Integrating “Smart Documents” into PLM and the Digital Thread

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2019

Documents as Models in the Digital Thread

Agenda

- **What is a smart document?**
- **What's the problem?**
  - **Is it really a problem?**
- **What if a document was actually a model?**
- **Document models in PLM**
- **Benefits of documents as models**
- **What is the potential?**

What is a Smart Document?

- **Templates**
- **Document "Review" options**
  - **Collaboration & Change notifications**
- **Capable of being programmed (spreadsheets)**
- **Forms with selection options**
- **eSignature capabilities**
- **Connections back to the company Customer Relationship Management (CRM) system**
  - **Digital rights management (DRM)**
  - **Tracking Import / Export management**

Can documents be more?

What’s the problem?

Let us look at access to specifications

The document quagmire

- **Large amounts of information**
- **Stacks and folders of specifications**
- **Extraneous Information**
- **Large amounts of cross referencing**
- **Version Verification**

Lets Go Electronic!

Electronic solution

Applications:

Microsoft Word, Excel, PowerPoint

Adobe FrameMaker, PageMaker

Arbortext

Others

- Convert to PDF format
- Include hyperlinks
- Store in PDM system
- DRM management

Electronic is not enough!

“Electronic Documents” enhance search capabilities but most documents don’t talk to each other

Let us look at an example

Is it really a problem?

A Simple Printed Wiring Board Drawing Note

“UNLESS OTHERWISE SPECIFIED PERFORM ELECTRICAL TESTS PER FIND NUMBER 106”

FIND NUMBER 106:
“PRINTED WIRING BOARDS, RIGID, FABRICATION REQUIREMENTS”

Parts list find number 106

"PRINTED WIRING BOARDS, RIGID, FABRICATION REQUIREMENTS"

DOCUMENT PAGE COUNT - 24

4 GOVERNMENT / NATIONALLY RECOGNIZED PUBLICATIONS

- **12** REFERENCED DOCUMENTS

6 INDUSTRY PUBLICATIONS (ANSI, IPC, SAE)

- **2** GOVERNMENT PUBLICATIONS
- **11** INDUSTRY PUBLICATIONS (ASTM, ANSI, IPC)
- **4** OTHER NGSC DOCUMENTS

2 OTHER NGSC DOCUMENTS (AS APPLICABLE)

- **2** GOVERNMENT PUBLICATIONS
- **12** INDUSTRY PUBLICATIONS (ASTM, ANSI, IPC)
- **4** OTHER NGSC DOCUMENTS

Represents 40+ Unique Documents

Let us get real specific

Let's narrow further

Bow & Twist (Para 3.11.4)

→ Shall Meet Para 3.6.1.2

→ Requirements of IPC-6012 apply

→
- **25** IPC specs
- **2** joint industry standards
- **3** ASTM standards
- **1** UL standard
- **1** NEMI standard
- **2** AMS standards
- **1** ASME standard

37 Unique Documents

How do we see only relevant information?

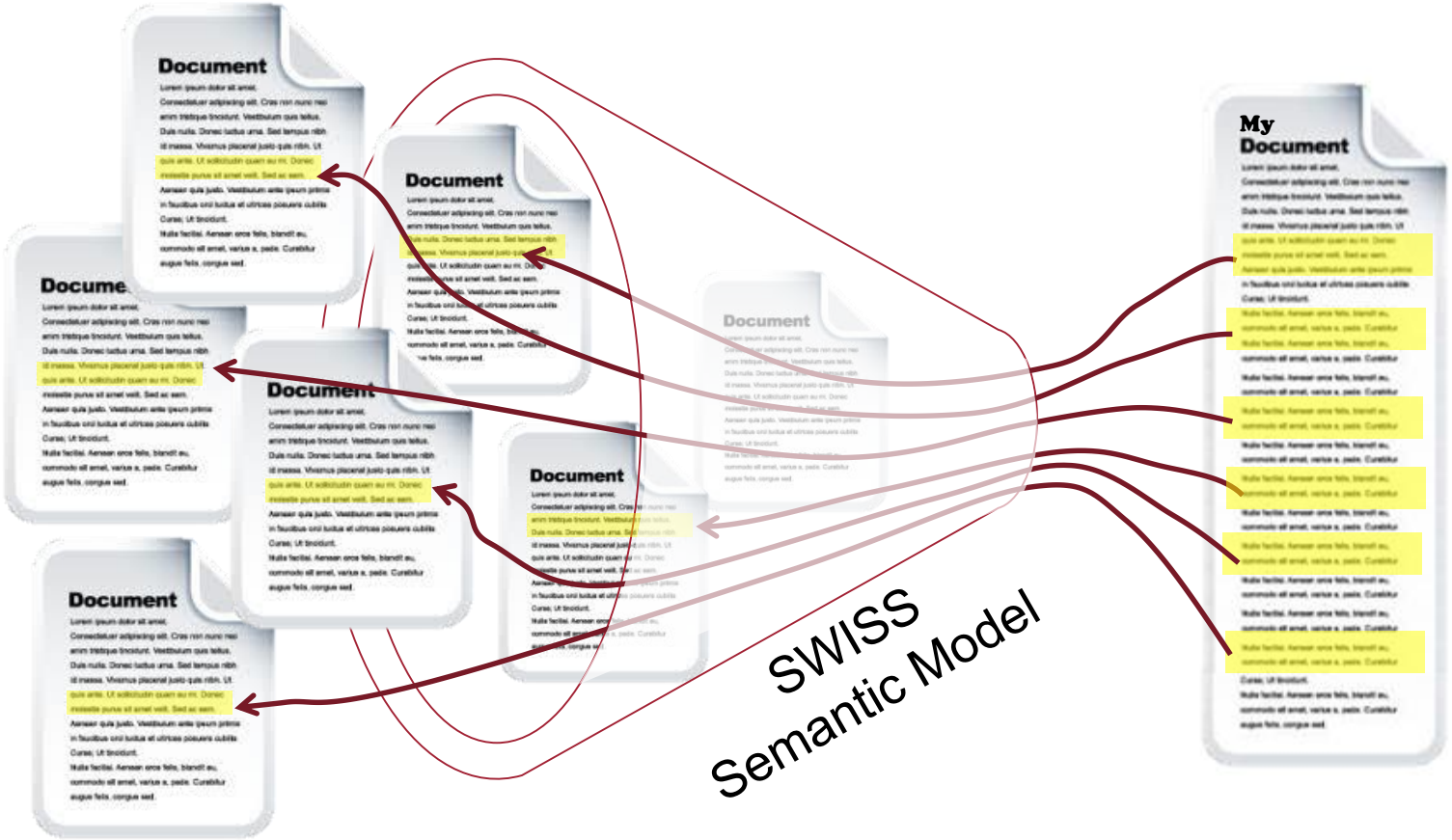
Leverage transclusion

Standard Cut & Paste

What if a document was actually a model?

