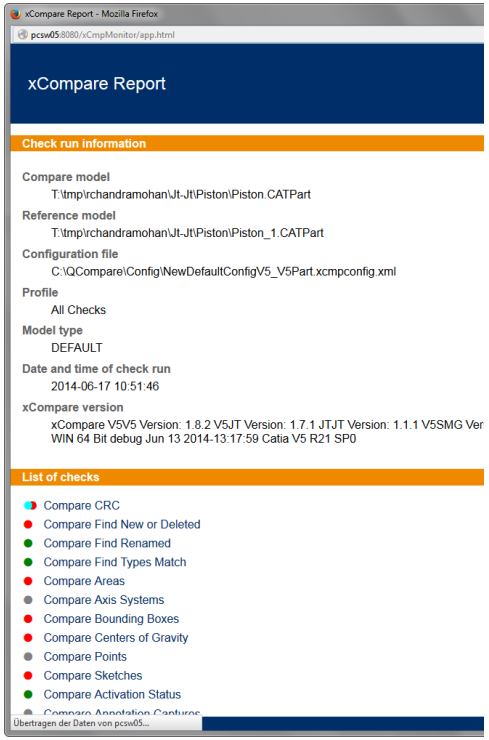


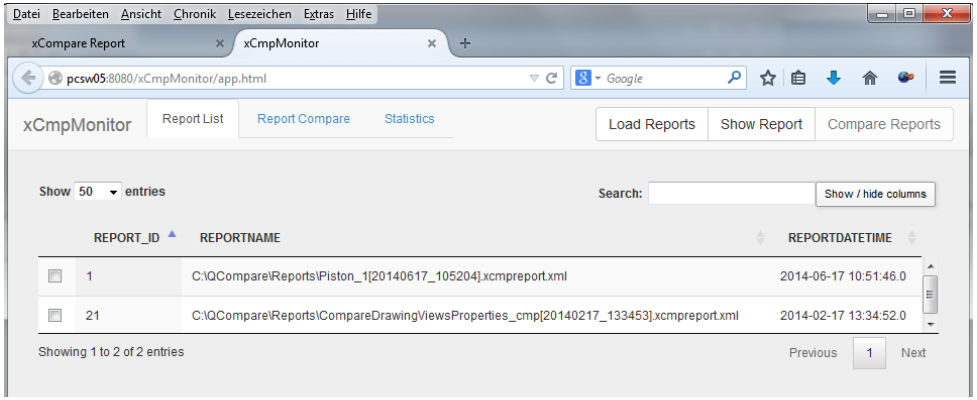
Database connection for traceability

This automated solution does also provide a database of comparison results that is extremely beneficial to the certification process

This increases the capabilities for tracing and monitoring the results, i.e. search for:

- All data which are reported as “different”
- Which single checks / elements cause the “difference”
- All data of a specific status in a given time period





Summary

Track ALL design and engineering changes made to the CAD model

- For all CATIA V5 document types
- Feature-based comparison detects **ALL design changes**, including geometric, topologic and annotation (**FT&A**)
- Supports complete 3D MBD (Model Based Definition) and **Long Term Data Archival**

Fully integrated with CATIA and direct access to SMG data

No model conversion necessary

Fast and accurate results listed in an easy to use GUI

Batch Comparison

The batch comparison allows automatic validation process in batch mode

Detailed and flexible reporting

- Detailed xml report of all modifications
- Highly customizable through style sheets

Benefits

- **Saving time with comparing models**
  Instead of doing it manually xCompare provides easy validation inside of CATIA or in batch mode. Results are presented in a detailed report.

- **Increase reliability**
  Manual inspection implies the risk of human errors – changes could be missed especially in complex models. xCompare ensures that ALL modifications are found.

- **Fulfill legal or company requirements regarding documentation**

Thank you

Questions?