

Integrating “Smart Documents” into PLM and the Digital Thread

Documents as Models in the Digital Thread

GLOBAL PRODUCT DATA
INTEROPERABILITY
S U M M I T
2019



- **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?

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- **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**

What's the problem?

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Let us look at access to specifications

The document quagmire

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





Applications:

Microsoft Word, Excel, PowerPoint

Adobe FrameMaker, PageMaker

Arbortext

Others

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

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

Let us look at an example

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”

“PRINTED WIRING BOARDS, RIGID, FABRICATION REQUIREMENTS” DOCUMENT PAGE COUNT - 24



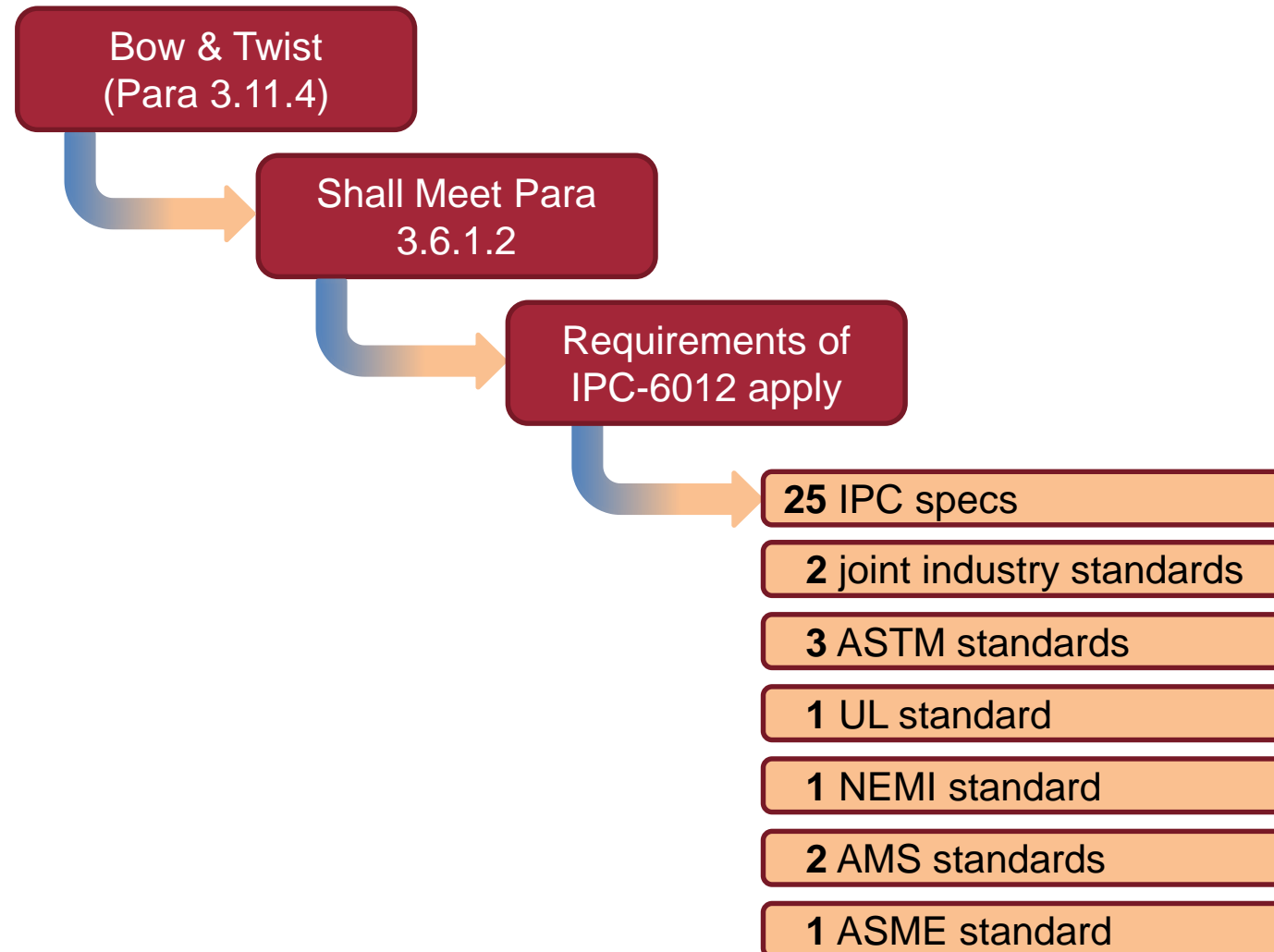
Represents 40+ Unique Documents

Let us get real specific

Let's narrow further

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How do we see only relevant information?

