3DPDF
CONSORTIUM

Best Practices for Creating MIL-STD-31000A Technical Data Packages (TDP’) using (3D) PDF and STEP

Jerry McFeeters
Executive Director

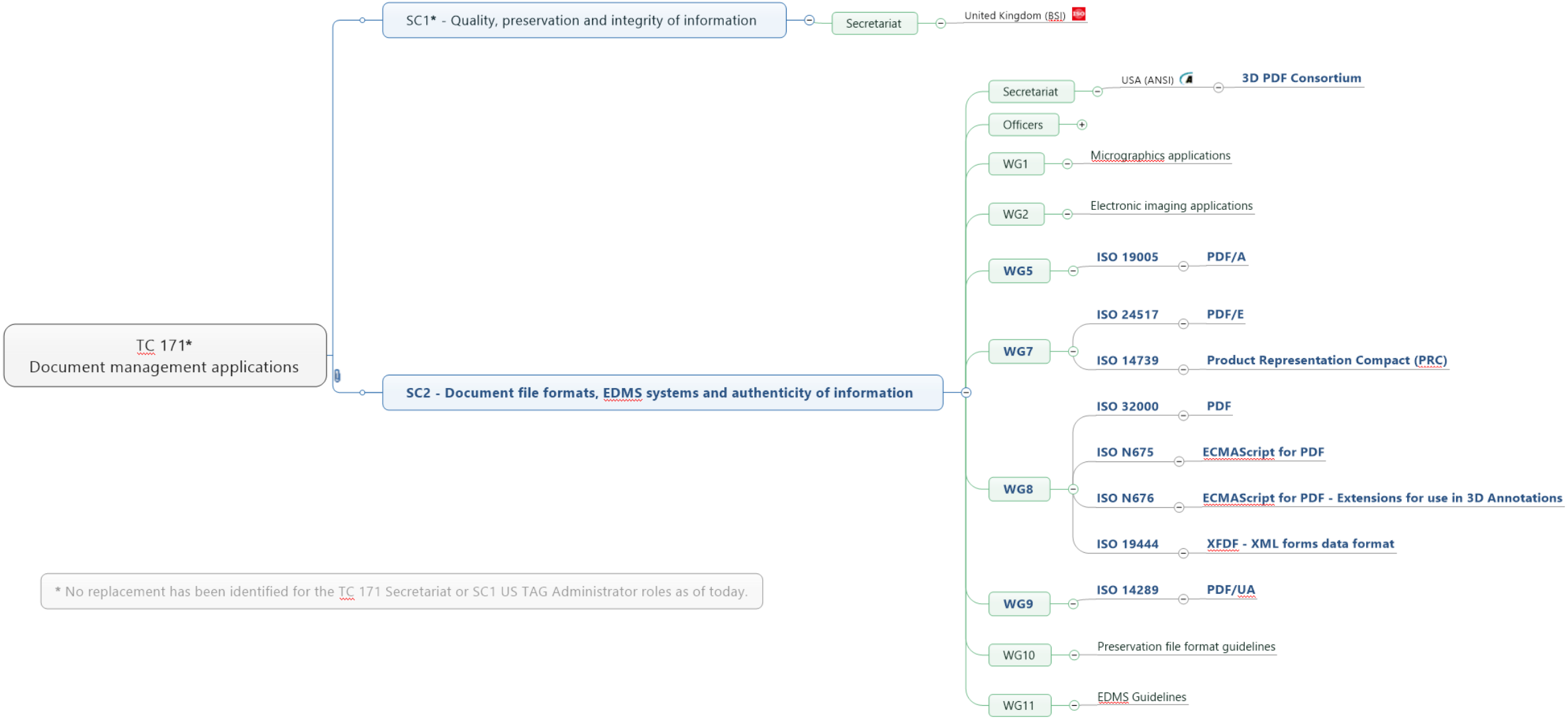
The 3D PDF Consortium

- A world wide community of organizations representing a broad cross-section of engineering domains.
- Our membership includes end user companies, software developers, consultants, government and educational organizations.
- We are a non-profit organization, passionately dedicated to 3D ubiquity and working together to make that happen