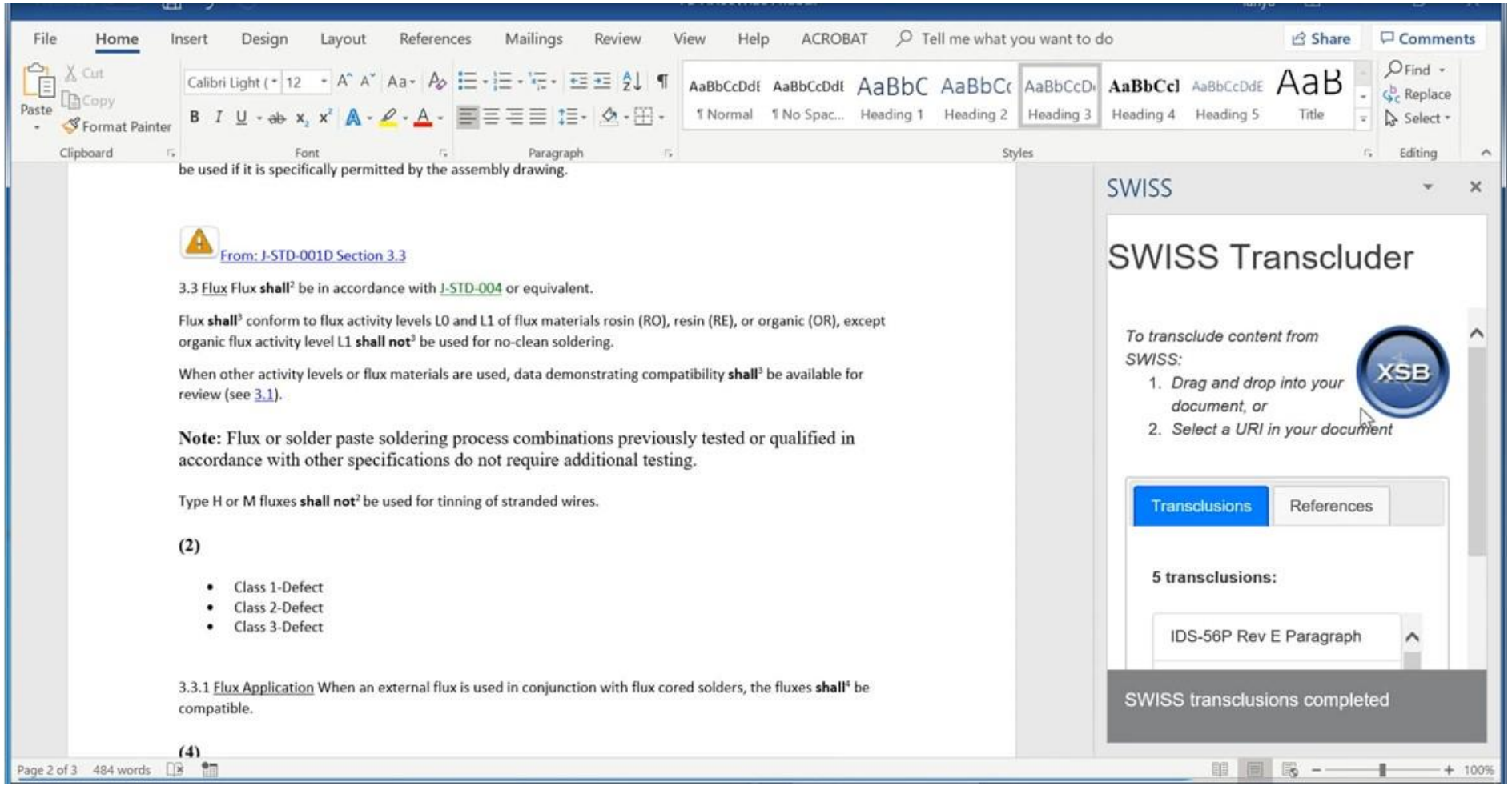
But what if a referenced document changes?

Let’s make it smart!



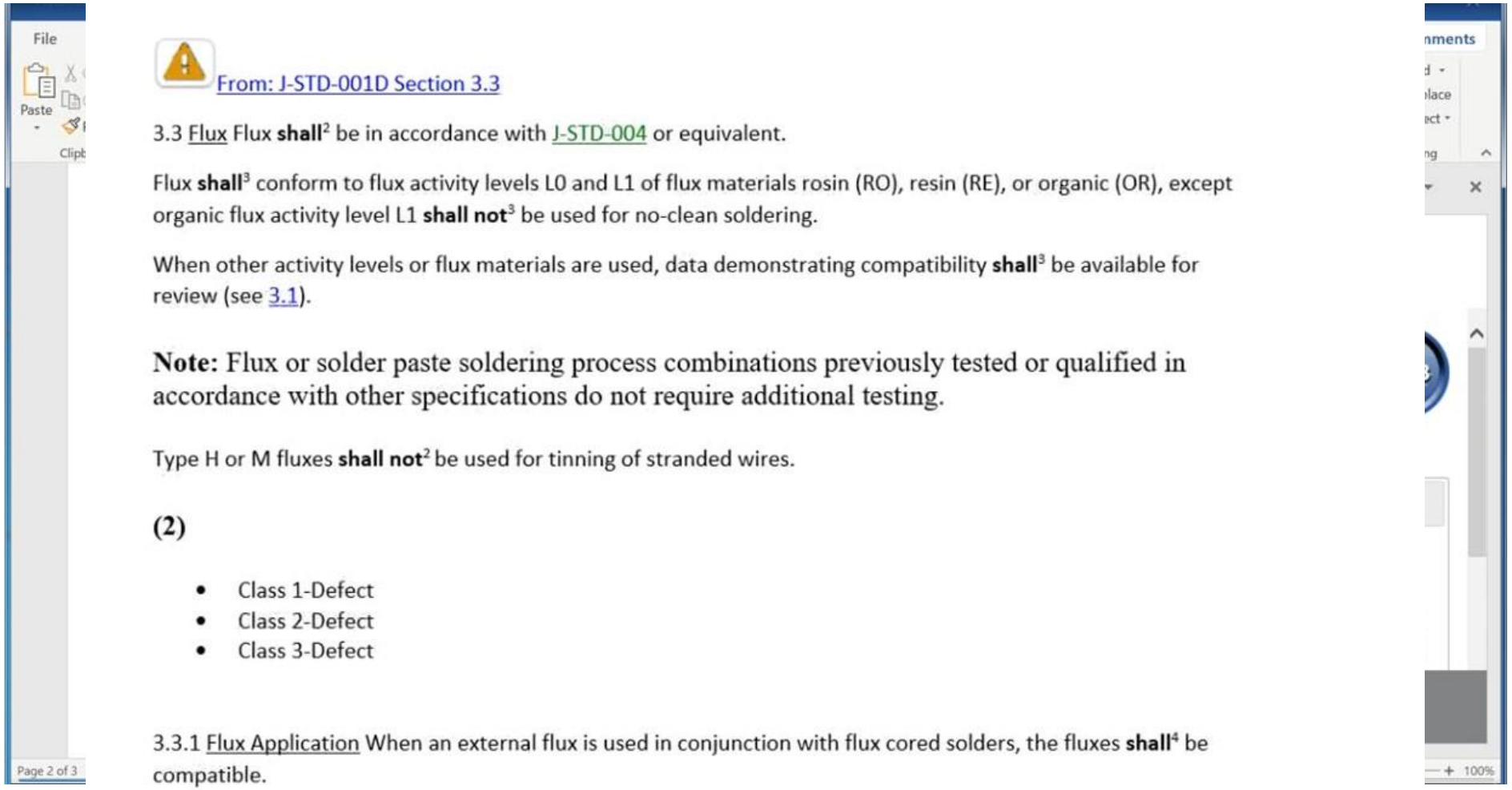
Two Way Communication!