Leverage transclusion

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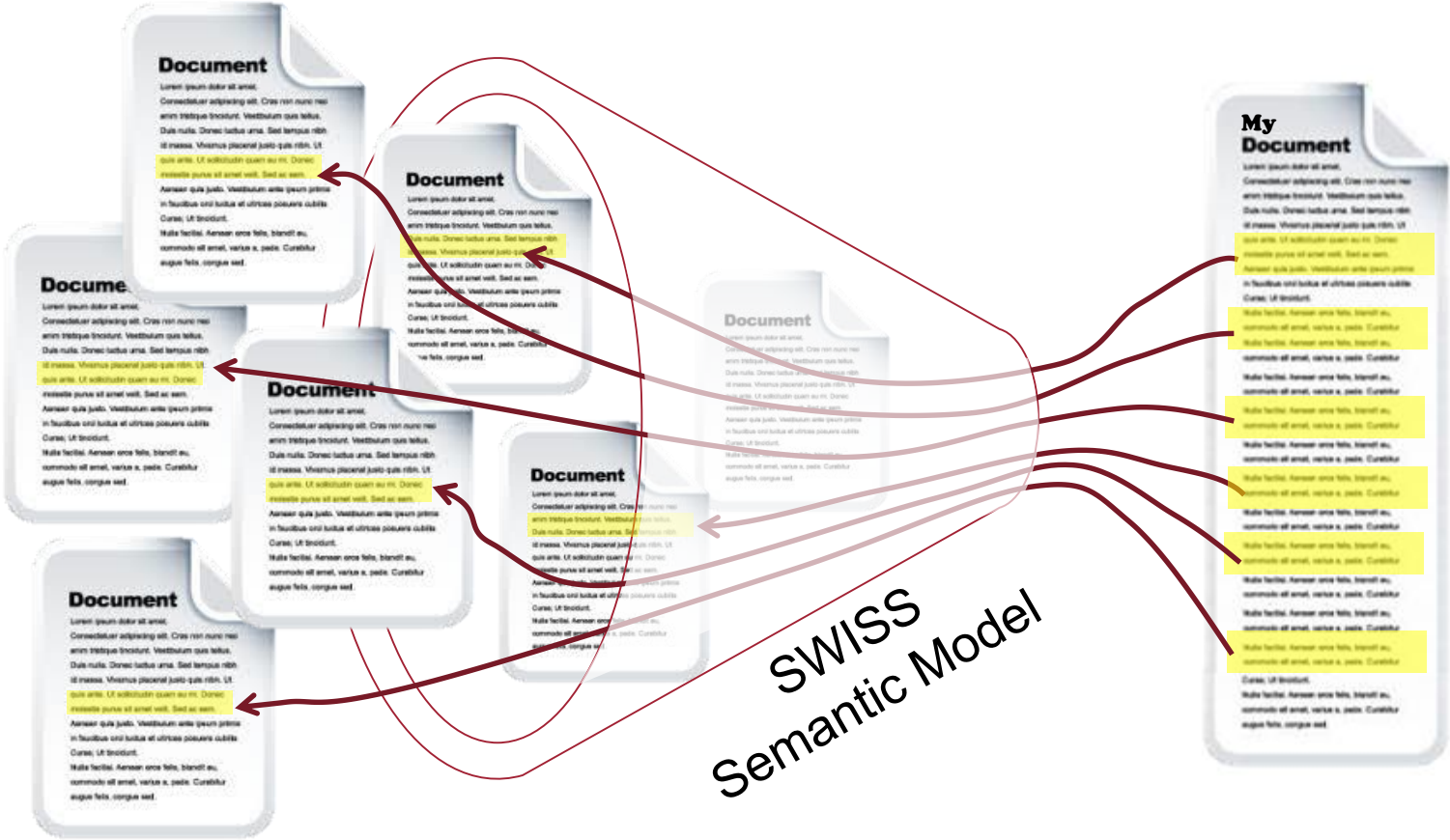
What if a document was actually a model?

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But what if a referenced document changes?

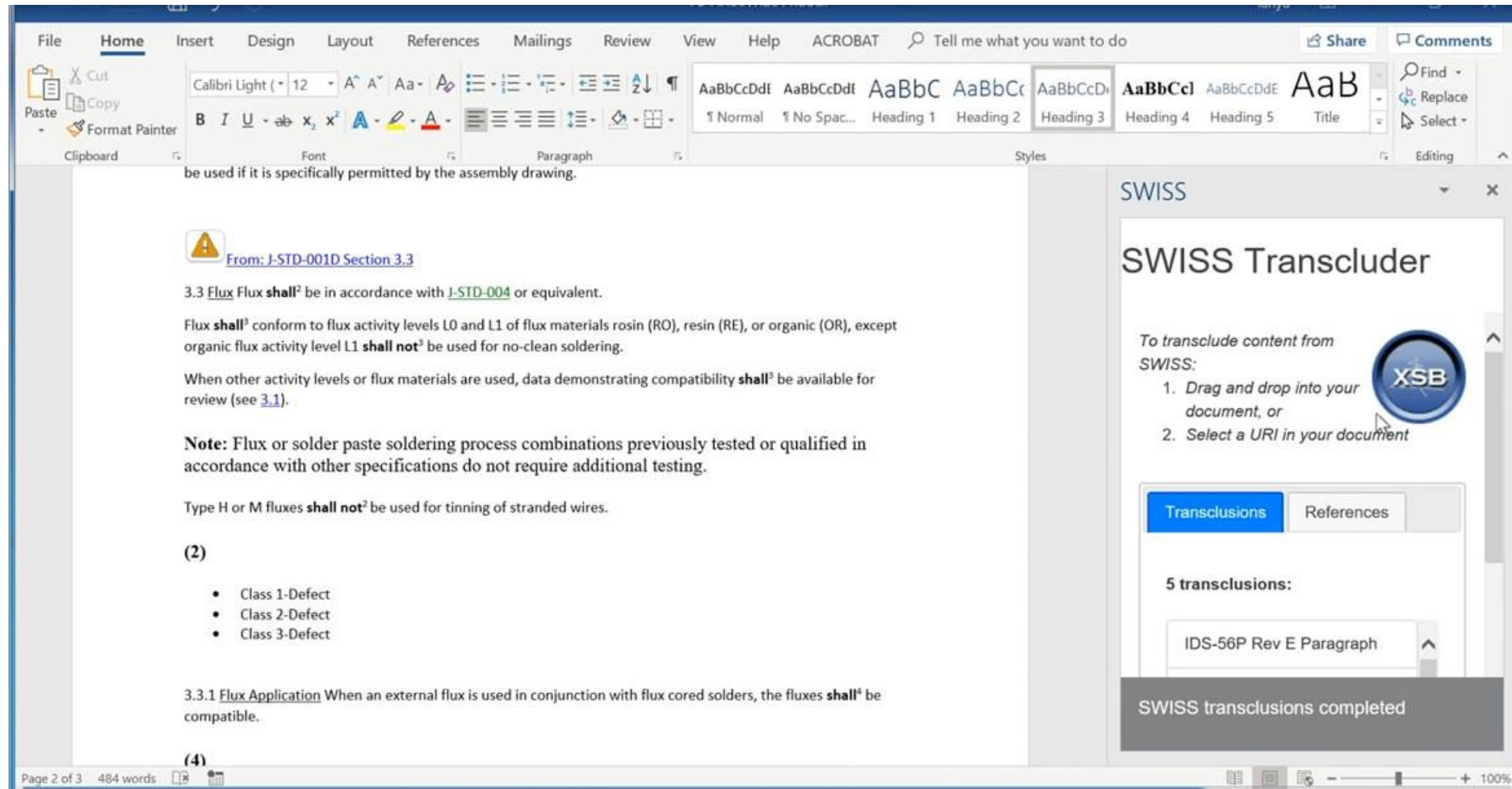
Let's make it smart!