Standards

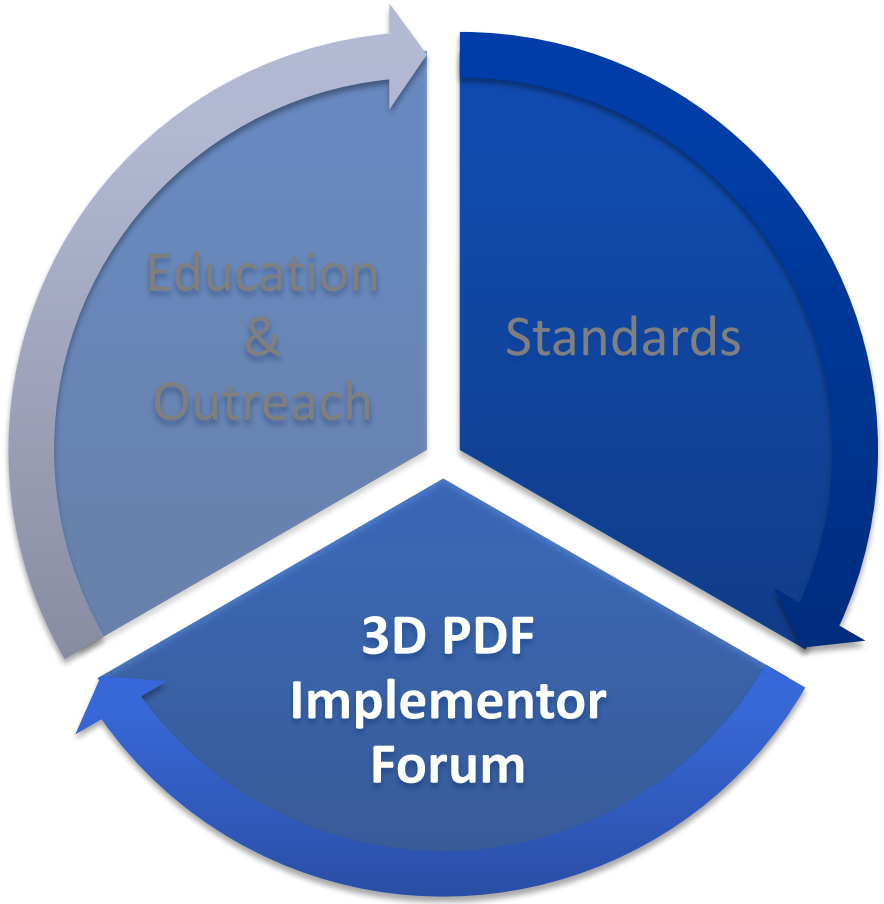
TC 171 SC 2
Secretariat and US TAG Administrator

- In Q4, 2016, the AIIM Board of Directors made the decision that AIIM would no longer be a standards developer.
- The 3D PDF Consortium has agreed to accept the responsibility for the ISO Secretariat and TAG Administrator for SC2.
- The 3D PDF Consortium, ANSI and AIIM are working towards a transition date of May 12, 2017



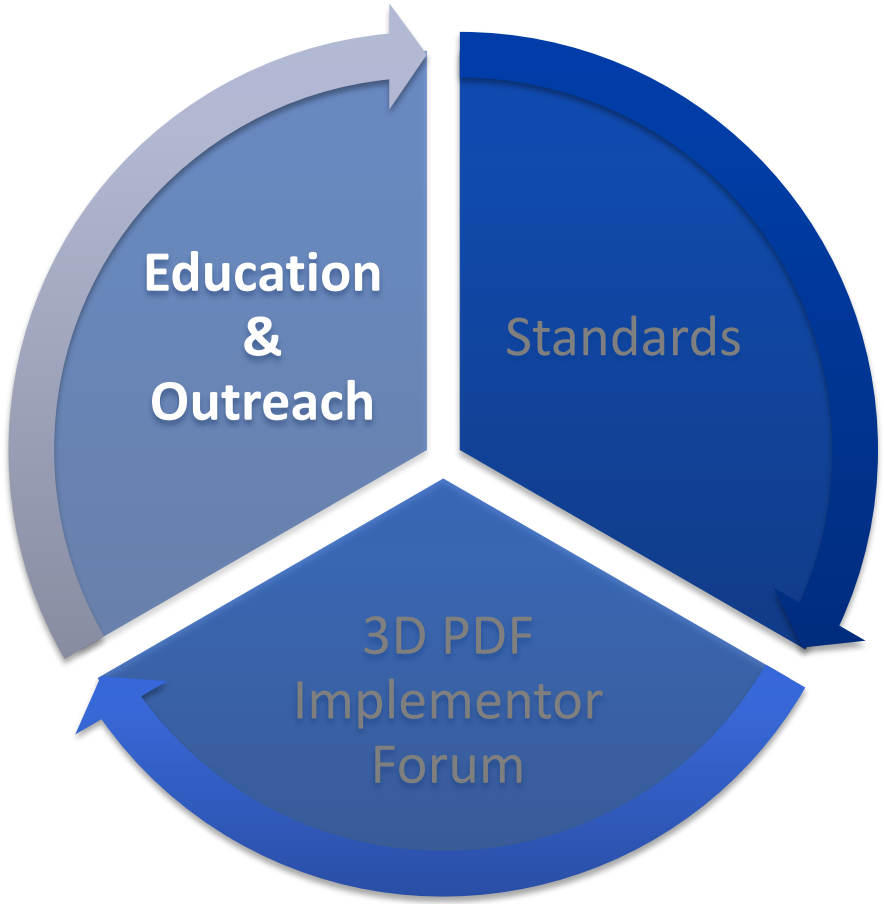
* No replacement has been identified for the TC 171 Secretariat or SC1 US TAG Administrator roles as of today.

3D PDF Implementor Forum (3DPDF-IF)



- Open to members of the 3D PDF Consortium
- Runs test rounds that are focused on creating engineering documents using PDF.
- Each participating company develops a PDF file that is validated to determine any deviations from the source CAD file
- Develops best practice documentation for any common issues that are found

Education Programs



- We develop and deliver webinars on subjects important to our membership:
  - 3D PDF
  - JavaScript for 3D PDF
- Exhibit and speak world wide at conferences focused on manufacturing market

Engineering Documentation Landscape - 2017

- 3D PDF currently published natively from:

Solid Edge

- 3D PDF Solutions available for most popular CAD programs
  - Autodesk AutoCAD®
  - CATIA
  - NX