What does a smart document look like?



Defines the Authoritative Source!

What does a smart document look like?



From: J-STD-001D Section 3.3

3.3 Flux Flux **shall**[2] be in accordance with J-STD-004 or equivalent.

Flux **shall**[3] conform to flux activity levels L0 and L1 of flux materials rosin (RO), resin (RE), or organic (OR), except organic flux activity level L1 **shall not**[3] be used for no-clean soldering.

When other activity levels or flux materials are used, data demonstrating compatibility **shall**[3] be available for review (see 3.1).

Note: Flux or solder paste soldering process combinations previously tested or qualified in accordance with other specifications do not require additional testing.

Type H or M fluxes **shall not**[2] be used for tinning of stranded wires.

(2)

- Class 1-Defect
- Class 2-Defect
- Class 3-Defect

3.3.1 Flux Application When an external flux is used in conjunction with flux cored solders, the fluxes **shall**[4] be compatible.

Defines the Authoritative Source!

What changed at the source?

Type H or M fluxes **shall not**[2] [D1D2D3] be used for tinning of stranded wires.

(2)

- ~~Class 1 Defect~~
- ~~Class 2 Defect~~
- ~~Class 3 Defect~~

3.3.1 Flux Application When an external flux is used in conjunction with flux cored solders, the fluxes shall [D1D2D3] be compatible both from a cleaning process standpoint and a chemical standpoint. Objective evidence of compatibility, e.g., surface insulation resistance testing, ion chromatography testing, shall [N1D2D3] be available for review, see 1.8.7 and Appendix C. IPC-9202 and IPC-9203 are examples for qualification testing.~~When an external flux is used in conjunction with flux cored solders, the fluxes **shall**[4] be compatible.~~

(4)

- ~~Class 1 Defect~~
- ~~Class 2 Defect~~
- ~~Class 3 Defect~~

That is a Smart Document!

What if a document model was part of the Ecosystem?