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What does a smart document look like?

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What does a smart document look like?

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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.



What changed at the source?

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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.

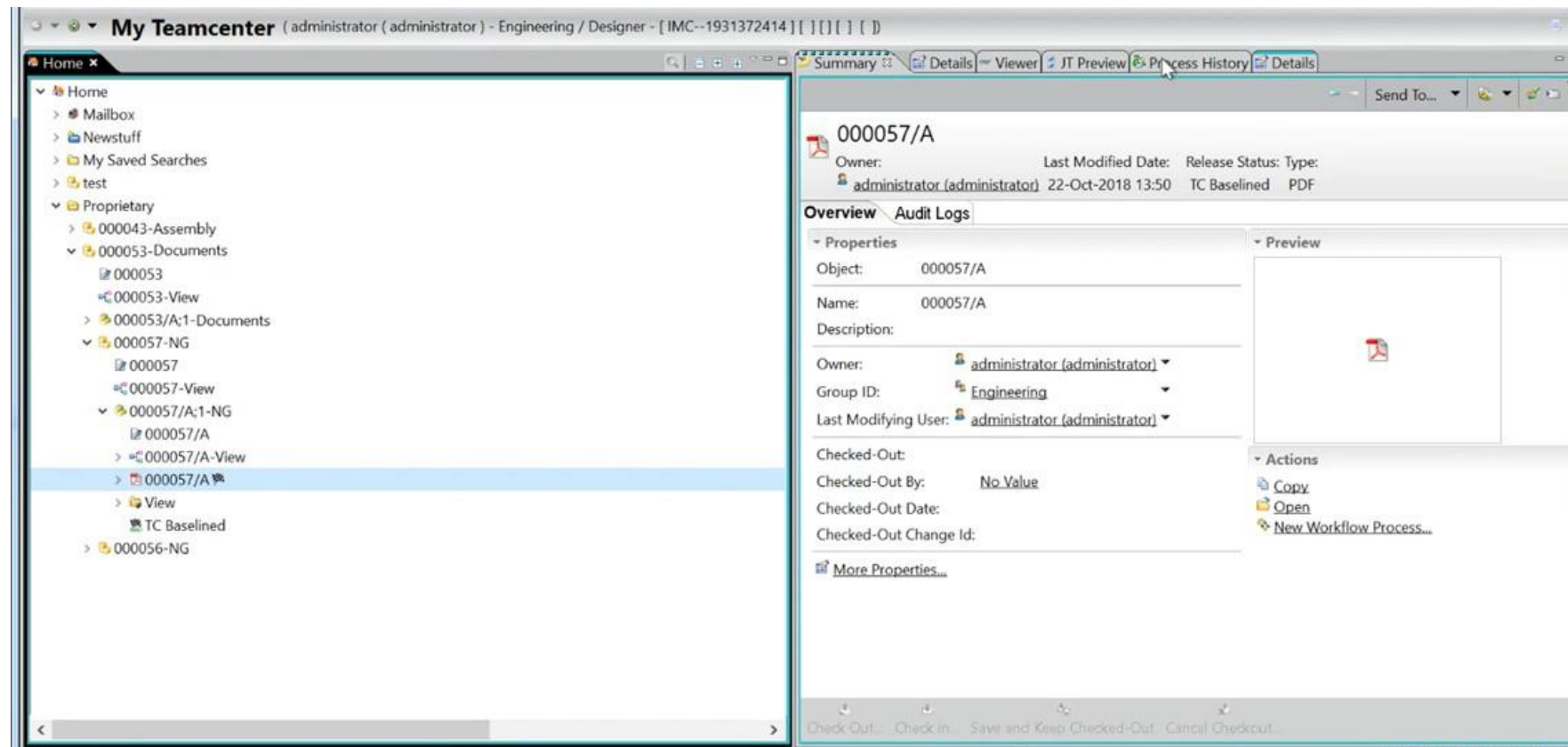
(4)

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

That is a Smart Document!

What if a document model was part of the Ecosystem?