The Idea

- A TDP Packaged as a 3D PDF

  MIL-STD-31000A used for TDP Guidelines

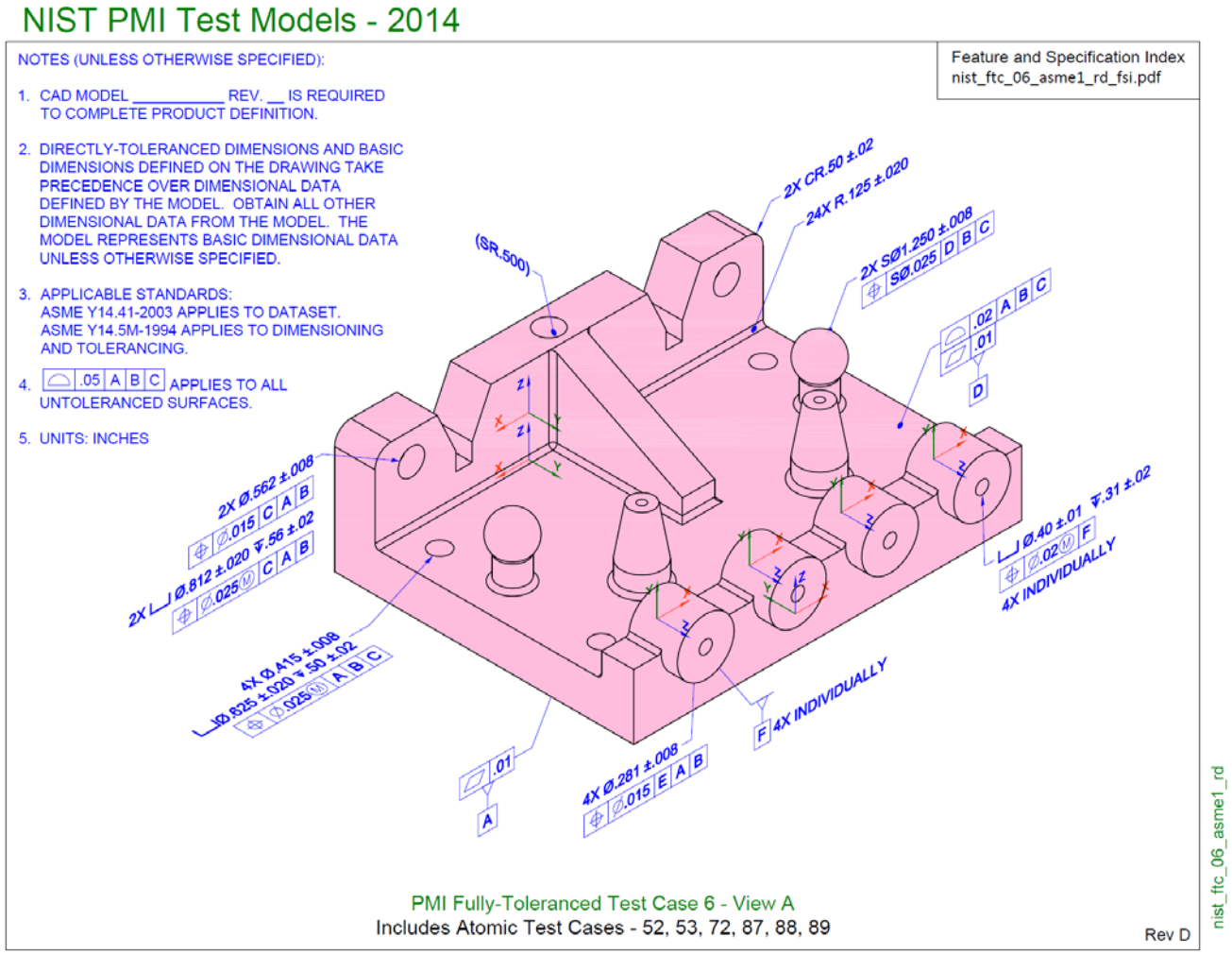
  Focused on best practices for implementing 3D PDF

