

3D Work

Instructions and Automated Data Validation with xCompare

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GLOBAL PRODUCT DATA INTEROPERABILITY **S U M M I T** 2014



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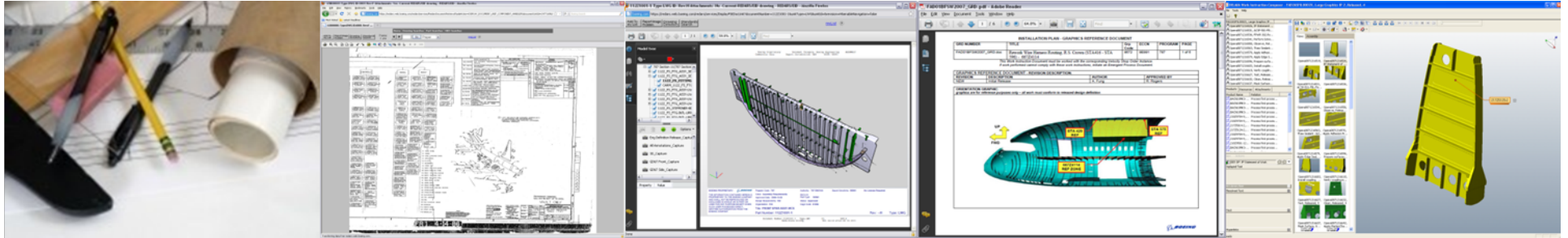


2014

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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

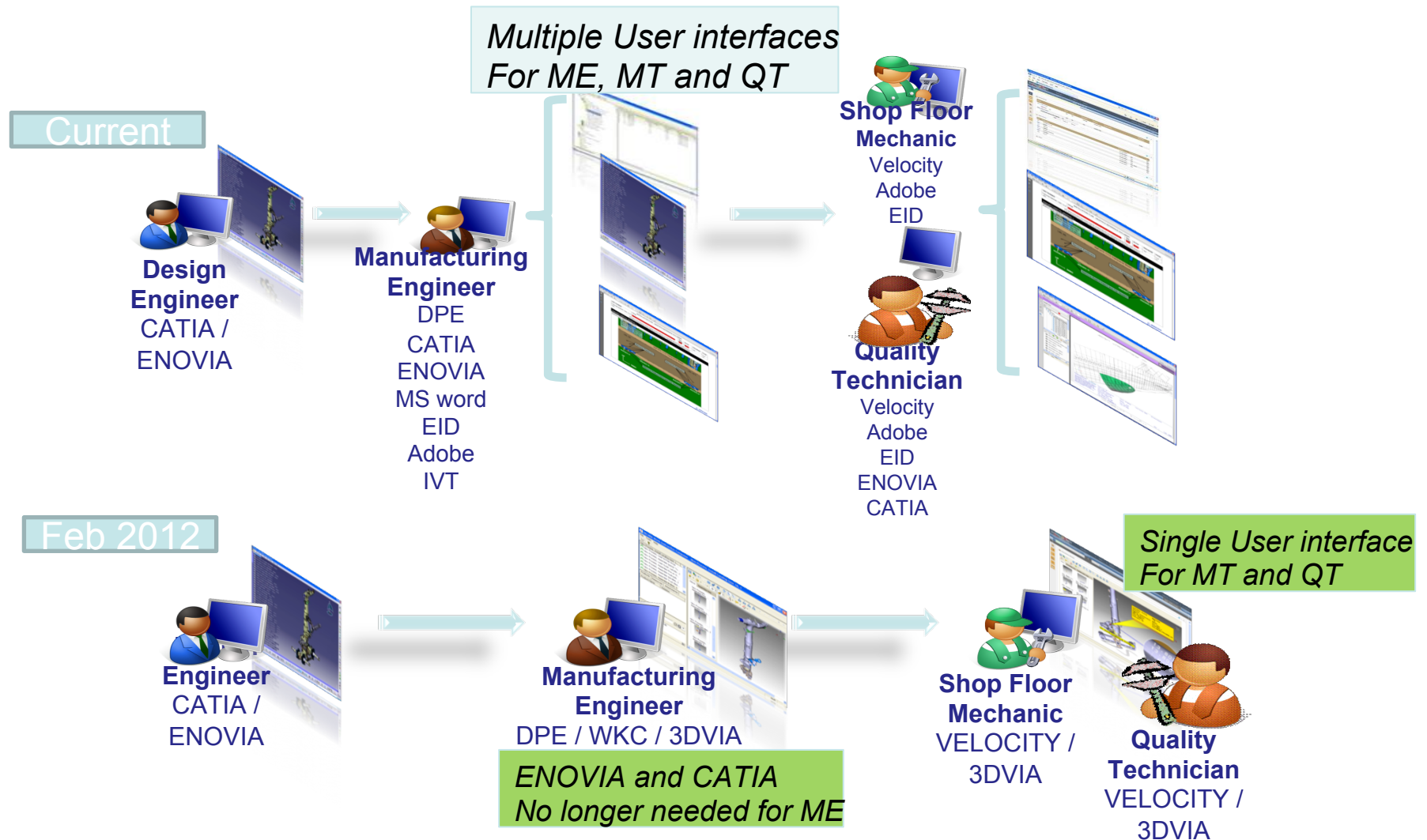
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Develop and implement a solution that allows Manufacturing Engineering the ability to create, annotate graphical views and associate them to Process plans. ME would have the ability to associate manufacturing context, and build exceptions to the graphical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