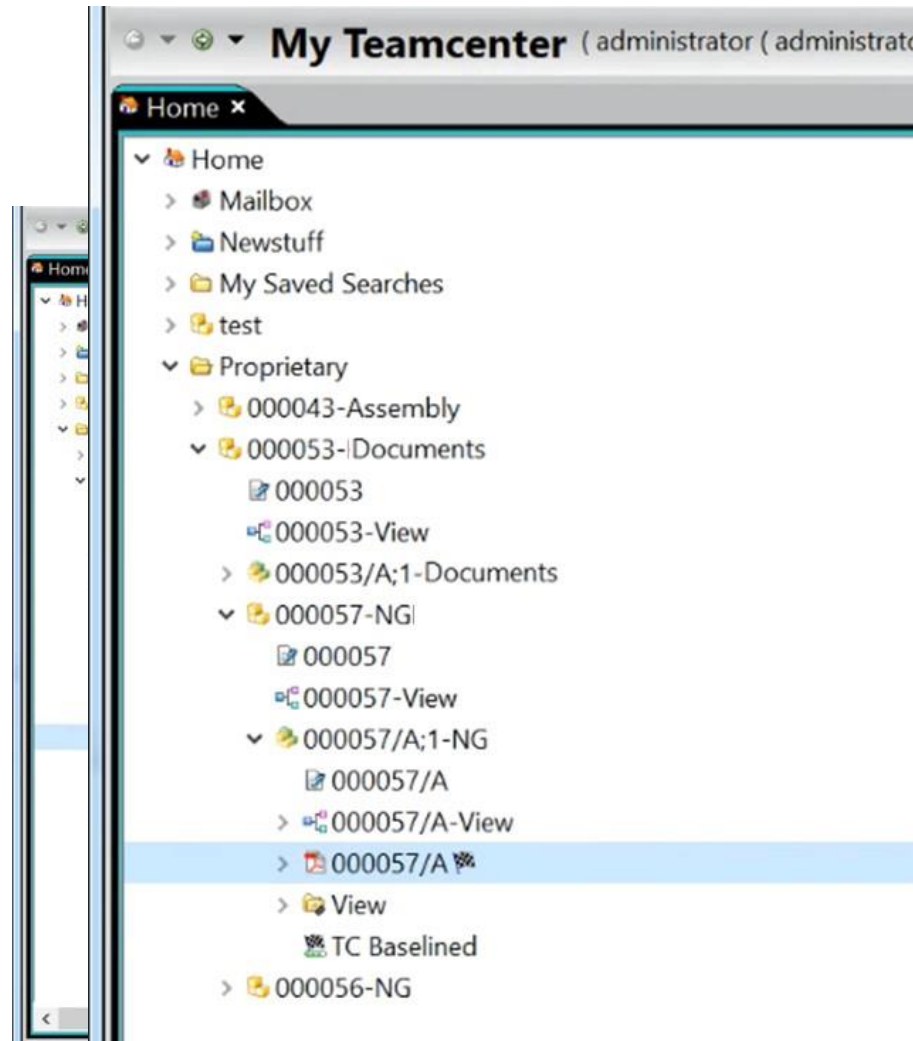
Engineering BOM
Manufacturing BOM
Bill Of Process
Product Structure