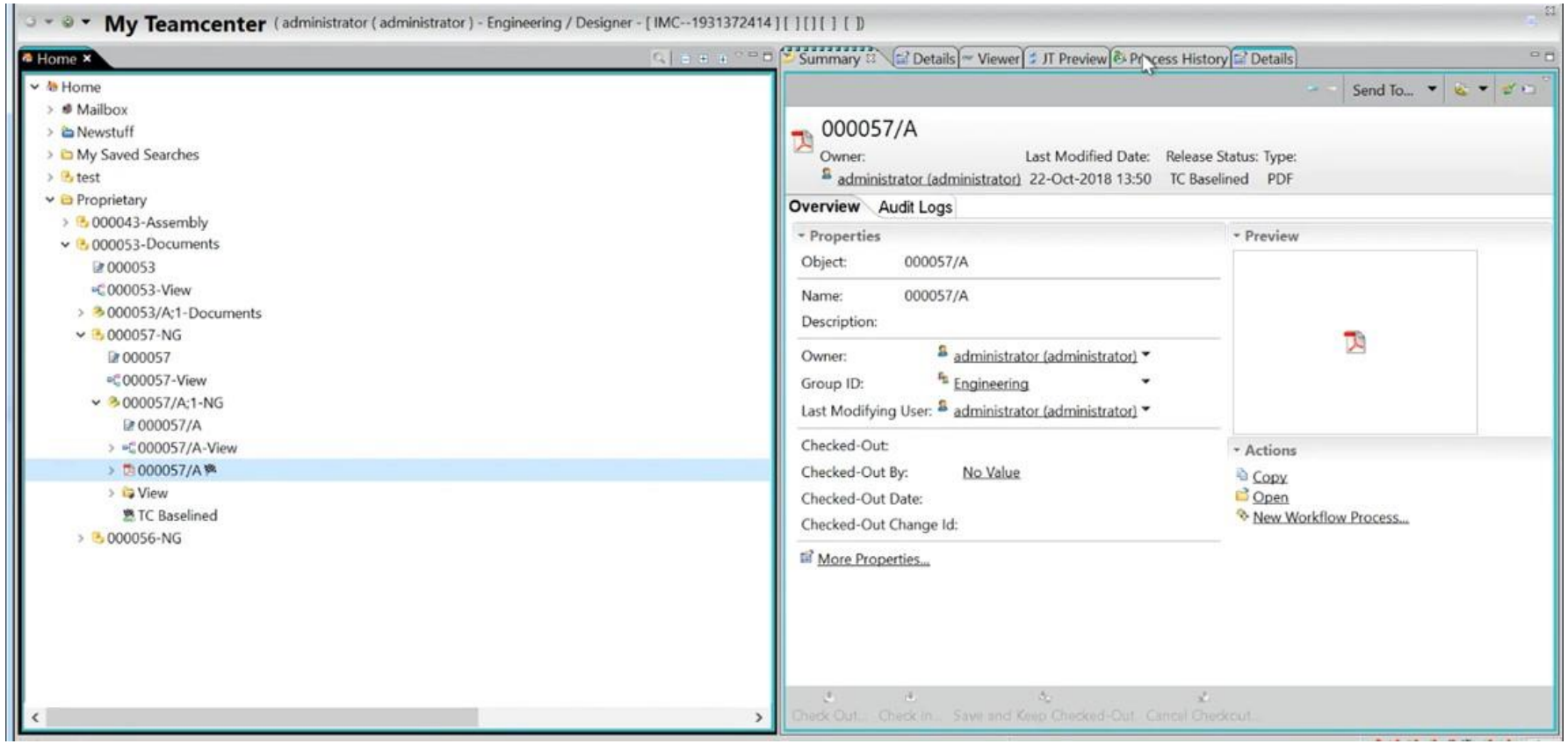
PLM representation

Engineering BOM

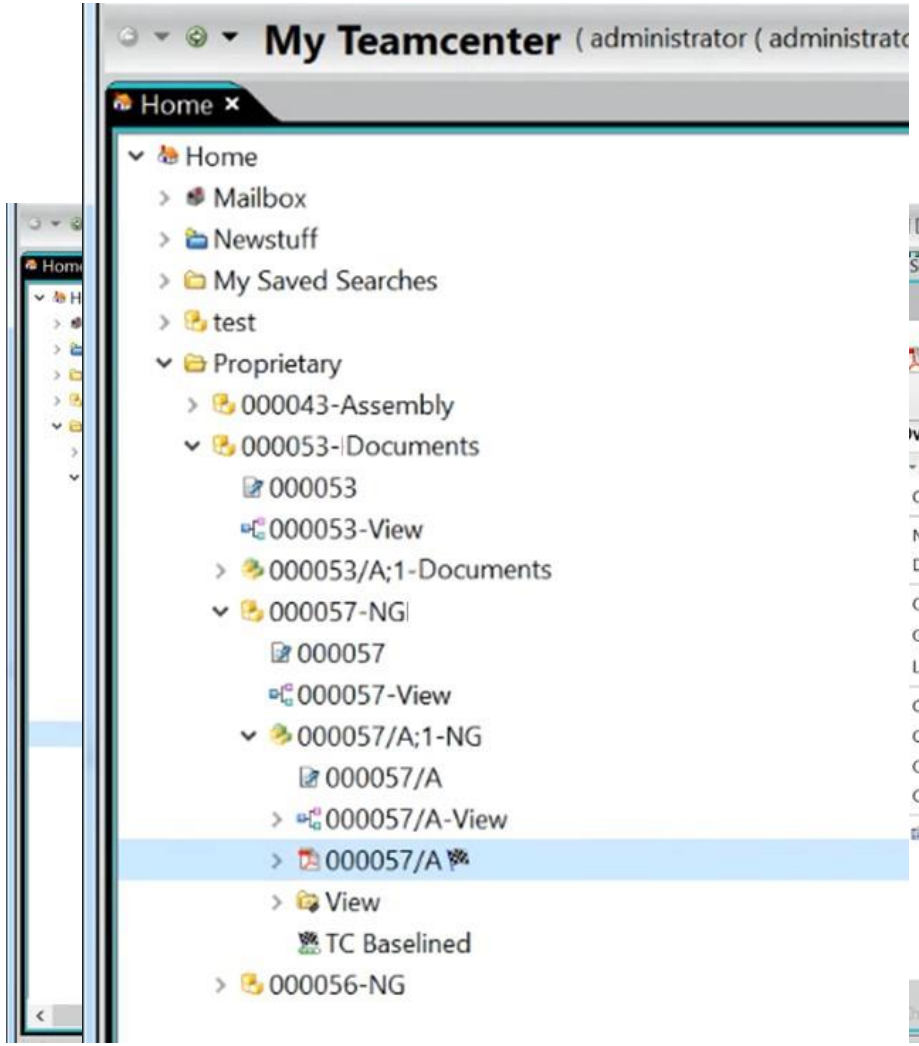
Manufacturing BOM

Bill Of Process

Product Structure



PLM representation

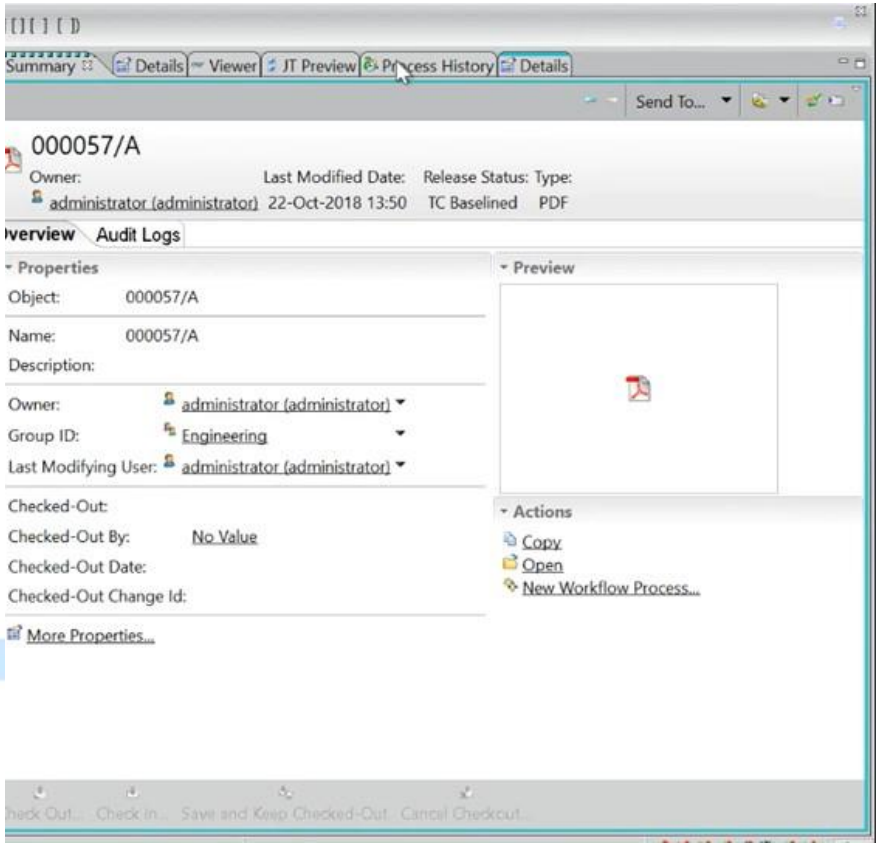


Engineering BOM

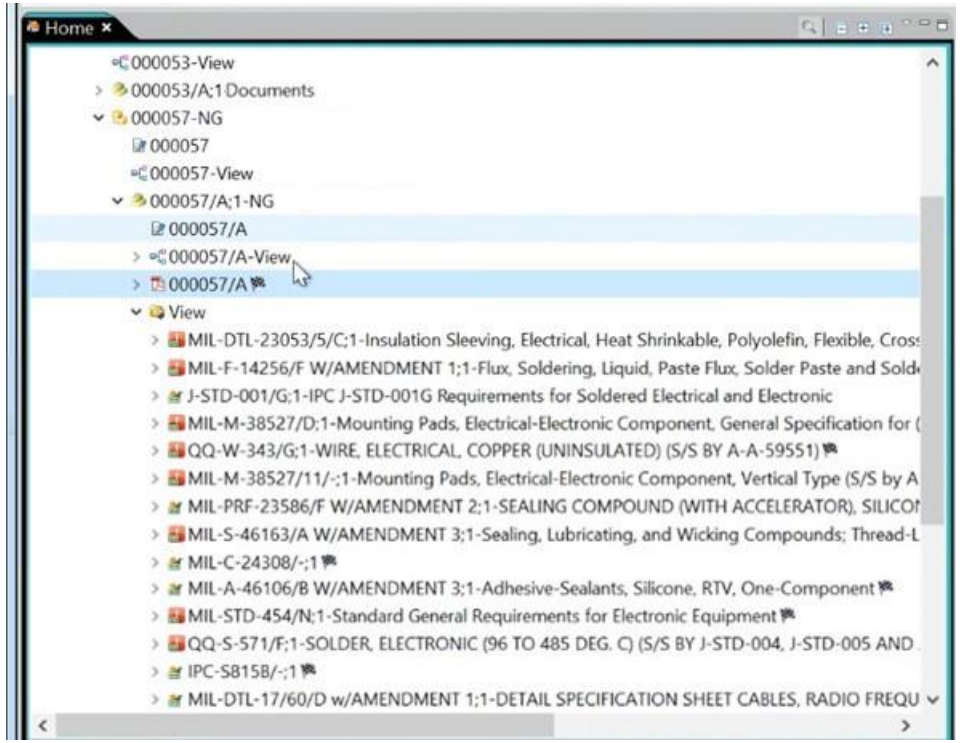
Manufacturing BOM

Bill Of Process