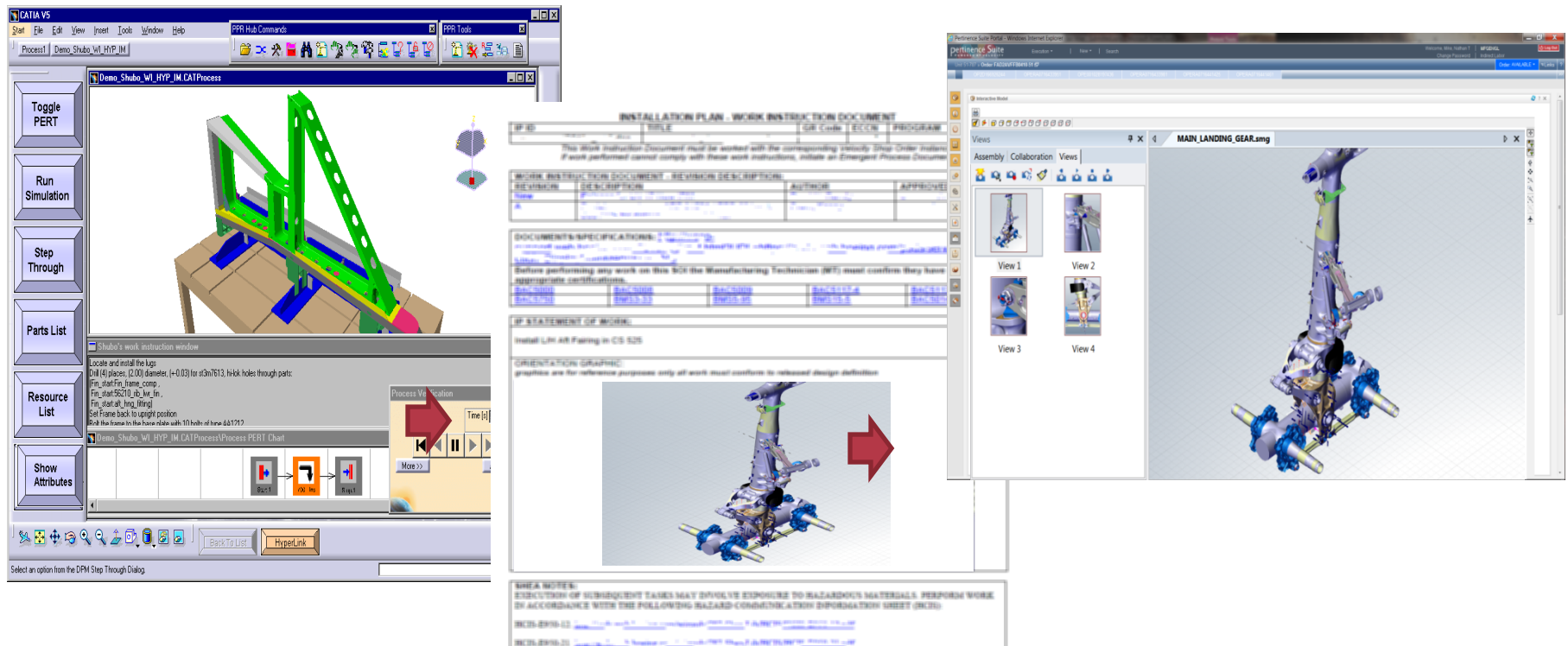
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787 Early 3D Manufacturing

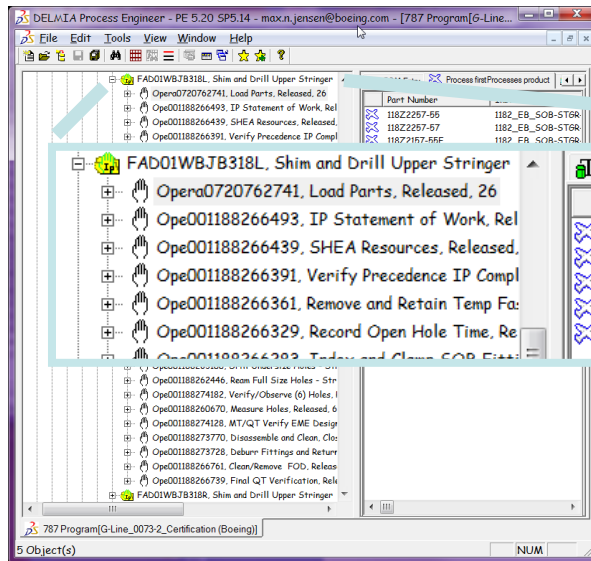
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- DPM Shop – View of consumed parts in V5 product
- 2D Captures in PDF – reference to authority 3D models
- 3DVIA Plan and Geometry integrated in Velocity



787 3D Planning & Work Instructions

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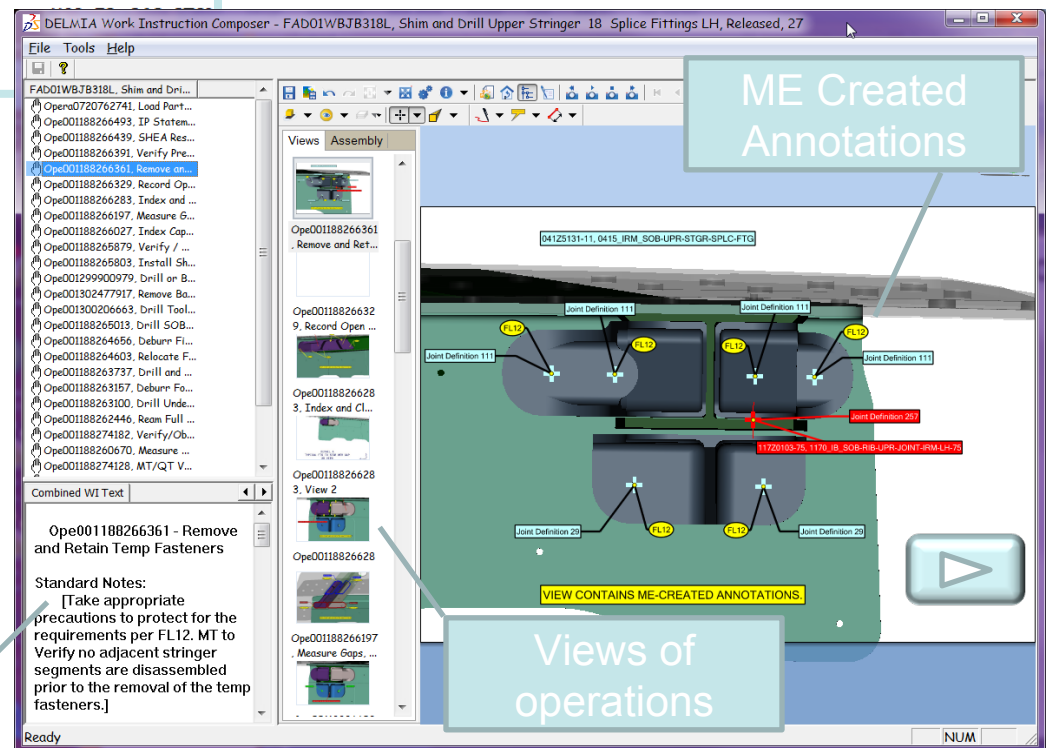


- DELMIA process engineer is used to create the manufacturing bill of material, create plans, add standard work instructions and drive part demand

View of work instruction

Part Number	Instance ID
118Z2257-55	1182_EB_SOB-STGR
118Z2257-57	1182_EB_SOB-STGR
118Z2157-55F	
041Z5131-11	
117Z0103-75	

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



Views of operations

787 3D Shop Floor

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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