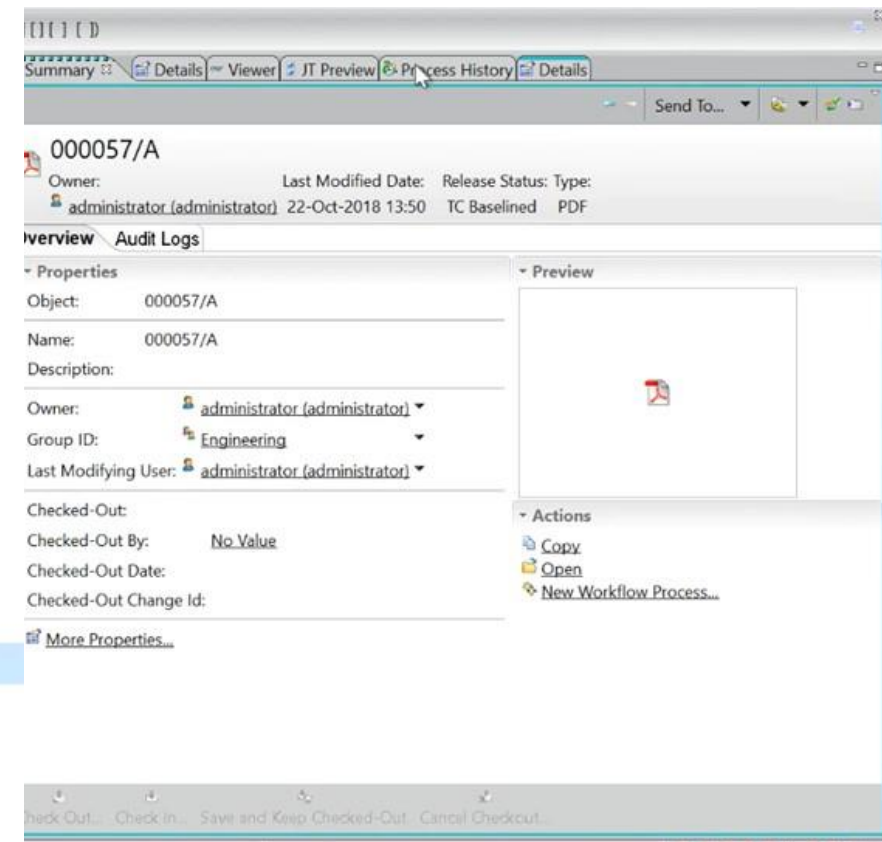
PLM representation

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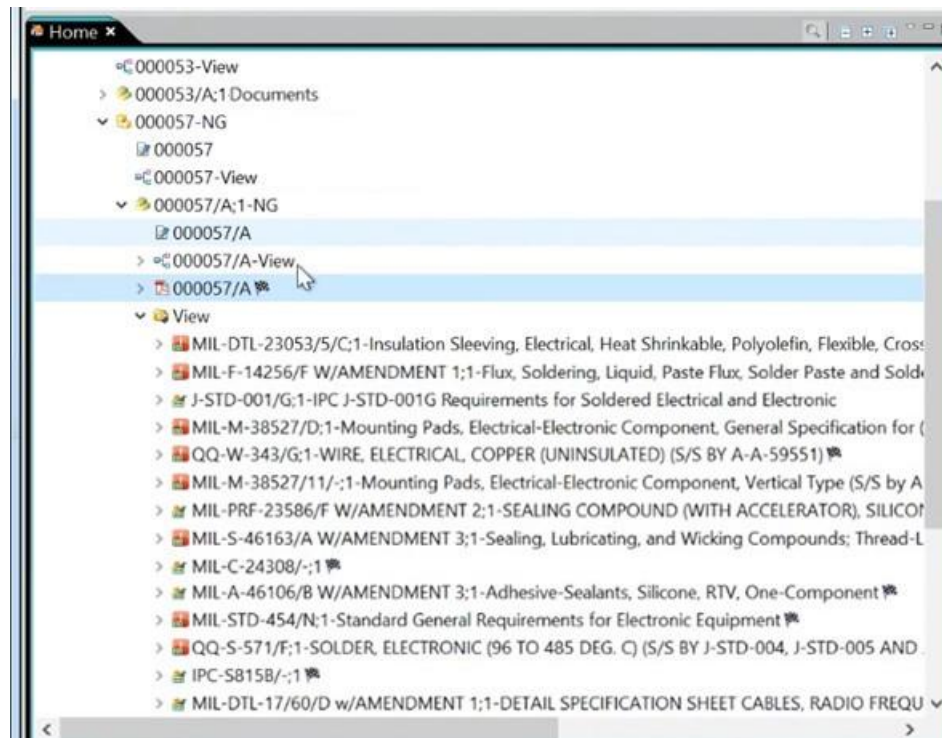
Engineering BOM
Manufacturing BOM
Bill Of Process
Product Structure



PLM expanded view

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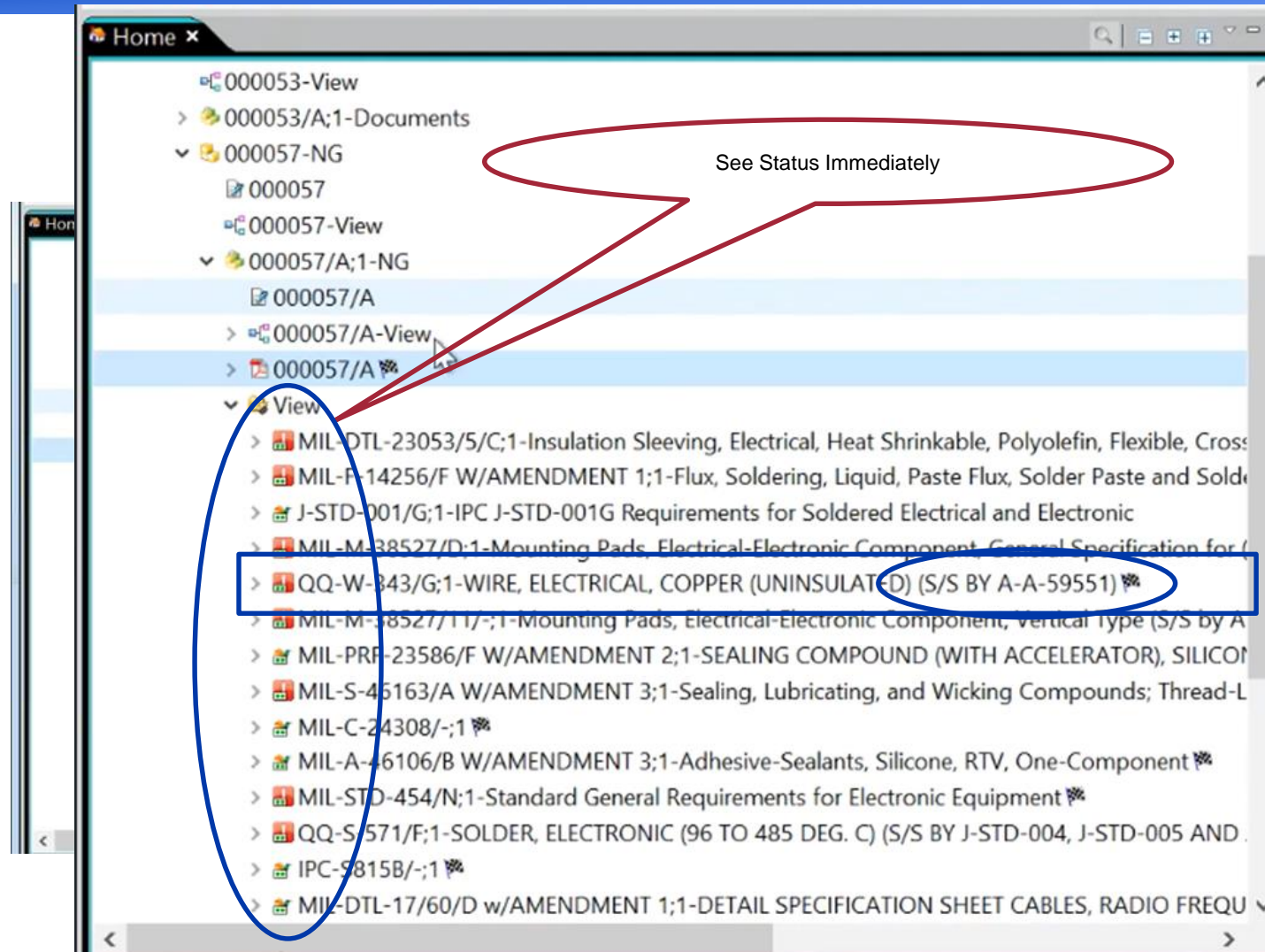
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PLM expanded view