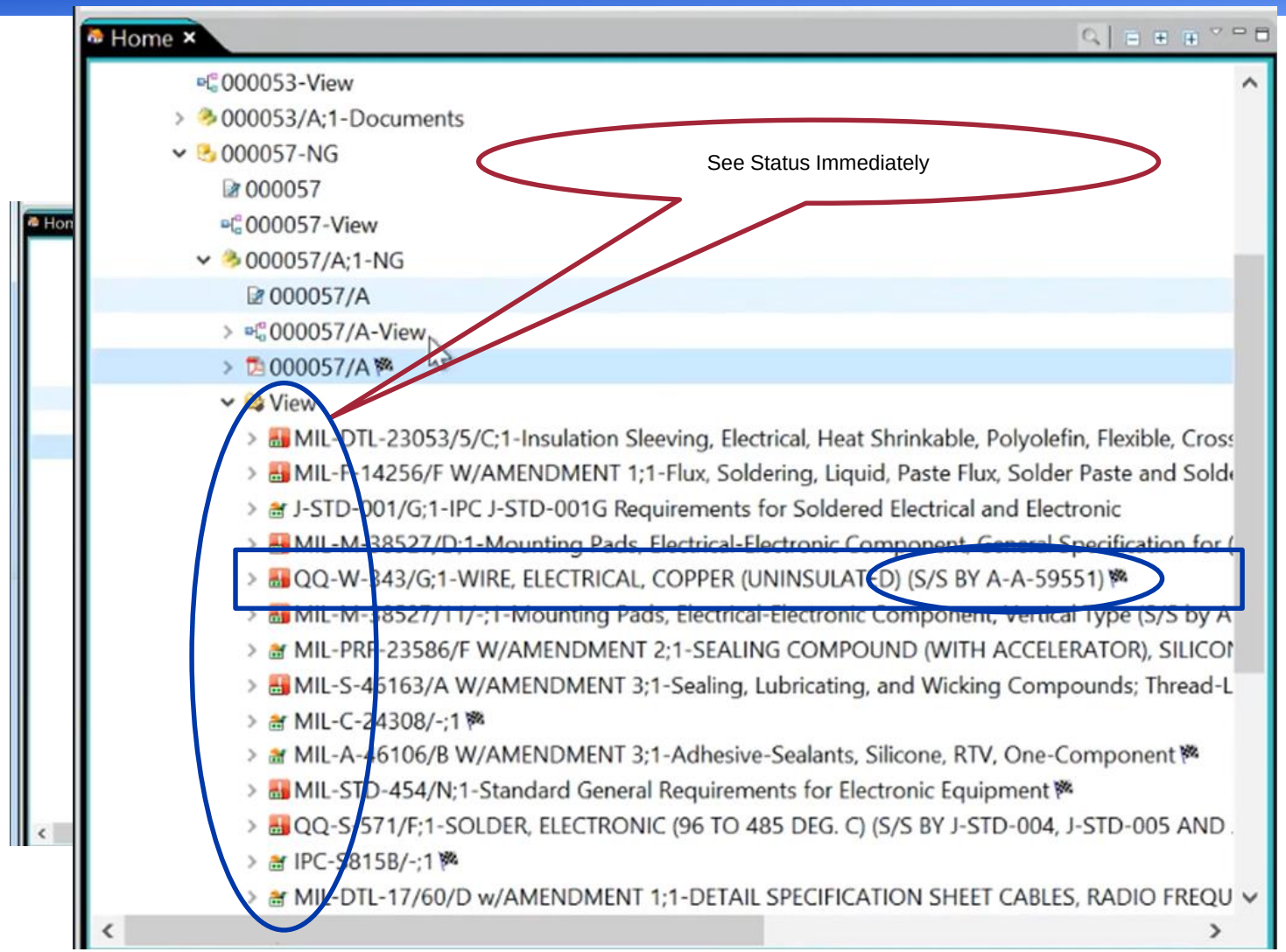
Product Structure



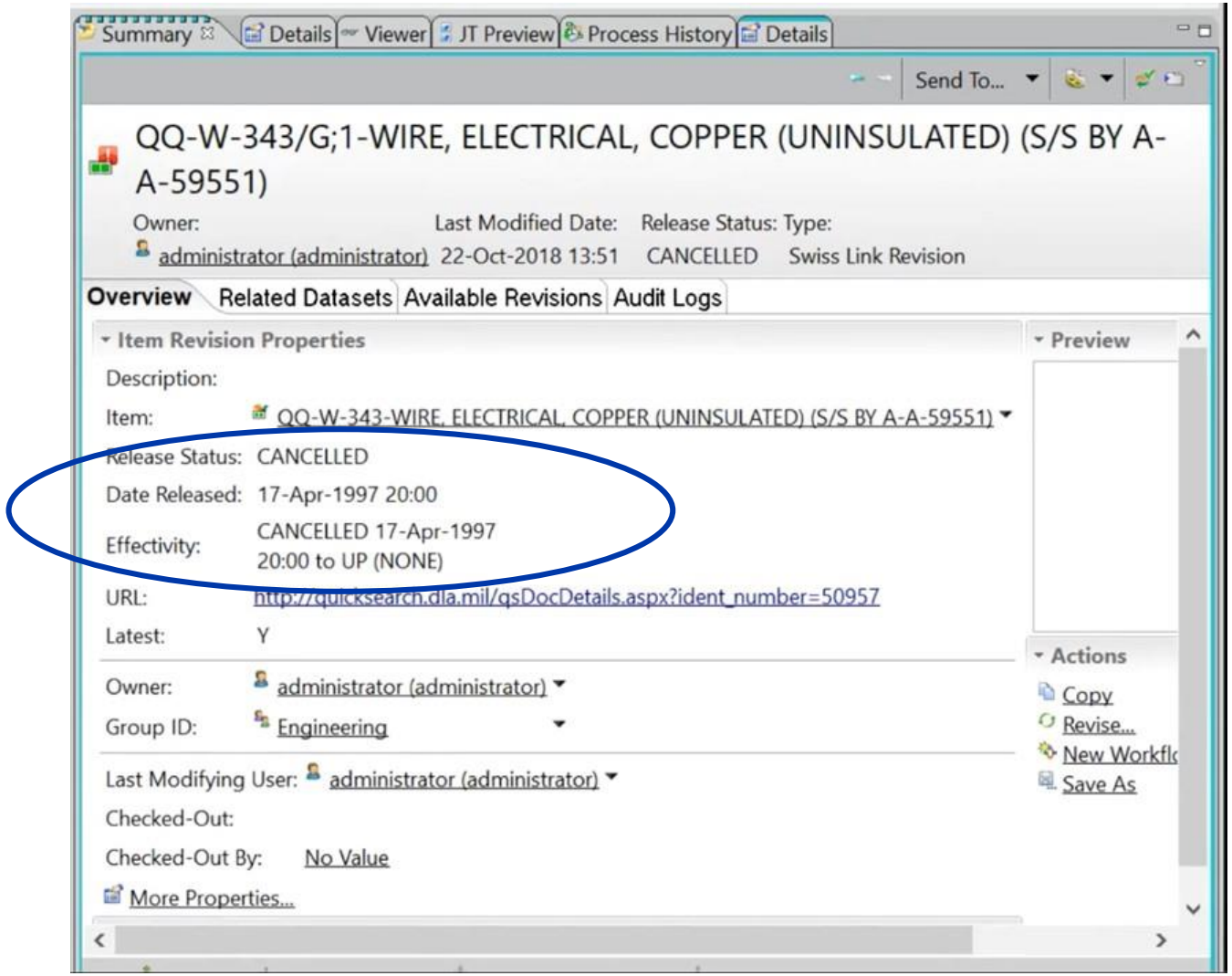
PLM expanded view



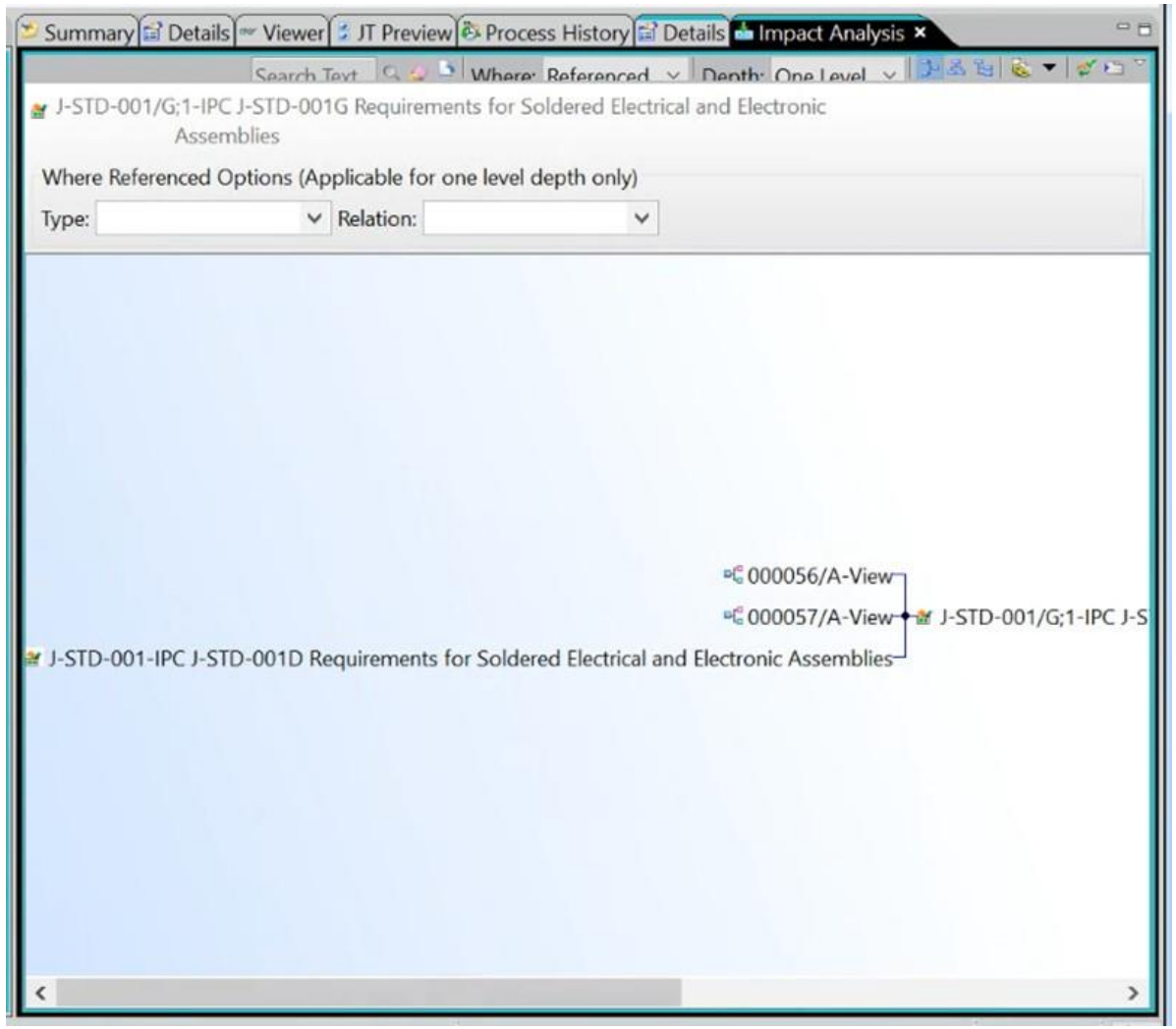
PLM expanded view



See the details



PLM where used



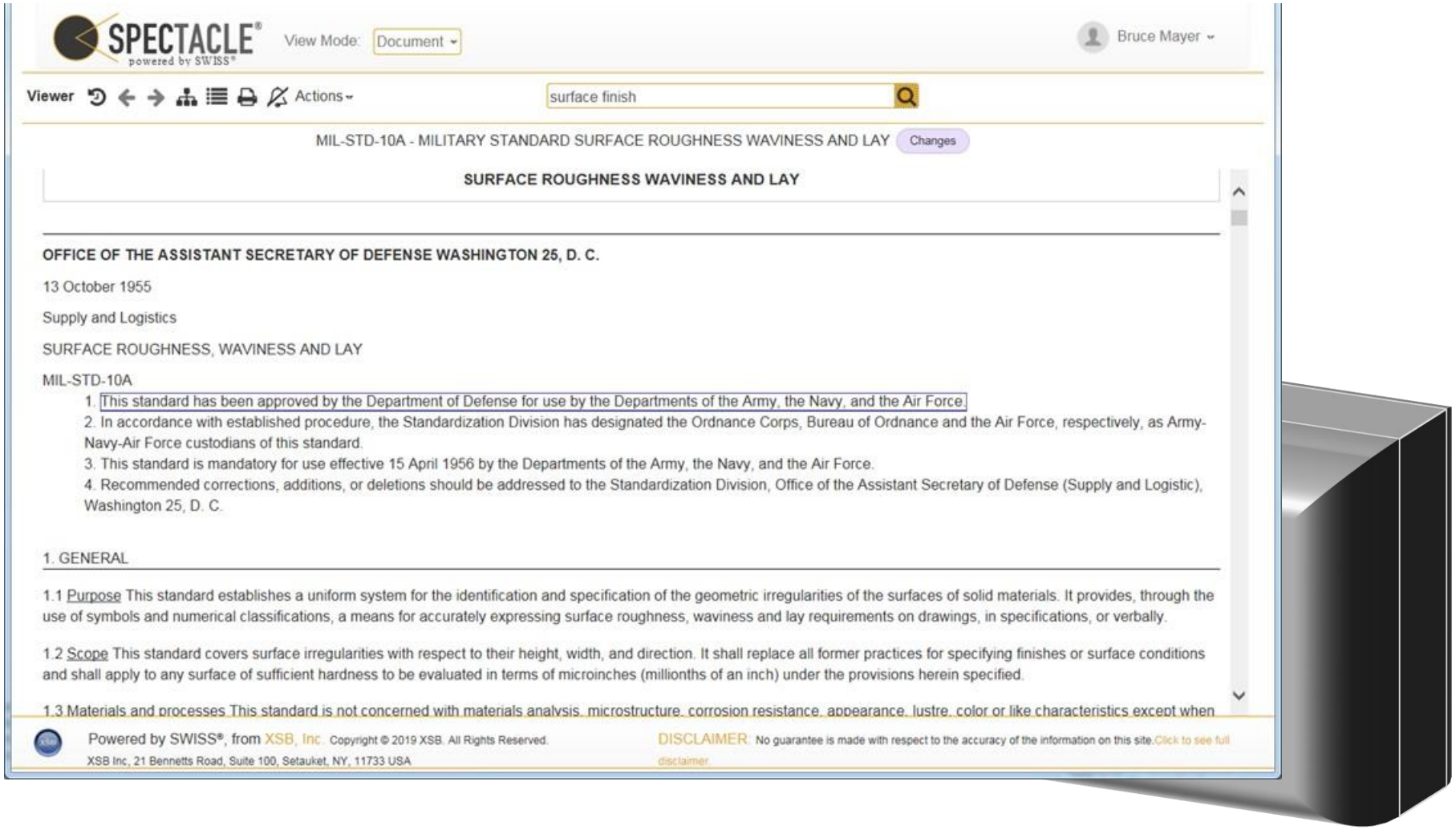
Benefits of documents a models

Benefits of documents a models

But wait, there’s more?