The screenshot displays the Velocity web application interface within a Windows Internet Explorer browser. The address bar shows the URL: http://velut1nowss0.web.boeing.com/Interim/pub/Execution_shell.aspx. The application header includes the 'pertinence Suite' logo and navigation tabs for 'Execution', 'New', and 'Search'. A user login bar at the top right shows 'Welcome, MEL' and 'MFGENGL' with options to 'Change Password' and 'Indirect Labor'. Below this, a row of process IDs is visible: OPERA0720762741, OPE001188266493, OPE001188266439, OPE001188266391, OPE001188266361, and OPE001188266329. The main content area is divided into three sections: 'Information', 'Instruction', and 'Operations'. The 'Information' section is highlighted and contains a red banner that reads 'SOI Preview Only!'. Below the banner, the following details are listed: SOI Number: FAD01WBJB318L, Line #: 75, Kit POU: 43L, Kit Location: (with a 'Certification Check' link), SOI Title: Shim and Drill Upper Stringer 18 Splice Fittings LH, Current WC: 551WBJE1, Planned WC: 551WBJE1, Superintendent: S-EF-POSITION 1, General: G-EF-P1 WINGS, Team: WG1-EF-WBJ, and Work Type: (blank). The 'Operations' section contains a table with the following data:

Seq	Description	Status
OPERA0720762741	Load Parts	PREVIEW
OPE001188266493	IP Statement of Work	PREVIEW
OPE001188266439	SHEA Resources	PREVIEW
OPE001188266391	Verify Precedence IP Complete	PREVIEW
OPE001188266361	Remove and Retain Temp Fasteners	PREVIEW
OPE001188266329	Record Open Hole Time	PREVIEW
OPE001188266283	Index and Clamp SOB Fittings	PREVIEW
OPE001188266197	Measure Gaps	PREVIEW
OPE001188266027	Index Cap Fitting	PREVIEW
OPE001188265879	Verify / Measure Gaps	PREVIEW

The bottom status bar of the browser shows 'Done' and 'Trusted sites | Protected Mode: Off'.

787 3D Shop Floor Larger Example

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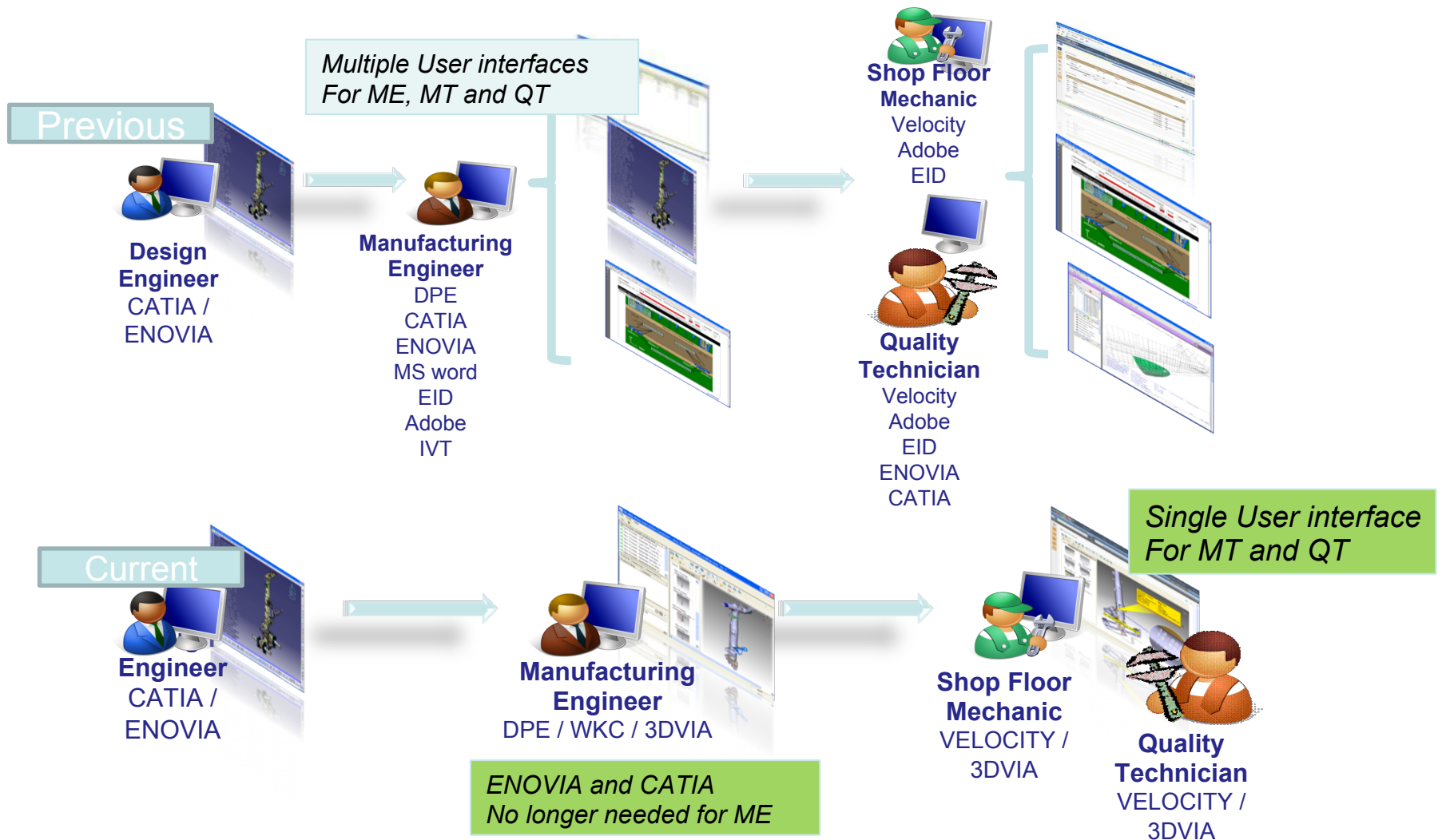
- Ability to display large amount of geometry with tablet hardware
- Airplane grid can be toggled on to help orient the mechanic on location of job
- Authoritative measurements are possible
- Ability for the QT to deselect ME overlay

The screenshot displays the Pertinence Suite Portal interface within a Windows Internet Explorer browser. The page header includes the user name 'Peck, Gregory J', the role 'MFGENG', and a 'Log Out' button. The main content area is titled 'Unit 52-787 » Order XAI01UFSE301N-52'. Below this, a table lists various OPE (Order Part Entry) numbers. The 'Information' section provides details for SOI Number (XAI01UFSE301N), Line # (52), Kit POU (21L), and Kit Location. It also lists SOI Title (INSTALL ECS DUCTS SEC 43 ZONE B1), Current WC (330MCNC3), Planned WC (330MCNC3), Superintendent (S-CM-CELL30), General (G-CM-C30-MID), Team (C30-CM-1145MCN), and Work Type. The 'Instruction' section is currently empty. The 'Operations' section contains a table with the following data:

Seq	Description
OPE001141964415	Load Parts
OPE001141964455	Graphic Reference Document (GRD)
OPE001141964461	IP Statement of Work
OPE001141964466	FPWP-303-Scaffolding - airplane in

3D Derived Authority

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787 3D Manufacturing Specifications