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See the details

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The screenshot displays a software application window with a tabbed interface. The active tab is 'Details'. The main content area shows the following information:

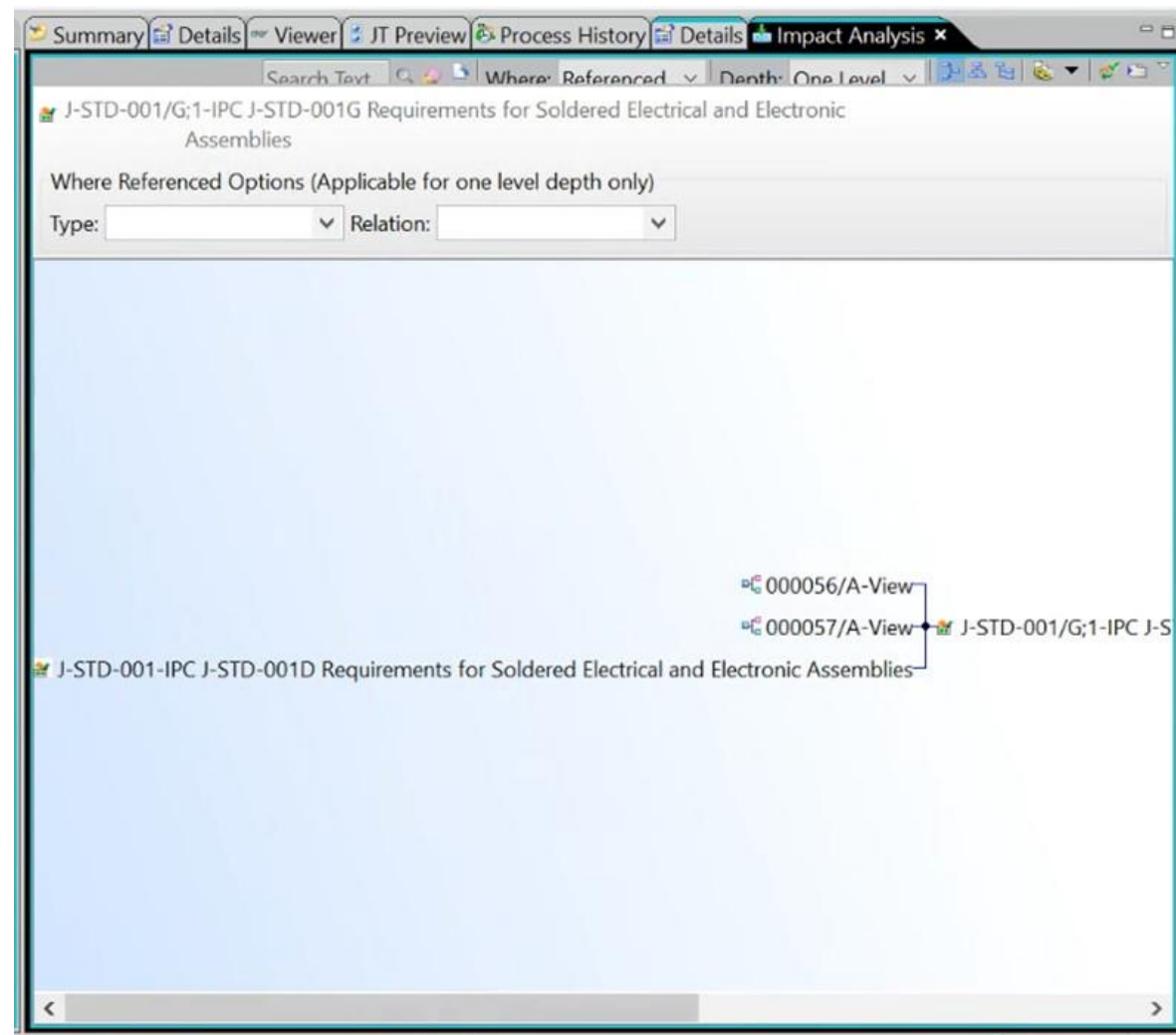
- Item Name:** QQ-W-343/G;1-WIRE, ELECTRICAL, COPPER (UNINSULATED) (S/S BY A-A-59551)
- Owner:** administrator (administrator)
- Last Modified Date:** 22-Oct-2018 13:51
- Release Status:** CANCELLED
- Type:** Swiss Link Revision

Below this, there are tabs for 'Overview', 'Related Datasets', 'Available Revisions', and 'Audit Logs'. The 'Overview' tab is selected, showing 'Item Revision Properties'.

The 'Item Revision Properties' section includes the following details:

- Description:**
- Item:** QQ-W-343-WIRE, ELECTRICAL, COPPER (UNINSULATED) (S/S BY A-A-59551)
- Release Status:** CANCELLED
- Date Released:** 17-Apr-1997 20:00
- Effectivity:** CANCELLED 17-Apr-1997 20:00 to UP (NONE)
- URL:** http://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=50957
- Latest:** Y
- Owner:** administrator (administrator)
- Group ID:** Engineering
- Last Modifying User:** administrator (administrator)
- Checked-Out:**
- Checked-Out By:** No Value
- More Properties...**

On the right side of the 'Overview' tab, there is a 'Preview' section and an 'Actions' menu with options: Copy, Revise..., New Workfl..., and Save As.