  Translation/Validation included as well

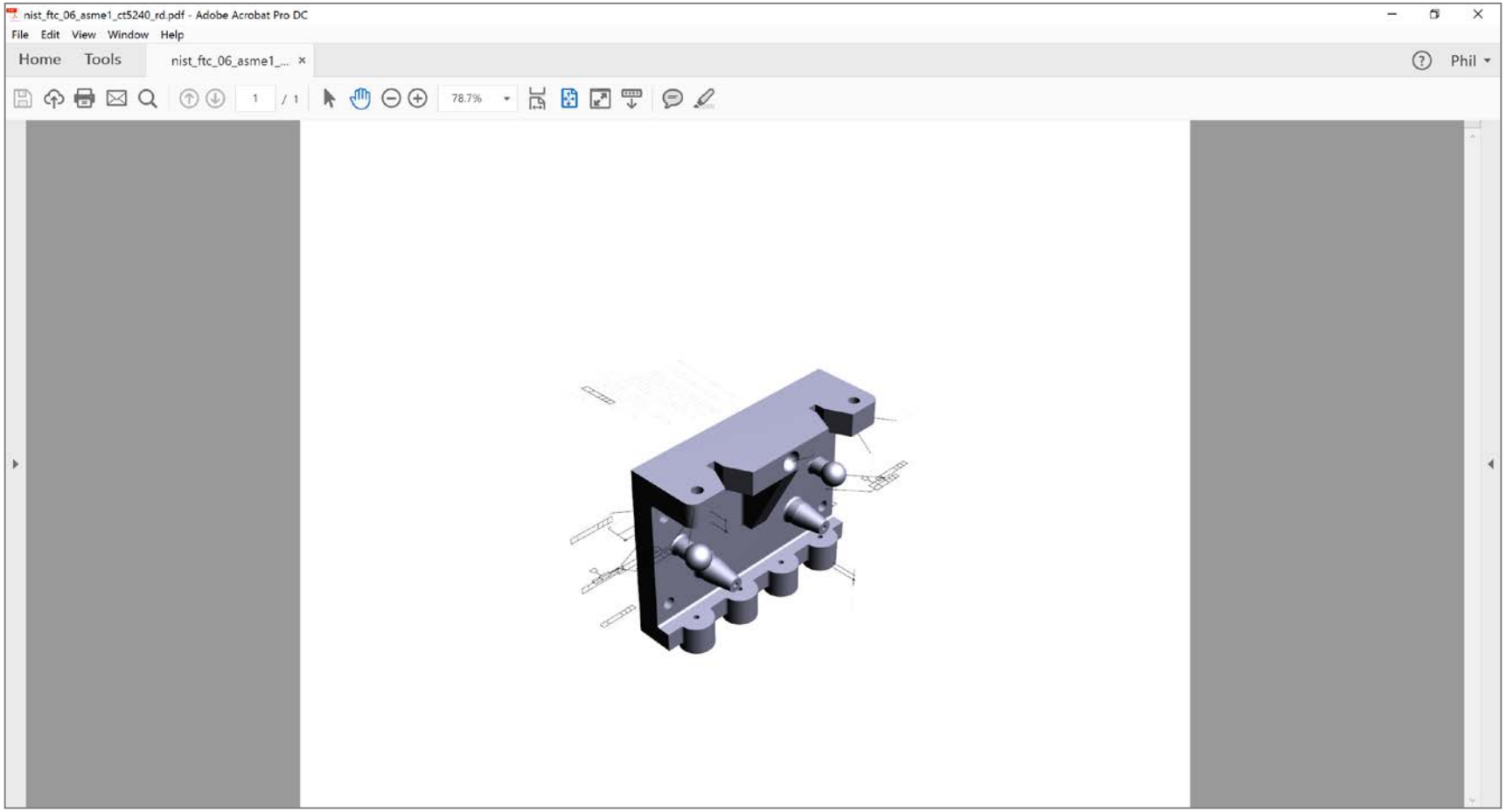
- Goal:

  To develop and document best practices for creating a TDP using the PDF and STEP file formats that conforms to MIL-STD-31000A

The 3D Model


NIST PMI Test Models - 2014
NOTES (UNLESS OTHERWISE SPECIFIED):
1. CAD MODEL _____ REV. __ IS REQUIRED TO COMPLETE PRODUCT DEFINITION.
2. DIRECTLY-TOLERANCED DIMENSIONS AND BASIC DIMENSIONS DEFINED ON THE DRAWING TAKE PRECEDENCE OVER DIMENSIONAL DATA DEFINED BY THE MODEL. OBTAIN ALL OTHER DIMENSIONAL DATA FROM THE MODEL. THE MODEL REPRESENTS BASIC DIMENSIONAL DATA UNLESS OTHERWISE SPECIFIED.
3. APPLICABLE STANDARDS:
ASME Y14.41-2003 APPLIES TO DATASET.
ASME Y14.5M-1994 APPLIES TO DIMENSIONING AND TOLERANCING.
4. .05 A B C APPLIES TO ALL UNTOLERANCED SURFACES.
5. UNITS: INCHES
Feature and Specification Index
nist_ftc_06_asme1_rd_fsi.pdf
(SR.500)
2X CR.50 ±.02
24X R.125 ±.020
2X SØ1.250 ±.008
SØ.025 D B C
.02 A B C
.01
D
2X Ø.562 ±.008
Ø.015 C A B
2X Ø.812 ±.020 ⧾.56 ±.02
Ø.025 M C A B
4X Ø.415 ±.008
Ø.825 ±.020 ⧾.50 ±.02
Ø.025 M A B C
.01
A
4X Ø.281 ±.008
Ø.015 E A B
F 4X INDIVIDUALLY
Ø.40 ±.01 ⧾.31 ±.02
Ø.02 M F
4X INDIVIDUALLY
PMI Fully-Toleranced Test Case 6 - View A
Includes Atomic Test Cases - 52, 53, 72, 87, 88, 89
Rev D
nist_ftc_06_asme1_rd

Visualization – 3D PDF (ISO 32000)