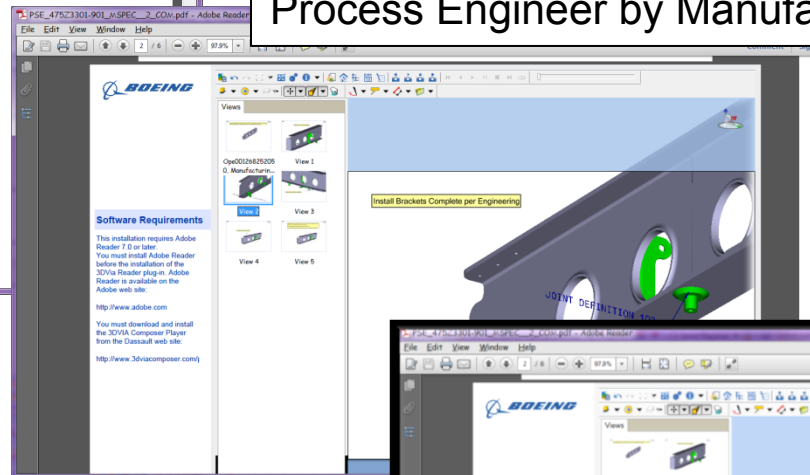
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June 2012 – Delivered 3DVIA based Specifications in a PDF container.
Configuration is maintained in DELMIA
Process Engineer by Manufacturing Engineer

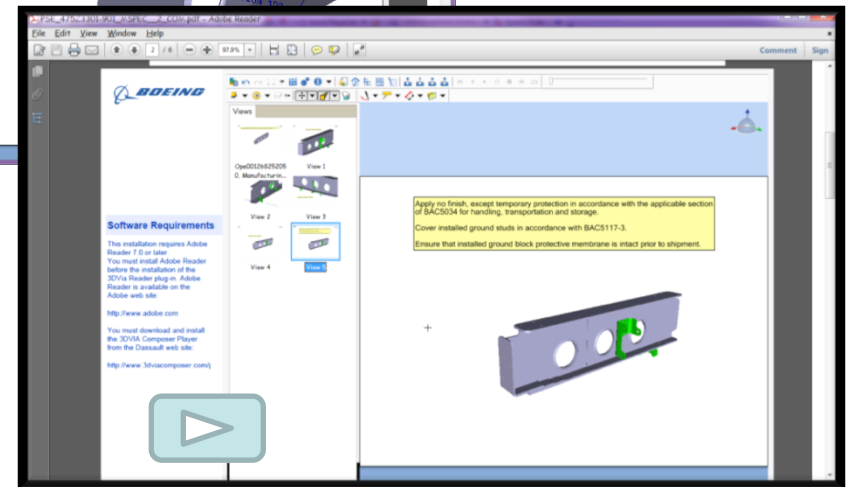
Boeing 787 Manufacturing Specification (MSPEC)

Part Number: 475Z3301-901
Part Name: PF_INT_HDR-BM-STA1695-STA1719

IP Number: MFG4753301901
IP Name: PF_INT_HDR-BM-STA1695-STA1719
IP Version: 2
IP ECCNs: 9E991



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

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- 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

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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

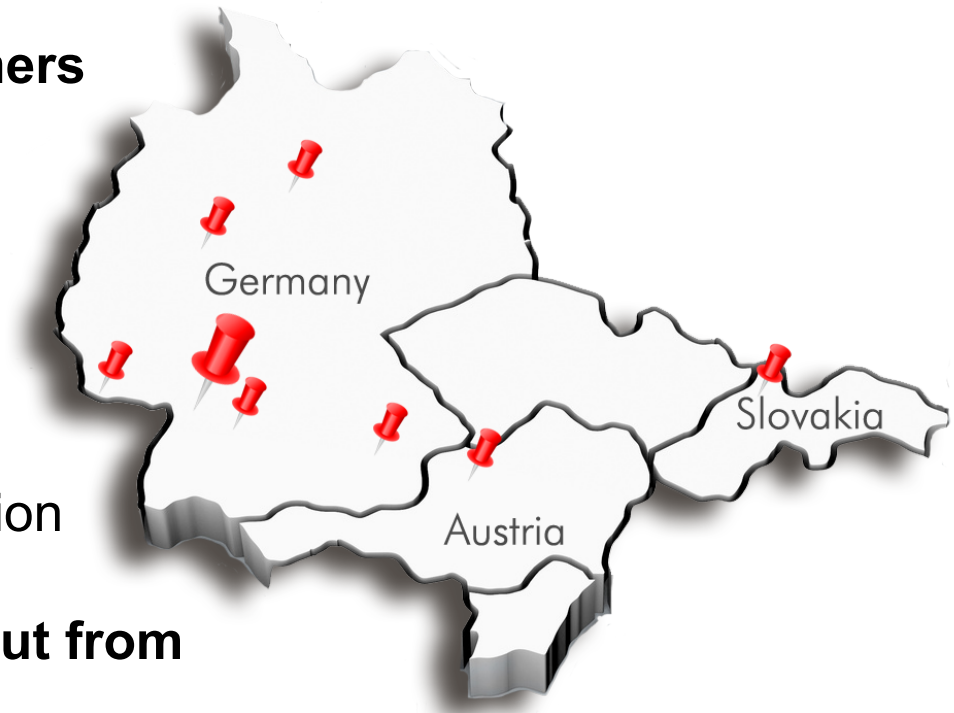
Significant recurring per job savings Quality time on research and integration of the ME graphics and the Engineering authority graphics.

- 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**



Transcat Software Positioning

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- **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

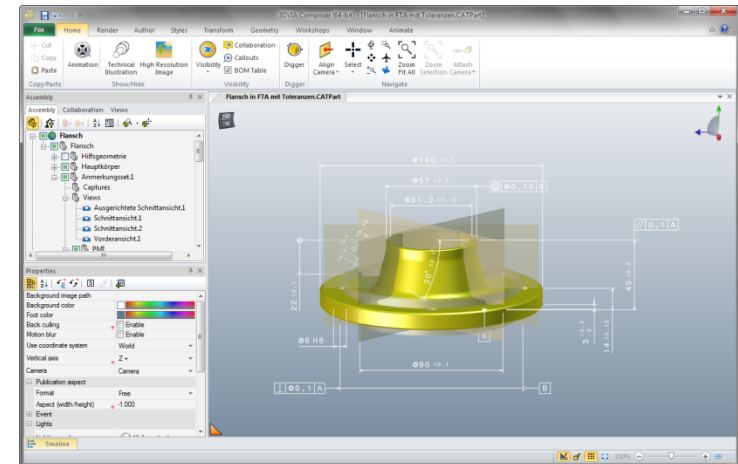
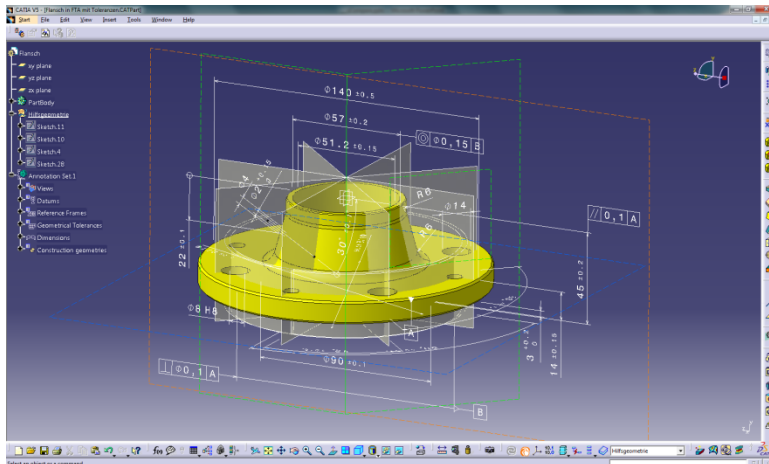


