Best Practices for Creating Technical Data Packages (TDP) using 3D PDF and STEP AP242

3D PDF Consortium

Jerry McFeeters — Executive Director

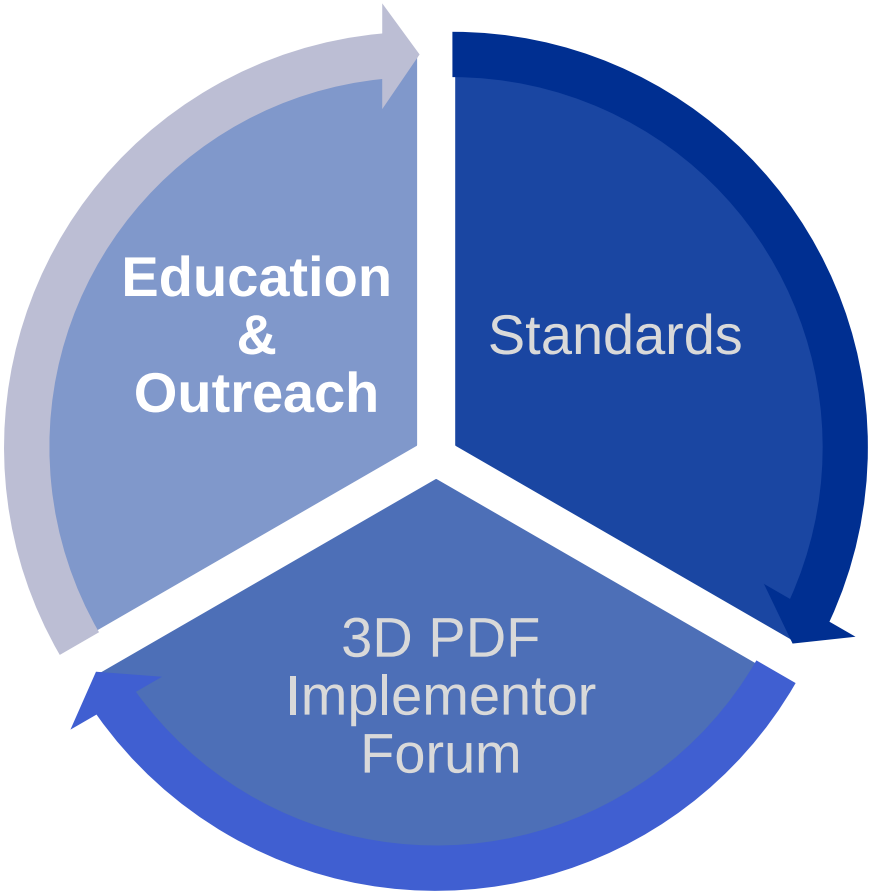
Phil Spreier — Technical Director

The 3D PDF Consortium

Global Product Data Interoperability Summit | **2016**

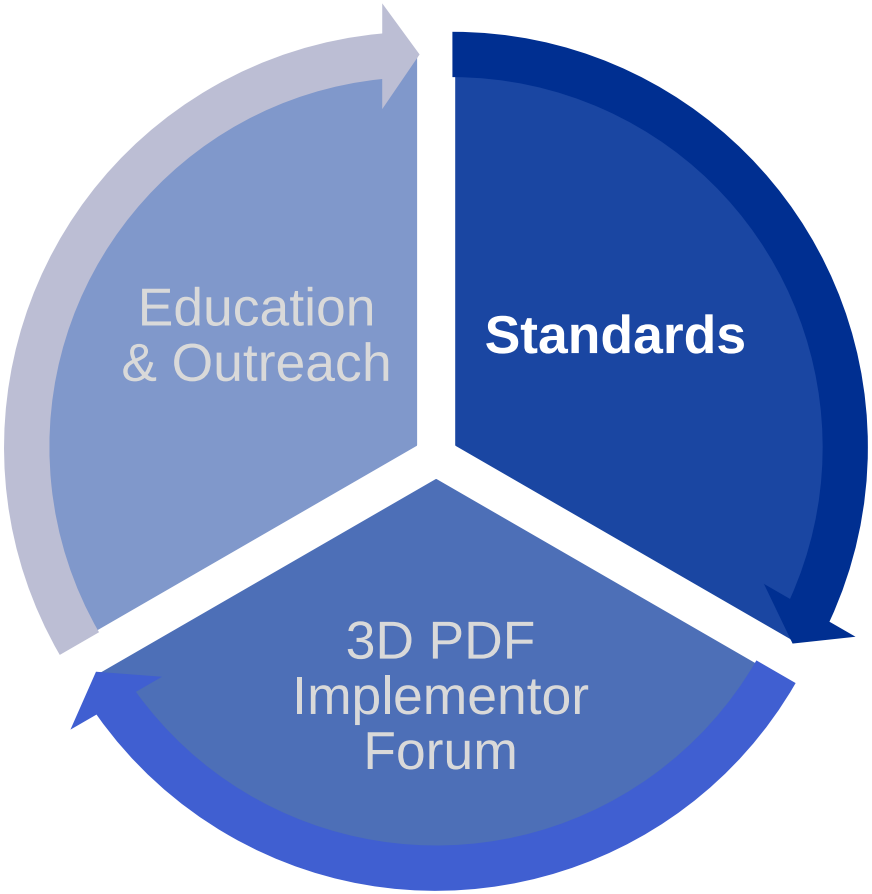
- A world wide community of organizations representing a broad cross-section of engineering domains.
- Our membership includes end user companies, software developers, consultants, government and educational organizations.
- We are a non-profit organization, passionately dedicated to 3D ubiquity and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