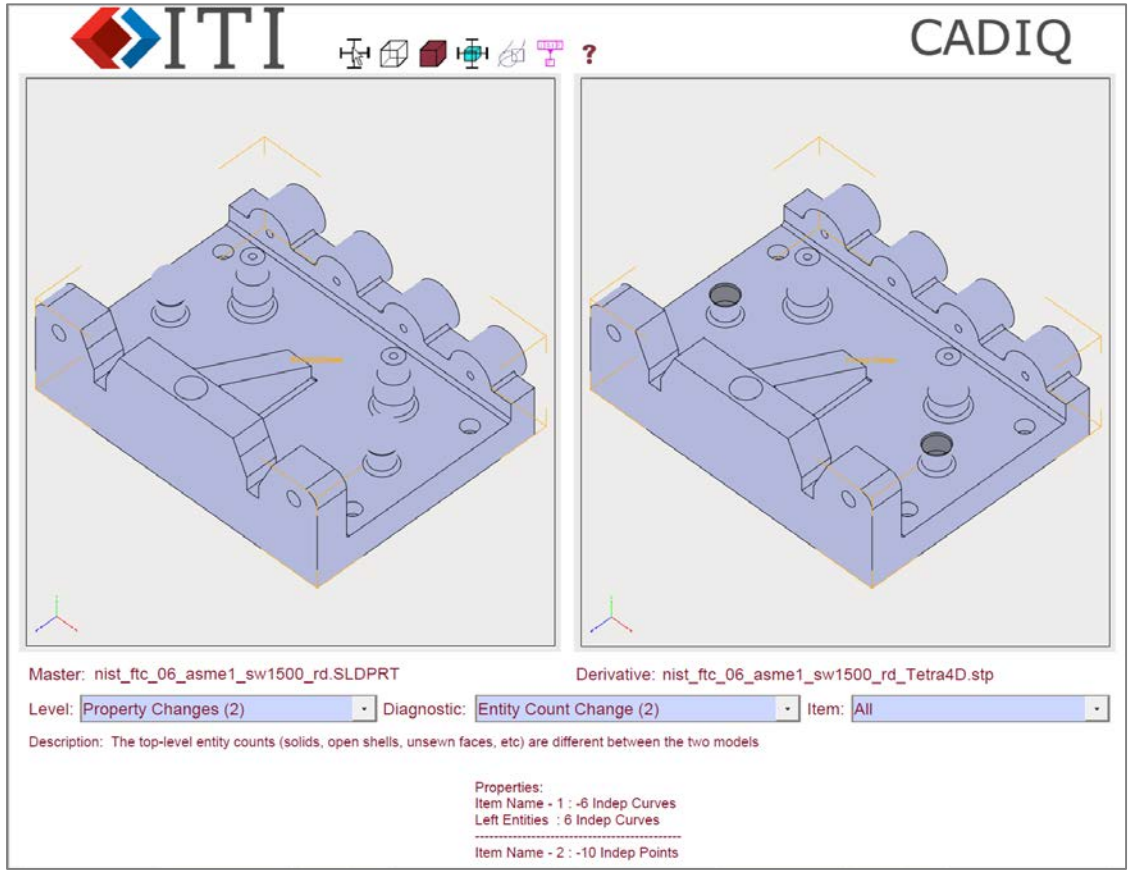


Geometry - STEP AP242 (ISO 10303-242)

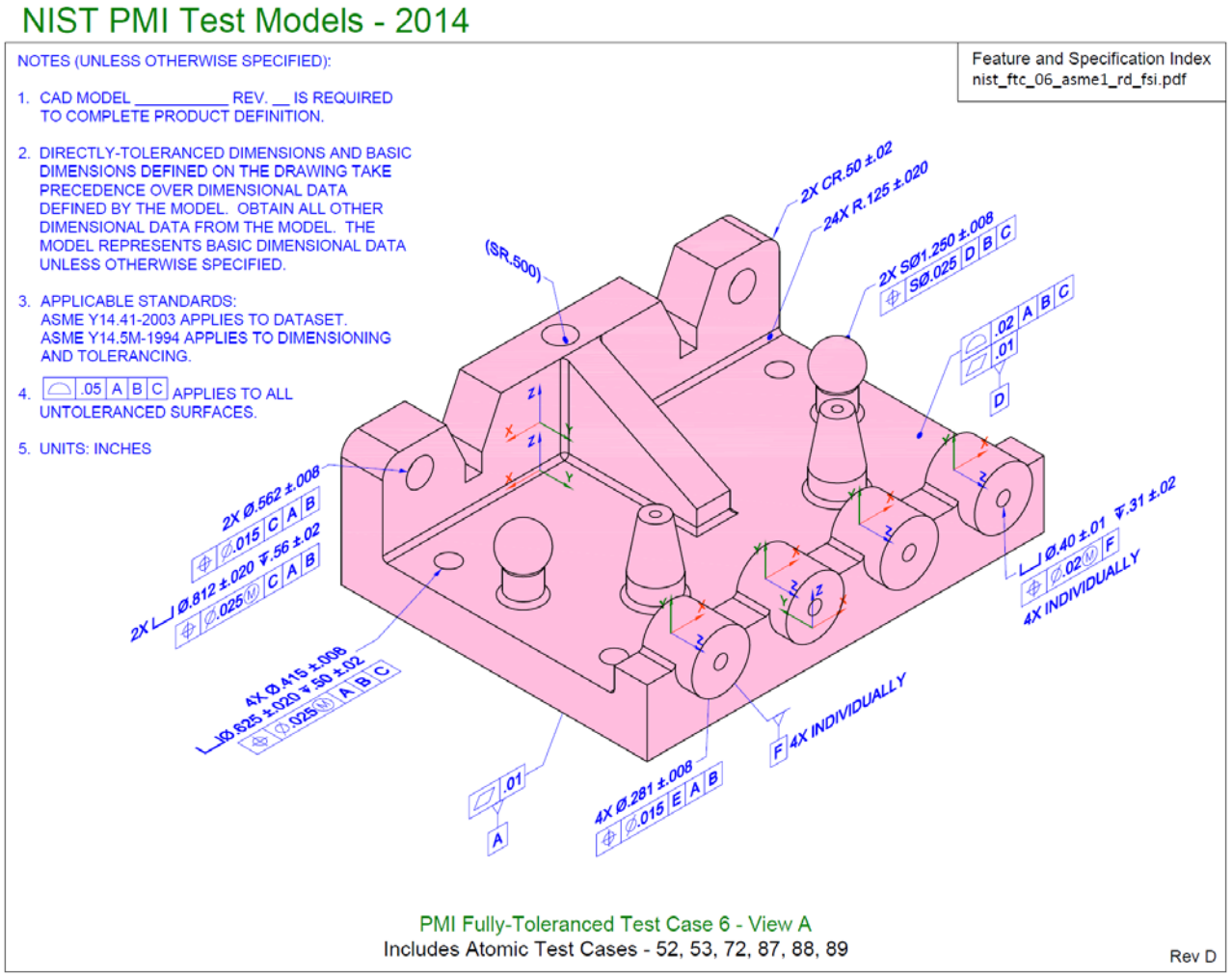
- Precise B-Rep
- PMI Representation
- PMI Graphic Presentation
- PMI Representation linked to Presentation
- Validation Properties
  - All participants providing STEP files for this test case were encouraged to include validation properties as far as supported; in particular for PMI presentation and representation.