We develop standard and individual software for CATIA, ENOVIA and JT. Our solutions guarantee consistency, quality and legal compliance of the engineering data. Thus we enhance the organization and the governance of the product generation at our global customers.

Why Model Validation?

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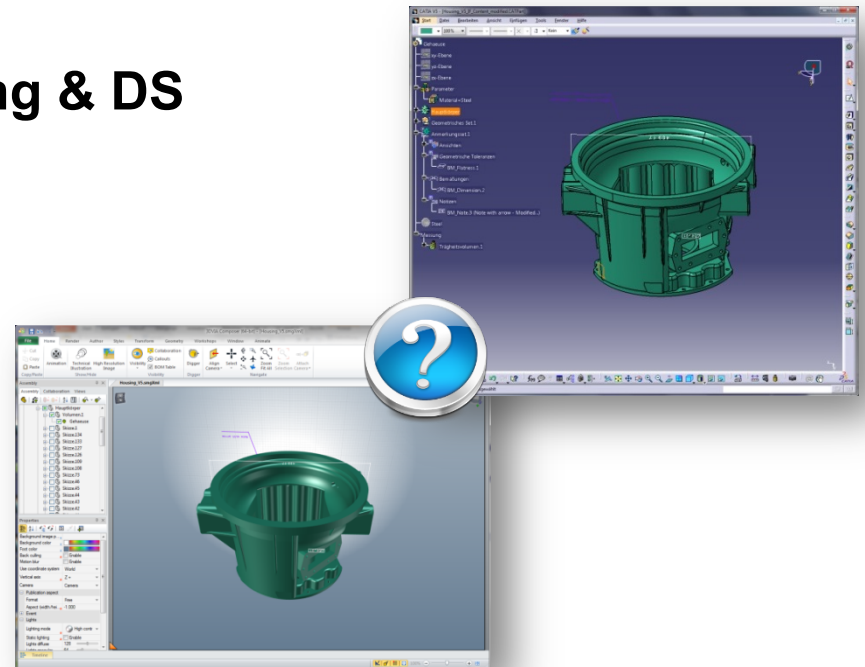
- **Data translation validation** – Avoid unacceptable differences caused by translation
 - Identify changes introduced while translating a CAD model into another format. Errors can be found easily before the model is moved into downstream
 - Fulfill legal requirements for documentation



xCompare project at Boeing

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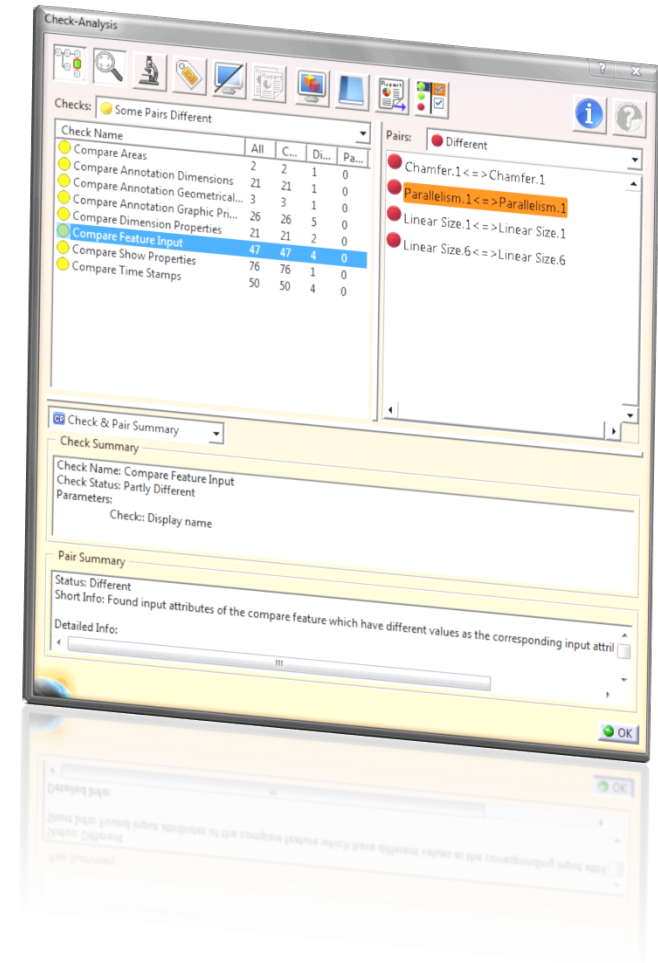
- **Comparison between V5 and 3DVIA Composer SMG data**
 - Project with Boeing and Dassault Systèmes in 2012 / 13
 - Target is automated validation of conversion
 - Solution based on existing xCompare V5 / V5 architecture
- **Very good partnership with Boeing & DS**
- **Products for**
 - V5 / SMG (3DVIA Composer)
 - V5 / JT
 - V5 / V5
 - JT / JT