Augmented reality

Augmented reality



What about drawings?

SPECTACLE® powered by SWISS® View Mode: Document Bruce Mayer

Viewer Actions

MIL-STD-10A - MILITARY STANDARD SURFACE ROUGHNESS WAVINESS AND LAY Changes

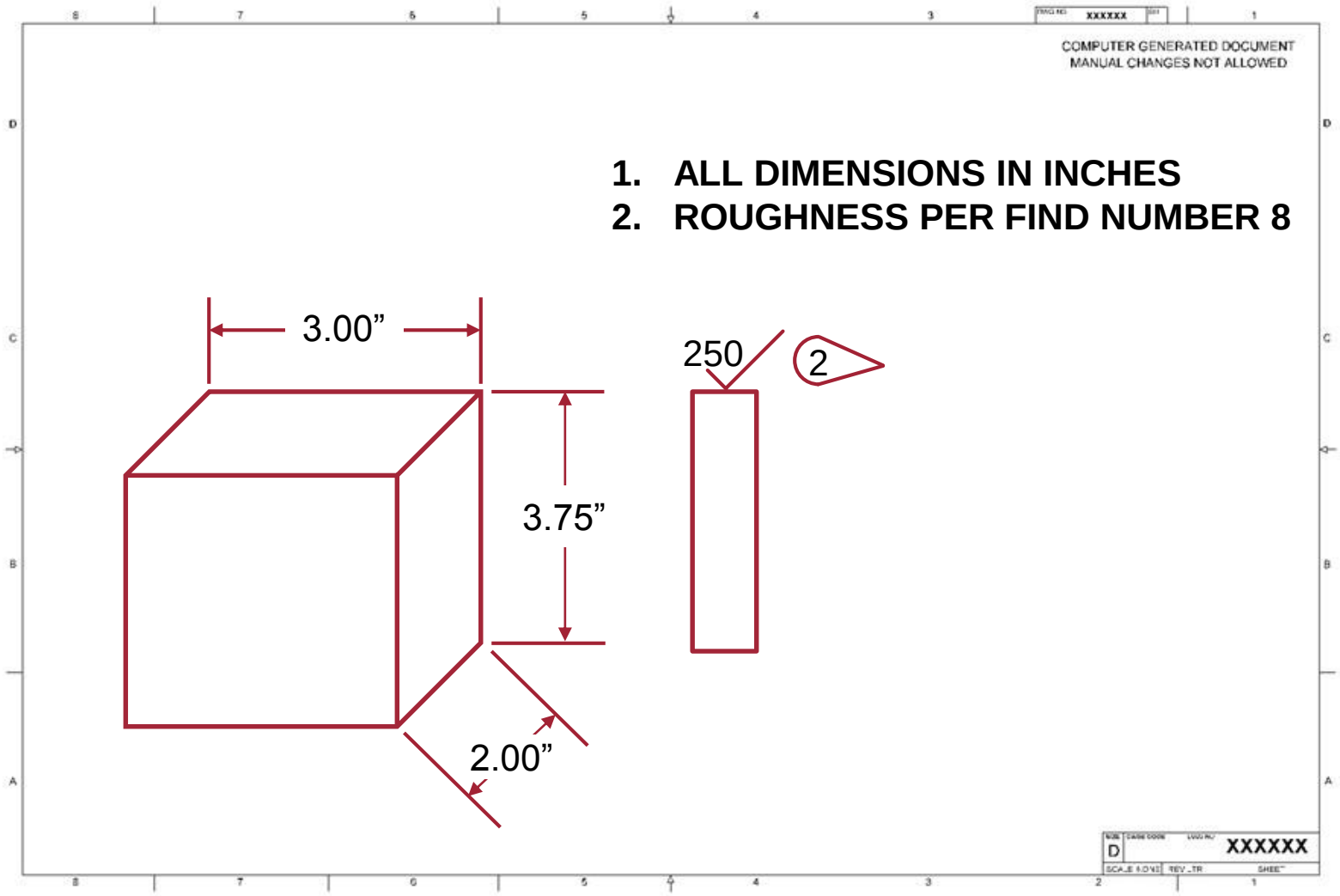
5.2.4 Effect on drawings, specifications, etc In normal design applications the numerical difference between the values obtained from the roughness height averaging method and the RMS method is not large enough to warrant the conversion of drawings, specifications, etc. However, on critical surfaces where slight differences in surface roughness is significant, the 11 percent conversion factor may be used.