Benefits of documents a models

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Benefits of documents a models

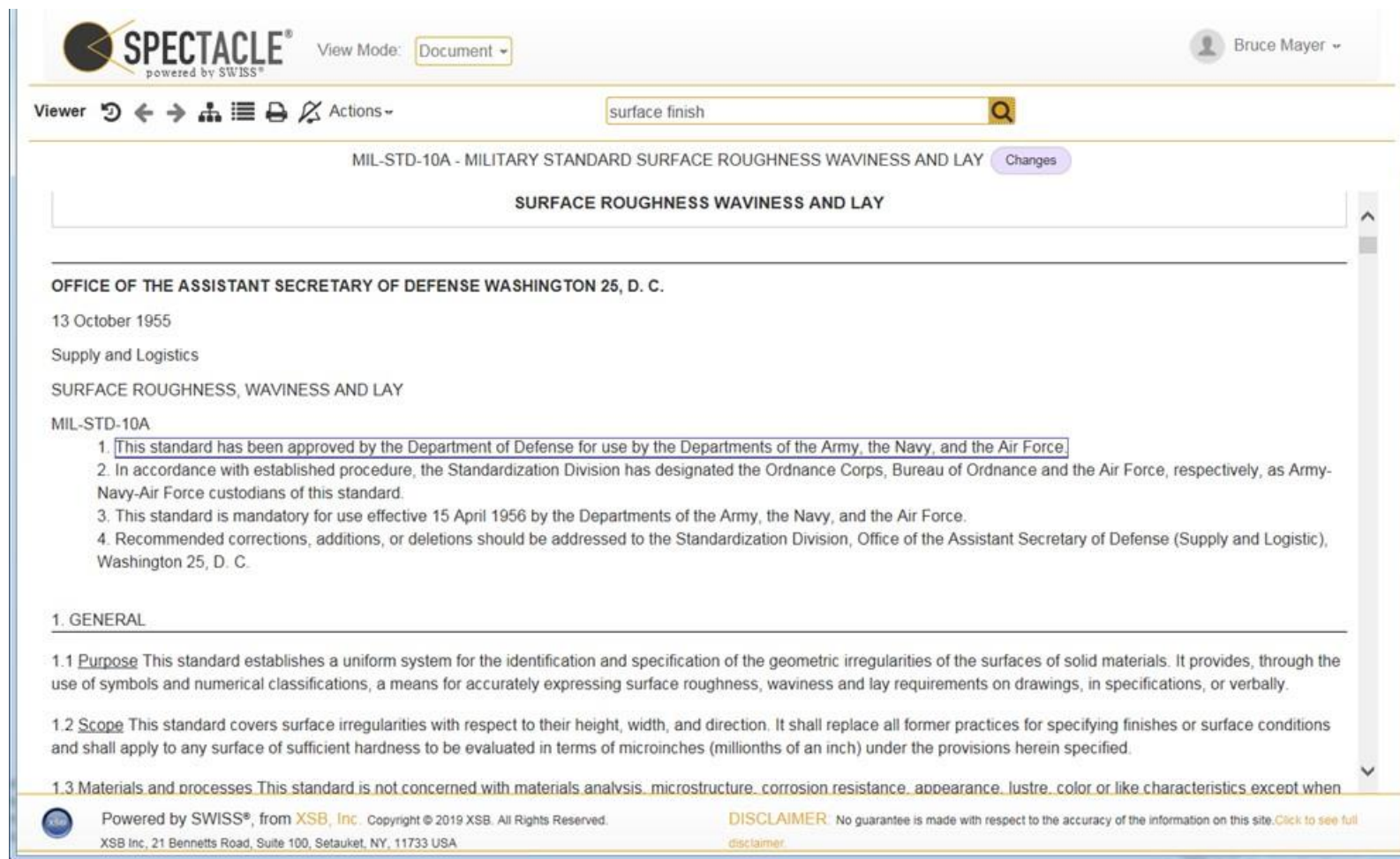
But wait, there's more?

Augmented reality

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The screenshot displays the SPECTACLE web application interface. At the top, the SPECTACLE logo is visible, along with a 'View Mode' dropdown set to 'Document' and a user profile for 'Bruce Mayer'. Below the header is a toolbar with various icons for document navigation and a search bar containing the text 'surface finish'. The main content area displays the title 'MIL-STD-10A - MILITARY STANDARD SURFACE ROUGHNESS WAVINESS AND LAY' with a 'Changes' button. The document text includes the title 'SURFACE ROUGHNESS WAVINESS AND LAY', the issuing office 'OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE WASHINGTON 25, D. C.', the date '13 October 1955', and the subject 'Supply and Logistics'. The standard itself is titled 'SURFACE ROUGHNESS, WAVINESS AND LAY' and 'MIL-STD-10A'. The first section, '1. GENERAL', contains three subsections: '1.1 Purpose' which states the standard establishes a uniform system for identifying and specifying geometric irregularities; '1.2 Scope' which states the standard covers surface irregularities with respect to height, width, and direction; and '1.3 Materials and processes' which states the standard is not concerned with materials analysis, microstructure, corrosion resistance, appearance, lustre, color or like characteristics except when... The footer of the application includes a copyright notice for XSB Inc. (2019) and a disclaimer stating that no guarantee is made with respect to the accuracy of the information on the site.

SPECTACLE
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View Mode: Document

Bruce Mayer

Viewer Actions ~

surface finish

MIL-STD-10A - MILITARY STANDARD SURFACE ROUGHNESS WAVINESS AND LAY [Changes](#)

SURFACE ROUGHNESS WAVINESS AND LAY

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE WASHINGTON 25, D. C.

13 October 1955

Supply and Logistics

SURFACE ROUGHNESS, WAVINESS AND LAY

MIL-STD-10A

1. This standard has been approved by the Department of Defense for use by the Departments of the Army, the Navy, and the Air Force.
2. In accordance with established procedure, the Standardization Division has designated the Ordnance Corps, Bureau of Ordnance and the Air Force, respectively, as Army-Navy-Air Force custodians of this standard.
3. This standard is mandatory for use effective 15 April 1956 by the Departments of the Army, the Navy, and the Air Force.
4. Recommended corrections, additions, or deletions should be addressed to the Standardization Division, Office of the Assistant Secretary of Defense (Supply and Logistic), Washington 25, D. C.