xCompare V5 / SMG Feature

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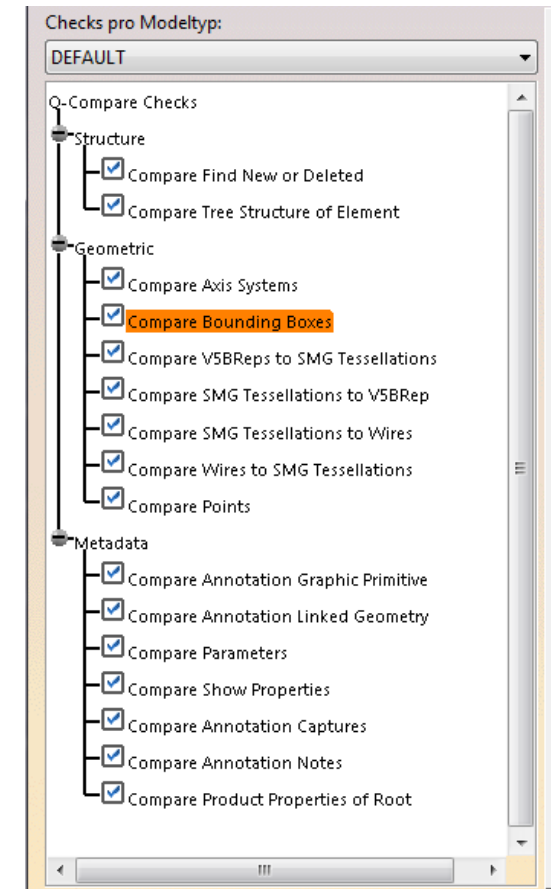
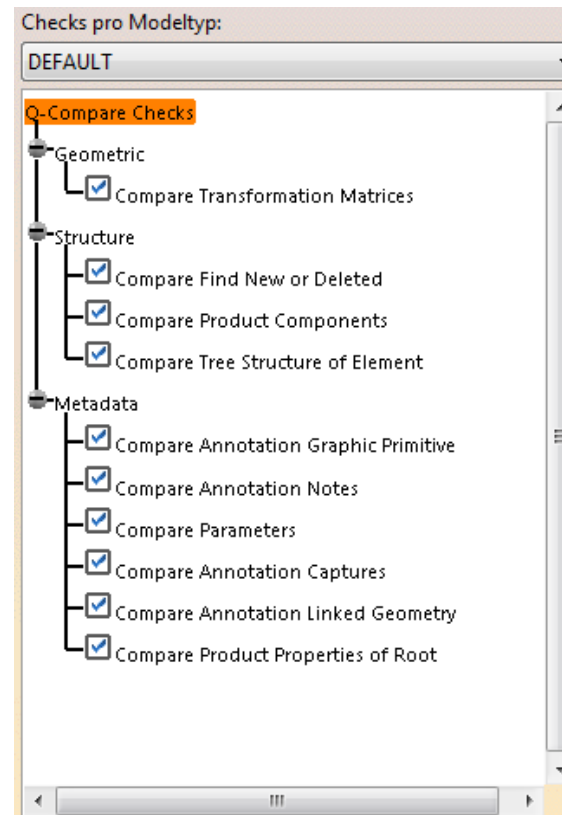
- Fully integrated with CATIA V5
- Feature-based comparison detects ALL design changes, including geometric, topologic and annotation (FT&A)
- Support of CATPart and CATProducts
- Interactive and batch comparison
- Build your own validation set
 - new / removed / renamed features
 - modified V5 B-REP 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

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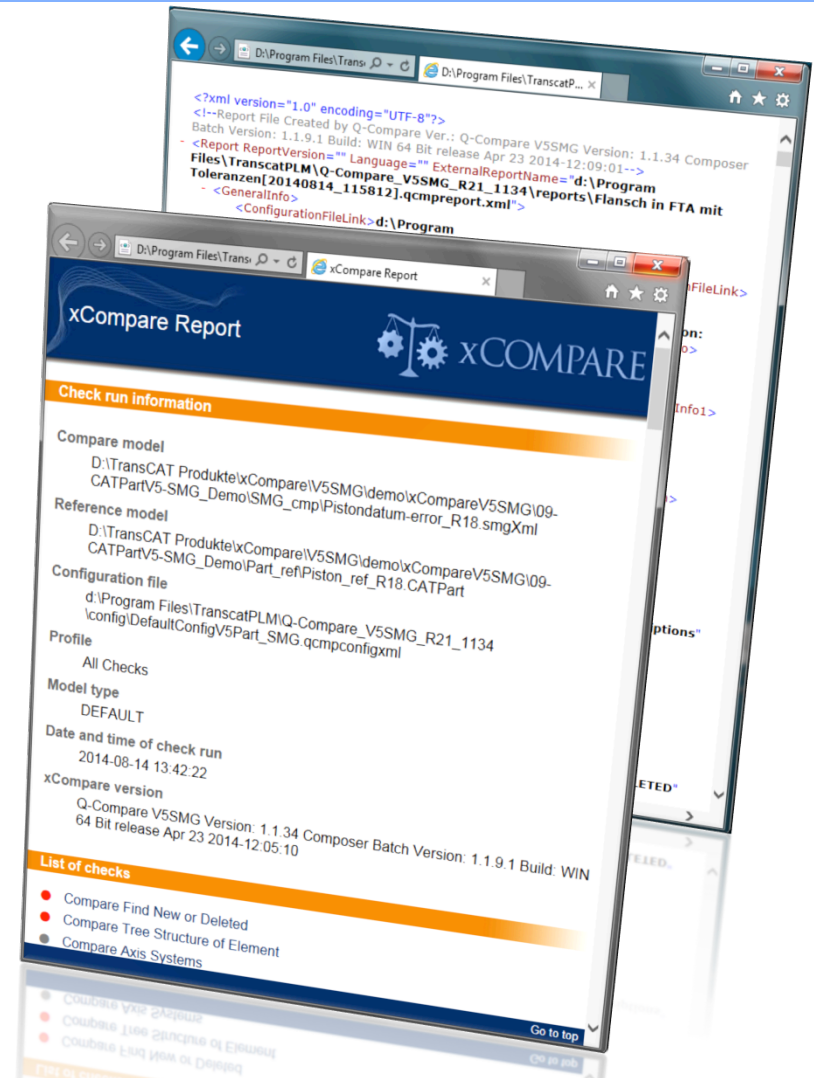
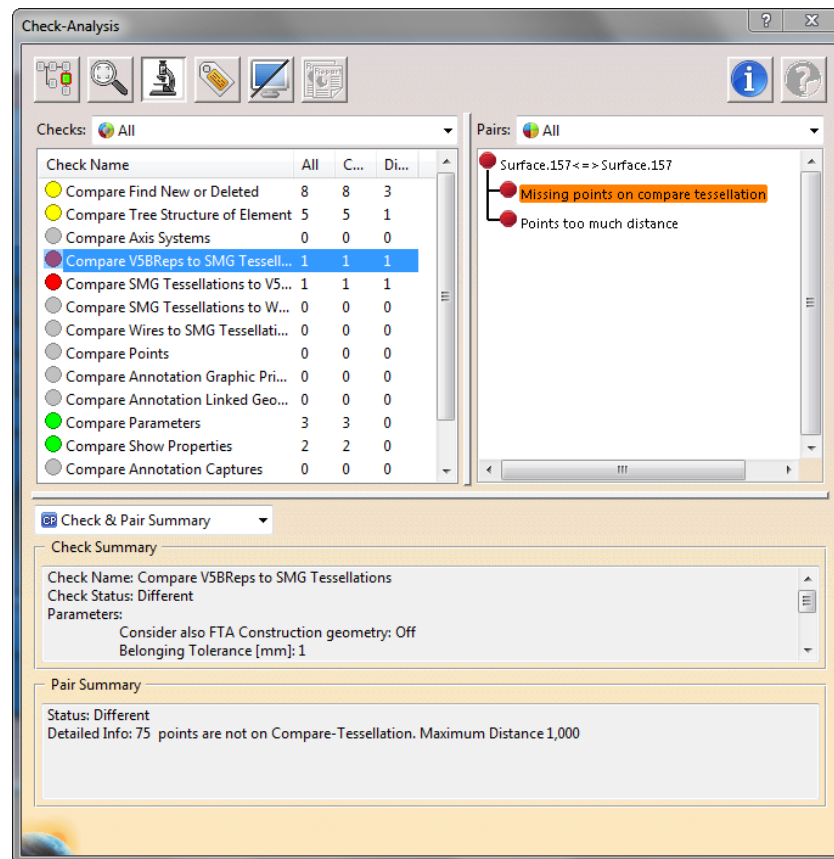
- Checks can be widely configured



xCompare V5 / SMG

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- Detailed analysis of results