Validation - ITI CADIQ

- Included validation reports for:
  - Native CAD File
  - PDF file
  - STEP File



2D Drawing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PMI Fully-Toleranced Test Case 6 - View A
Includes Atomic Test Cases - 52, 53, 72, 87, 88, 89
Rev D
nist_ftc_06_asme1_rd

The TDP Options Selection Sheet

MIL-STD-31000A

TDP OPTION SELECTION WORKSHEET

SYSTEM: DATE PREPARED:

A. CONTRACT NO.	B. EXHIBIT / ATTACHMENT NO.	C. CLIN	D. CDRL DATA ITEM NO(s)

1. TDP LIFECYCLE LEVEL (CHOOSE ONLY ONE PER WORKSHEET) Note: The level selected must coincide with the requirements of the elements selected in Block 5.

A. ☐ CONCEPTUAL LEVEL
☐ DEVELOPMENTAL LEVEL
☐ PRODUCTION LEVEL

B. REMARKS:

2. DELIVERABLE DATA PRODUCTS (X ALL THAT APPLY AND COMPLETE AS APPLICABLE)

TYPE	FORMAT
A. ☐ 2D DRAWINGS	☐ NATIVE CAD ☐ ISO 32000 PDF ☐ HARD COPY ☐ OTHER FORMAT (SPECIFY) _____
B. 3D MODELS: ☐ 3D Digital MODELS ONLY ☐ 3D Digital MODELS W/ ASSOCIATED 2D DRAWINGS	☐ NATIVE CAD (Specify level of annotation) _____ ☐ MODEL ORGANIZATION SCHEMA (Specify Appendix B or other) _____ ☐ NEUTRAL FORMAT (SPECIFY, e.g., ISO 10303 APxxx) _____ ☐ OTHER FORMAT (SPECIFY, E.G.,3D PDF, JT)_____
C. ☐ METADATA (Specify in Section 9)	☐ ASCII TEXT- PIPE DELIMITED ☐ ISO 10303 (SPECIFY, e.g., APxxx & DEX) _____ ☐ JEDMICS (DLF) ☐ OTHER FORMAT (SPECIFY) _____
D. ☐ ASSOCIATED LISTS (See Sect 7)	☐ NATIVE FORMAT ☐ ISO 32000 PDF ☐ HARDCOPY ☐ OTHER FORMAT (SPECIFY) _____
E. SUPPLEMENTAL ☐ TECHNICAL DATA (Specify in Section 9)	NATIVE _____ NEUTRAL (SPECIFY e.g., STEP AP238, 240, DEX, Other)_____ OTHER (SPECIFY e.g., PDF) _____

3. CAGE CODE & DOCUMENT NUMBERS	A. ☐ CONTRACTOR CAGE & DOCUMENT NUMBERS ☐ GOVERNMENT CAGE (COMPLETE 3B, 3C and 3D)	
B. USE CAGE CODE:	C. USE DOCUMENT NUMBERS:	D. TO BE ASSIGNED BY:

4. DRAWING FORMATS (X ONE AND COMPLETE AS APPLICABLE)

☐ CONTRACTOR FORMAT ☐ GOVERNMENT FORMAT
REMARKS: _____

5. TDP ELEMENTS AND ASSOCIATED DATA REQUIRED (X ALL THAT APPLY)

☐ CONCEPTUAL DESIGN DRAWINGS / MODELS
☐ DEVELOPMENTAL DESIGN DRAWINGS / MODELS AND ASSOCIATED LISTS
☐ PRODUCT DRAWINGS / MODELS AND ASSOCIATED LISTS
☐ SPECIAL INSPECTION EQUIPMENT (SIE) DRAWINGS, MODELS AND ASSOCIATED LISTS
☐ SPECIAL TOOLING (ST) DRAWINGS, MODELS AND ASSOCIATED LISTS
☐ SPECIAL PACKAGING INSTRUCTIONS (SPI) DRAWINGS, MODELS AND ASSOCIATED LISTS
☐ SPECIFICATIONS AND/OR STANDARDS (SPECIFY) _____
☐ SOFTWARE DOCUMENTATION (SPECIFY) _____
☐ QUALITY ASSURANCE PROVISIONS (QAP) (SPECIFY) _____
☐ METADATA (SPECIFY) _____
☐ SUPPLEMENTARY TECHNICAL DATA (SPECIFY) _____

MIL-STD-31000A

TDP OPTION SELECTION WORKSHEET

SYSTEM DATE PREPARED

ASME Y14.41.1 Digital Product Definition Data: Model Organization Schema Practices

ASME Y14.41.1-201?