Table V

Roughness Height Rating	General Application of Roughness Height Ratings
1000	Very rough, low grade surface resulting from sand casting, torch or saw cutting, chipping or rough forgings. Machine operations are not required as appearance is not objectionable. This finish, rarely specified, is suitable for unmachined clearance areas on machinery, jigs, and other rough construction items.
500	Very rough, low grade surfaces, where smoothness is of no object, resulting from heavy cuts and coarse feeds in milling, turning, shaping, boring, and from very rough filing, rough disc grinding and snagging. This surface is suitable for clearance areas on machinery, jigs, and fixtures. This surface roughness may be obtained by natural processes of sand casting or rough forging.
250	Coarse production surfaces, for unimportant clearance and cleanup operations, resulting from very coarse surface grind, rough file, disc grind, and from rapid feeds in turning, milling, shaping, drilling, boring, grinding, etc., where definite tool marks are not objectionable. This roughness may also be produced on the natural surfaces of forgings, permanent mold castings, extrusions and rolled surfaces. Surfaces with this roughness value can be produced very economically and is used to a great extent on parts where stress requirements, appearance, and conditions of operations and design permit.
125	This is the roughest surface recommended for parts subject to leads, vibration, and high stress. This surface roughness is also permitted for bearing surfaces when the motion is slow and the loads are light or infrequent, but not to be specified for fast rotating shafts, axles, and parts subject to severe vibration or extreme tension. This surface is a medium, commercial machine finish in which relatively high speeds and fine feeds are used in taking light cuts with well-sharpened tools, and may be economically produced on lathes, milling machines, shapers, grinders, etc. The surface finish may also be obtained on permanent mold castings, die castings, extrusions, and rolled

D XXXXXX

What about drawings?



What about CAD models?

SPECTACLE® powered by SWISS® View Mode: Document Bruce Mayer

Viewer Actions

MIL-STD-10A - MILITARY STANDARD SURFACE ROUGHNESS WAVINESS AND LAY Changes

5.2.4 Effect on drawings, specifications, etc In normal design applications the numerical difference between the values obtained from the roughness height averaging method and the RMS method is not large enough to warrant the conversion of drawings, specifications, etc. However, on critical surfaces where slight differences in surface roughness is significant, the 11 percent conversion factor may be used.

Table V

Roughness Height Rating	General Application of Roughness Height Ratings
1000	Very rough, low grade surface resulting from sand casting, torch or saw cutting, chipping or rough forgings. Machine operations are not required as appearance is not objectionable. This finish, rarely specified, is suitable for unmachined clearance areas on machinery, jigs, and other rough construction items.
500	Very rough, low grade surfaces, where smoothness is of no object, resulting from heavy cuts and coarse feeds in milling, turning, shaping, boring, and from very rough filing, rough disc grinding and snagging. This surface is suitable for clearance areas on machinery, jigs, and fixtures. This surface roughness may be obtained by natural processes of sand casting or rough forging.
250	Coarse production surfaces, for unimportant clearance and cleanup operations, resulting from very coarse surface grind, rough file, disc grind, and from rapid feeds in turning, milling, shaping, drilling, boring, grinding, etc., where definite tool marks are not objectionable. This roughness may also be produced on the natural surfaces of forgings, permanent mold castings, extrusions and rolled surfaces. Surfaces with this roughness value can be produced very economically and is used to a great extent on parts where stress requirements, appearance, and conditions of operations and design permit.
125	This is the roughest surface recommended for parts subject to leads, vibration, and high stress. This surface roughness is also permitted for bearing surfaces when the motion is slow and the loads are light or infrequent, but not to be specified for fast rotating shafts, axles, and parts subject to severe vibration or extreme tension. This surface is a medium, commercial machine finish in which relatively high speeds and fine feeds are used in taking light cuts with well-sharpened tools, and may be economically produced on lathes, milling machines, shapers, grinders, etc. The surface finish may also be obtained on permanent mold castings, die castings, extrusions, and rolled

Powered by SWISS®, from XSB, Inc. Copyright © 2019 XSB. All Rights Reserved.
XSB Inc, 21 Bennetts Road, Suite 100, Setauket, NY, 11733 USA

DISCLAIMER: No guarantee is made with respect to the accuracy of the information on this site. Click to see full disclaimer.

D XXXXXX

What is the Potential?

- **Interconnectivity to the authoritative source change**
  - **What if a critical value changed in a table?**
- **Proactively recognize change impact**
- **Demonstrable digital thread of documents**
- **Ensure compliance**
- **Maximize continuous improvement**
  - **Is there a best practice update?**
  - **Is there a change due to lessons learned?**
- **Documents as models today is akin to moving from paper to CAD**
  - **Potential is limited by ingenuity and imagination**

Work Smarter NOT Harder!

Maximize the Model Based Ecosystem

- **Purposeful specifications**
- **Version cognizance**
- **Managed in PLM/PDM/ERP**
- **Linked to CAD data**
- **Get the most out of your documents**
- **What about AI - ask questions “How do I …..”**
- **Think outside the box**

SMART CONNECTED DOCUMENTS!

Thank You

Contact information:
Bruce Mayer
Northrop Grumman
Manager Application Strategy, Process and technology
Bruce.Mayer@ngc.com