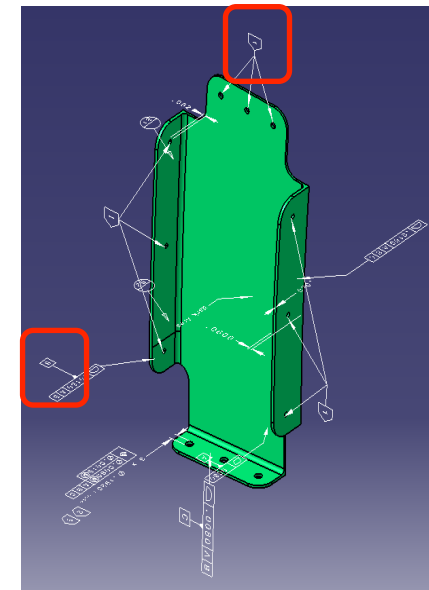
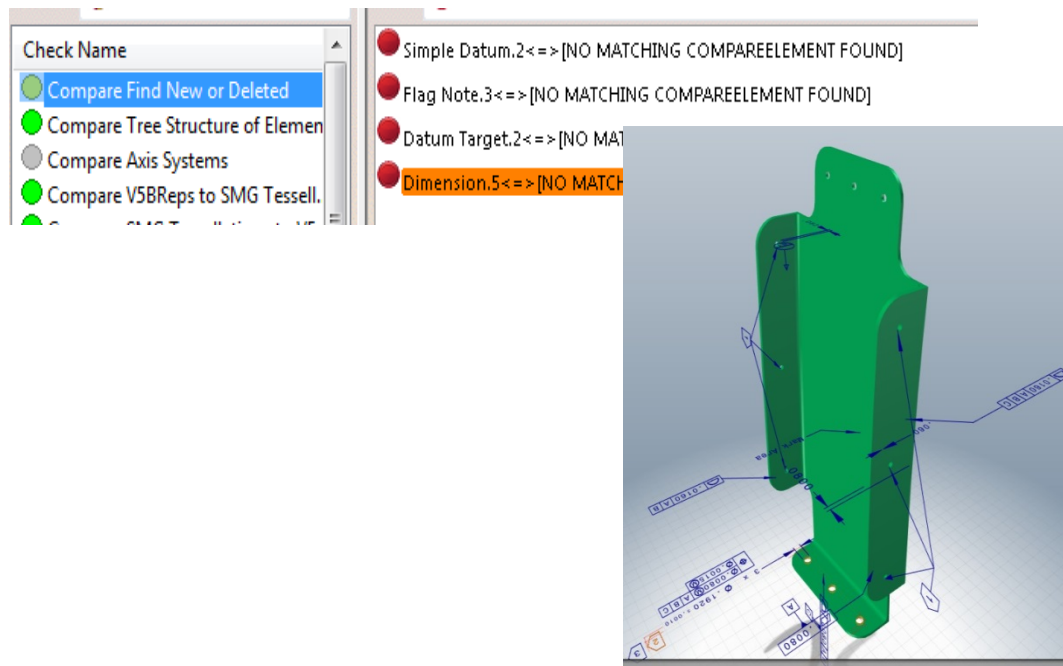
Samples - Verify FT&A / PMI

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Differences found in annotations

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



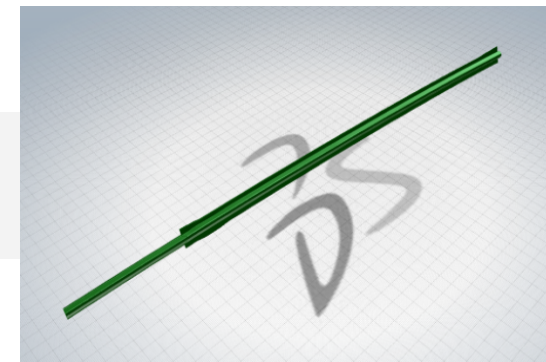
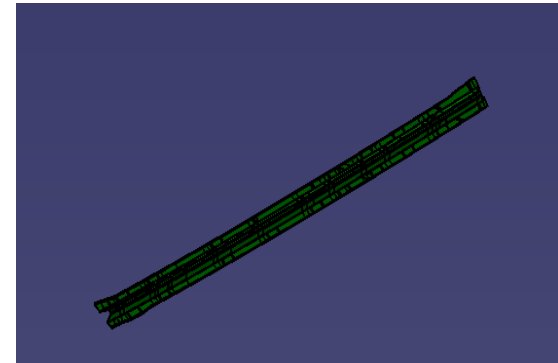
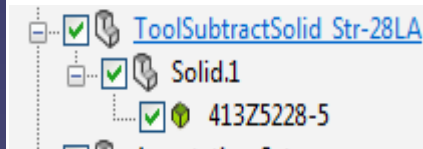
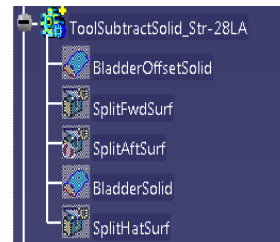
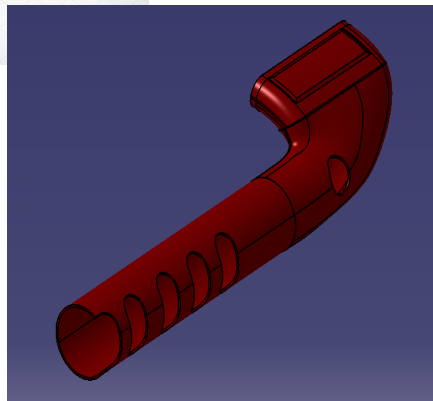
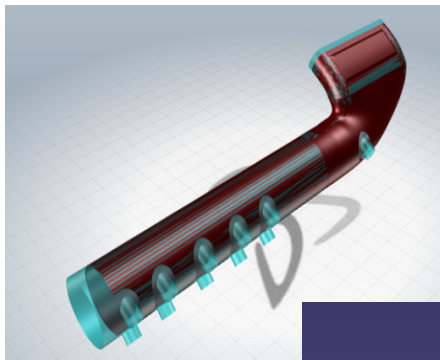
Samples - Differences in show properties