Digital Product Definition Data: Model Organization Schema Practices

Engineering Drawing and Related Documentation Practices

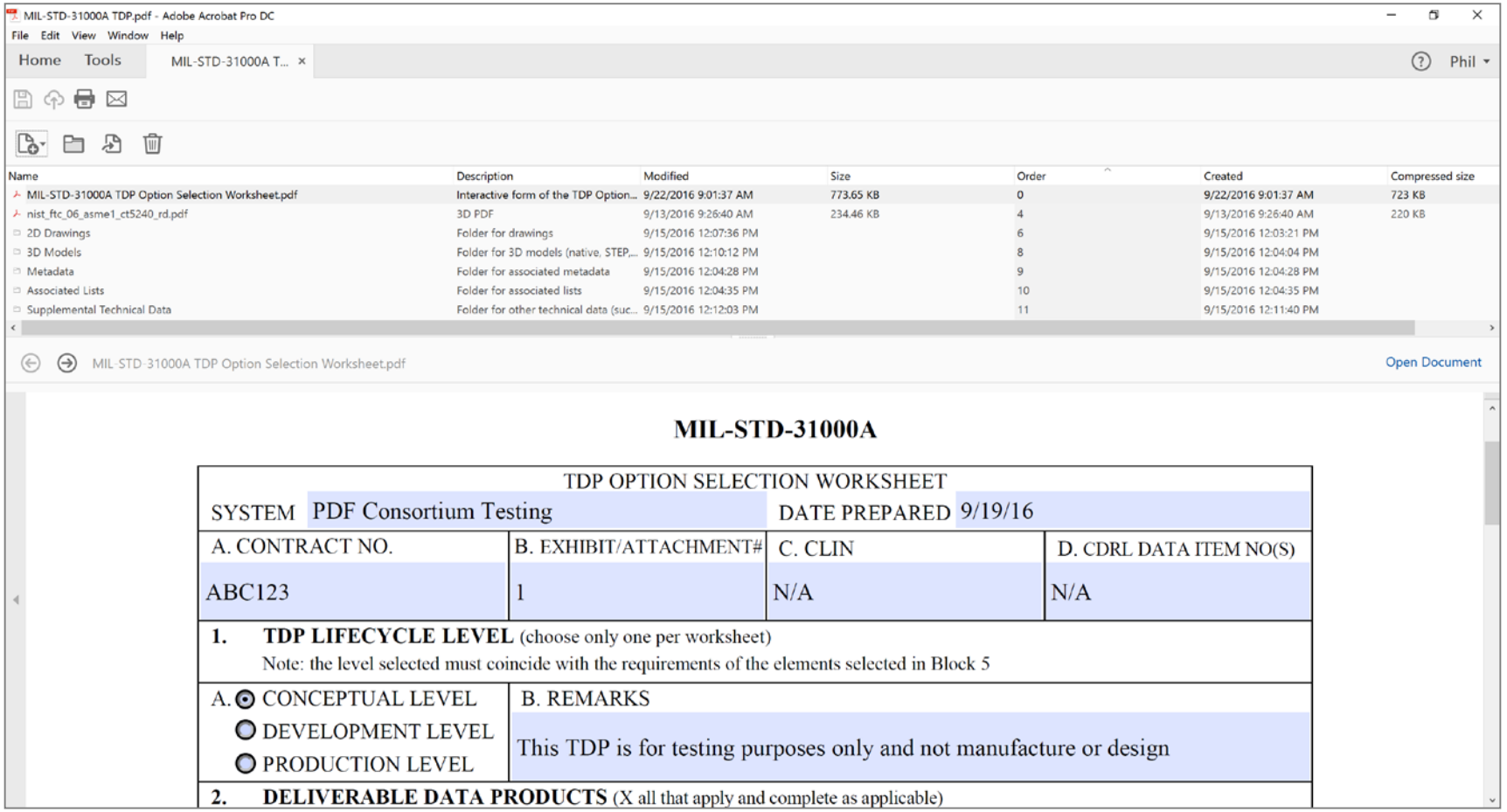
AN AMERICAN NATIONAL STANDARD

1

DRAFT

☐ QUALITY ASSURANCE PROVISIONS (QAP) (SPECIFY)
☐ METADATA (SPECIFY)
☐ SUPPLEMENTARY TECHNICAL DATA (SPECIFY)

Putting it all together

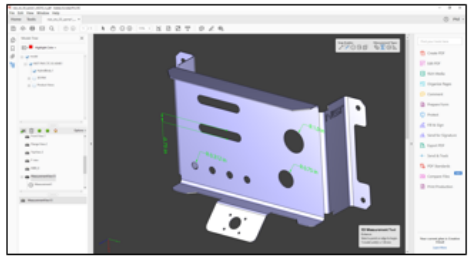
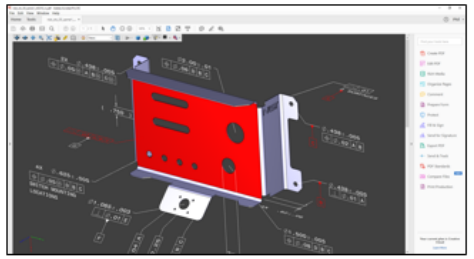
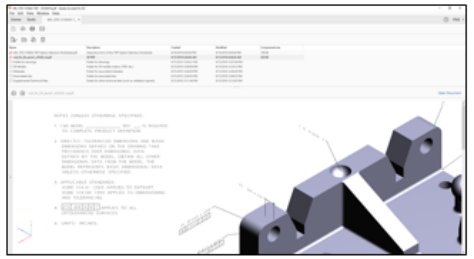


What did we learn?