1. GENERAL

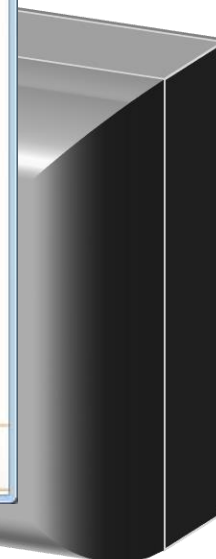
1.1 Purpose This standard establishes a uniform system for the identification and specification of the geometric irregularities of the surfaces of solid materials. It provides, through the use of symbols and numerical classifications, a means for accurately expressing surface roughness, waviness and lay requirements on drawings, in specifications, or verbally.

1.2 Scope This standard covers surface irregularities with respect to their height, width, and direction. It shall replace all former practices for specifying finishes or surface conditions and shall apply to any surface of sufficient hardness to be evaluated in terms of microinches (millionths of an inch) under the provisions herein specified.

1.3 Materials and processes This standard is not concerned with materials analysis, microstructure, corrosion resistance, appearance, lustre, color or like characteristics except when

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What about drawings?

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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

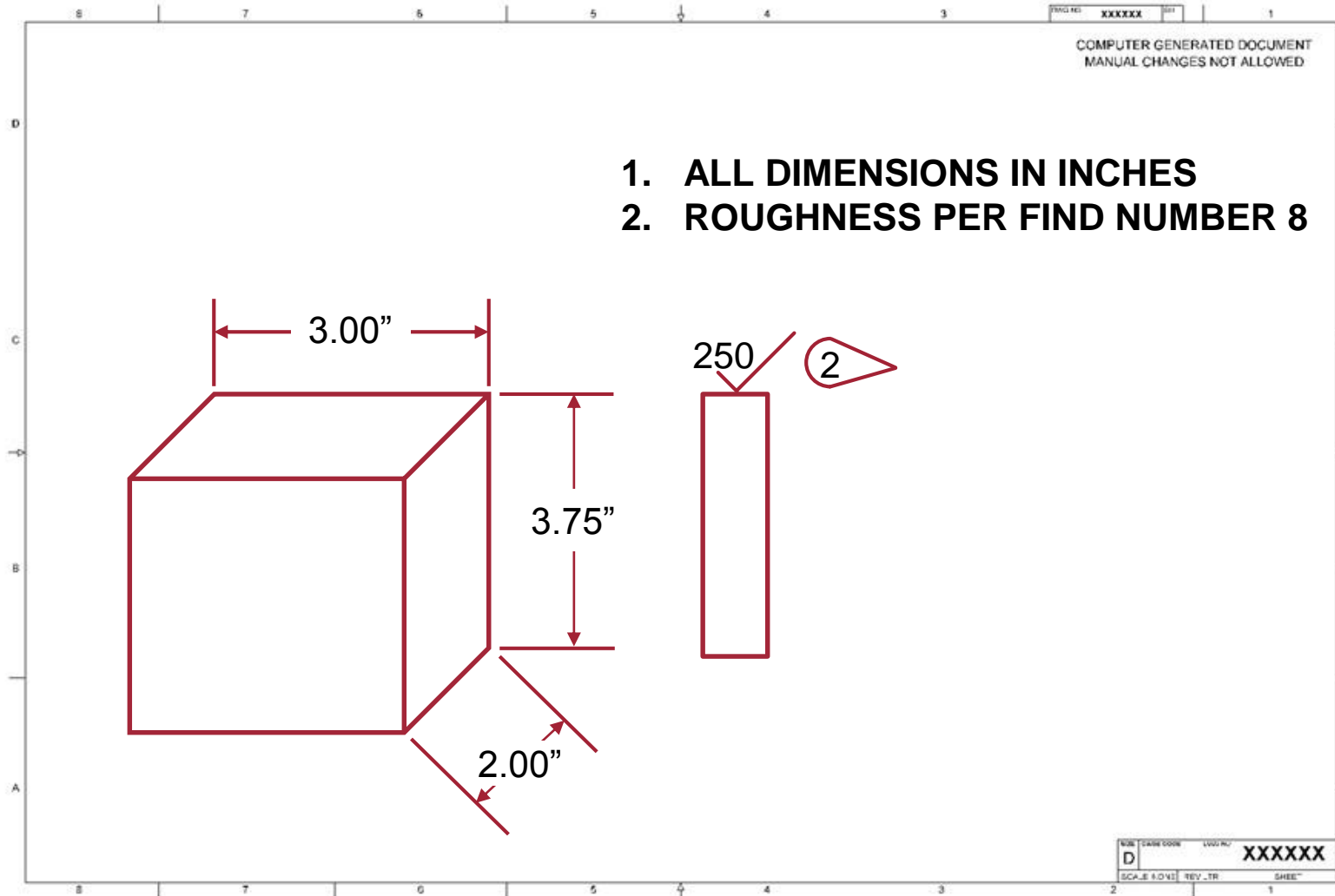
Roughness Height Rating	General Application of Roughness Height Ratings
1000 ✓	Very rough, low grade surface resulting from sand casting, torch or saw cutting, chipping or rough forgings. Machine operations are not required as appearance is not objectionable. This finish, rarely specified, is suitable 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

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NAME	DATE CODE	LOGIC	XXXXXX
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SCALE	REV	REV	TR

What about drawings?



What about CAD models?

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XXXXXXXX

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 loads, 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

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What is the Potential?

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- **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

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- **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**

Thank You

Contact information:

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Northrop Grumman

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