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Differences found in show properties

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



Samples – Differences in parameters

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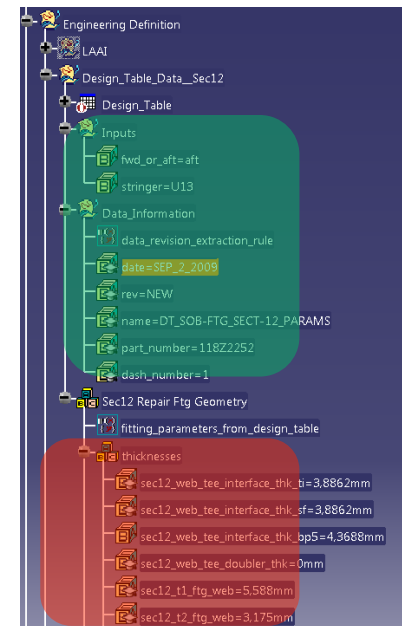
- **Differences in parameters**
 - The sting “-” is not converted correctly in SMG, instead “-” is used

`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

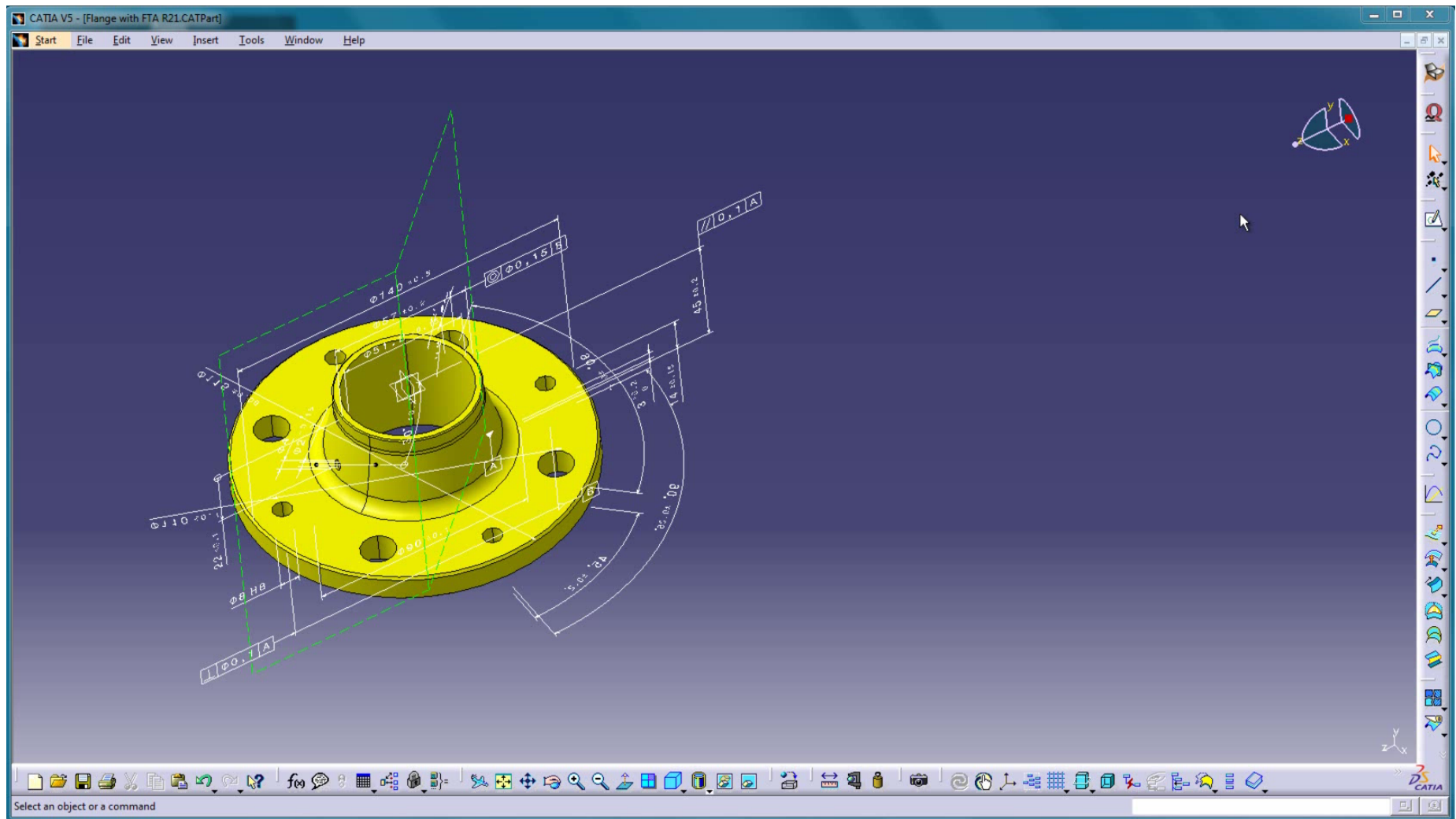


- **Parameters in a parameter set located under a geometrical set are not converted to SMG**
 - Parameters marked in red are missing in SMG
 - Parameters marked in green are existing in SMG



Video of an interactive inspection

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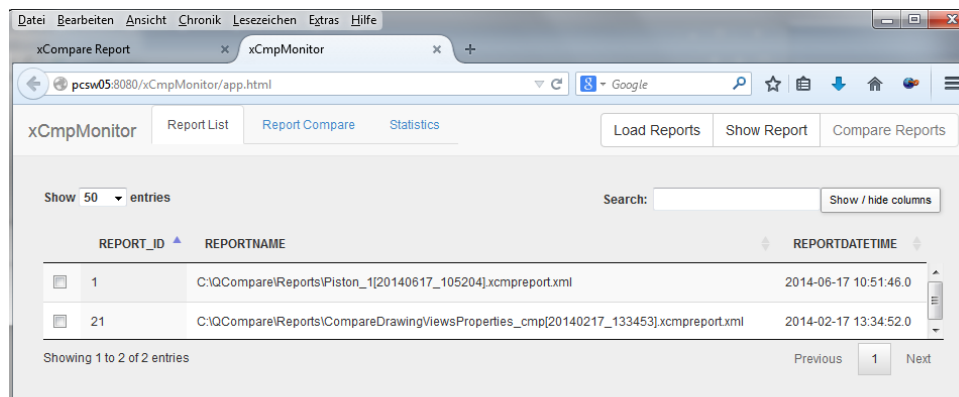
Database connection for traceability

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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

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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

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- **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

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Questions?