- 3D PDF has unique features that make it an excellent format for TDP
  - Collections / Attachments
  - XFDF
  - JavaScript
- Best practices can help to standardize implementations. This in turn benefits processes such as validation

3D PDF TDP – Best Practices

- Use Adobe Acrobat DC or Adobe Acrobat Reader DC

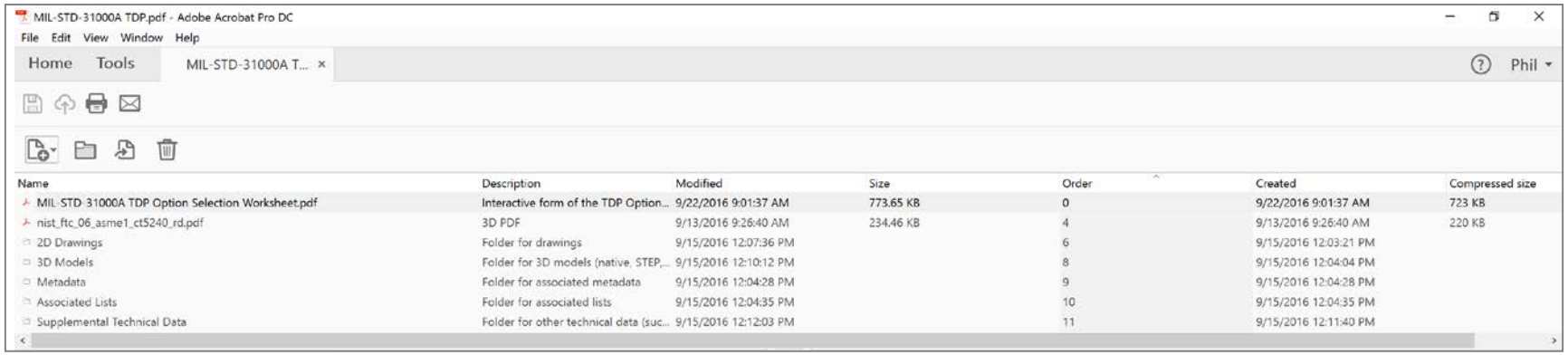
Version	Feature	Example
Adobe Reader X	Commenting and measuring enabled by default	
Adobe Reader XI	JavaScript API for face highlighting (enabling associative PMI)	
Adobe Acrobat Reader DC	Flash requirement removed for PDF portfolios	

3D PDF TDP – Best Practices

- Use The Best Standards for 3D
  - ISO 32000 (PDF)
  - ISO 14739 (PRC)
  - ECMA-363, 3rd Edition (U3D)
- Plan for New Revisions of Standards
  - ISO 32000:2 (PDF)
    - Adds support for PRC
  - ISO 24517:2 (PDF/E)
    - Current version good for documents and drawings, but does not allow JavaScript or PRC.
    - Version 2 (under development) is intended for archiving and will add support for both

3D PDF TDP – Best Practices

- Add Structure Using Portfolios and Attachments
  - Make sure all attachments have a description
  - Use folders to logically organize attachments
  - Use hyperlinks to easily open attachments from inside the portfolio



3D PDF TDP – Best Practices

- Attach CAD and/or STEP file
  - While PRC can represent precise geometry, very few programs can read this data from a PDF file
  - Workflows that require a precise CAD model, such as CAM, should attach a neutral STEP file and/or native CAD file

3D PDF TDP – Best Practices

- Use JavaScript to support ANSI Y14.41
  - The Adobe Acrobat Reader does not support some of the behaviors necessary to be compliant with CAD standards such as ASME Y14.41, “Digital Product Definition Data Practices.” In most cases, it is possible to add required behaviors to a 3D PDF file using the Adobe *JavaScript for Acrobat 3D Annotations* interface. For example, even though the Adobe Acrobat reader does not support the visual response requirements of ASME Y14.41, it is possible to satisfy the requirements by attaching custom JavaScript to a 3D annotation when creating a PDF file.

3D PDF TDP – Best Practices

- Ensure Your Document Is Portable
  - Poster Images
  - Watermarks
  - Embedded Fonts
  - Compression
  - Security

What’s next

- Explore ways to more tightly integrate 3D PDF with STEP and other open format
  - Test Round 3 – 2017
- Continue to drive standards to meet industry needs
  - PDF:3
  - PRC:2
  - ECMAScript for PDF
  - 3D XFDF

Find Out More!

- Visit a 3D PDF Consortium member website:

Click on a logo

- Contact
  - jerry.mcfeeters@3dpdfconsortium.org
  - (513) 235-4678