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**

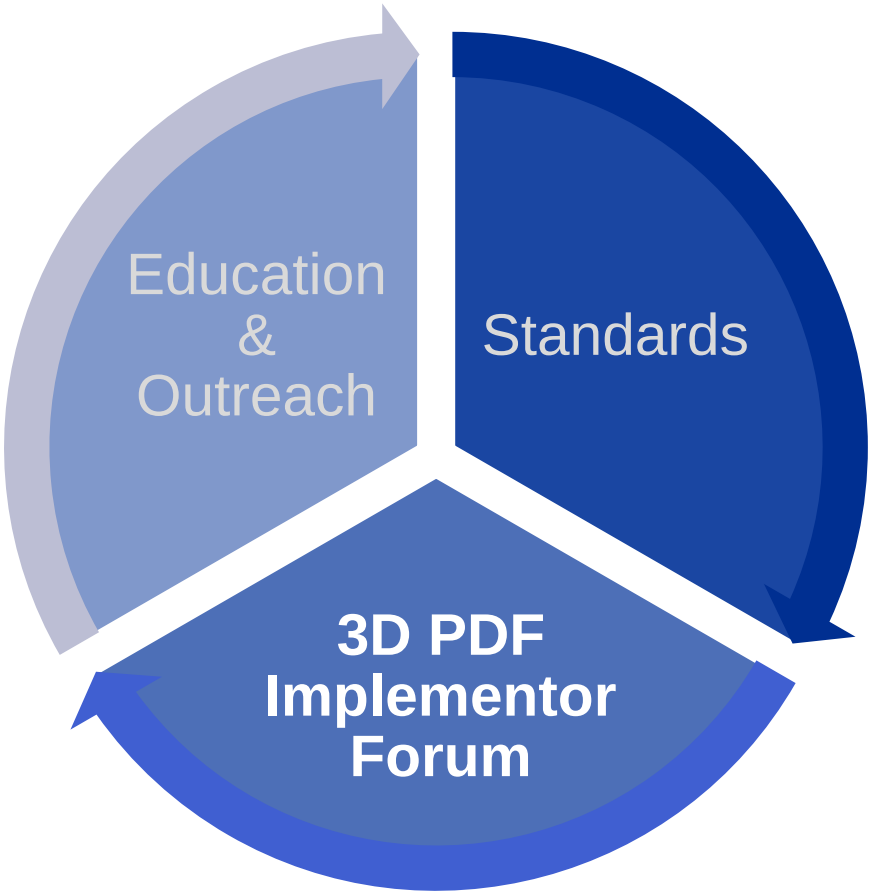
Standards



- **Actively participate in standards development for:**
  - **ISO 32000 (PDF)**
  - **ISO 24517 (PDF/E)**
  - **ISO 14739 (PRC)**

3D PDF Implementor Forum (3DPDF-IF)

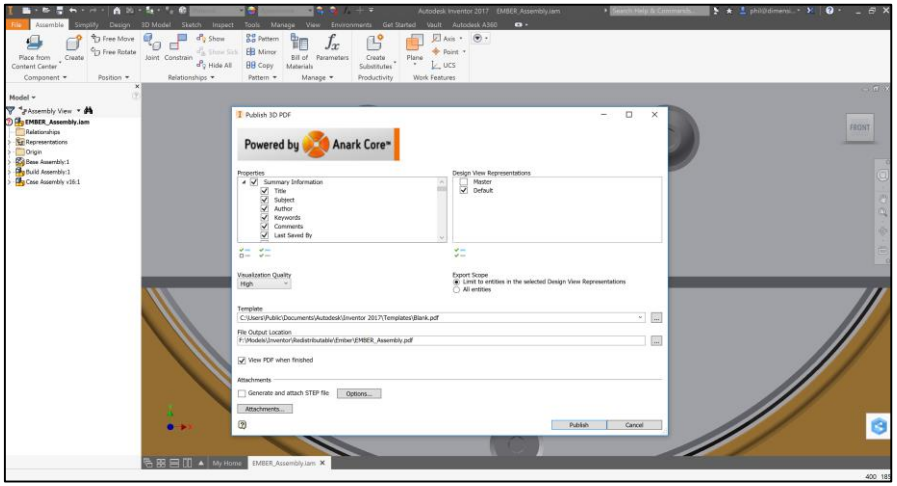
Global Product Data Interoperability Summit | **2016**



- **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**

Engineering Documentation Landscape - 2016

- **3D PDF currently published from:**
  - **SolidWorks MBD**
  - **Solid Edge**
  - **PTC Creo**
  - **Autodesk Inventor**



- **Adobe increased support for 3D printing**
  - **Partnered with Stratasys**

The Idea – MIL-STD-31000A

- **Reimagined the 3D PDF Implementor Forum**
- **Focus on best practices for implementing 3D PDF, rather than on translating**
- **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 Team

> Unity is strength... when there is teamwork and collaboration, wonderful things can be achieved.

Mattie Stepanek

The Team

3D PDF Implementor Forum

PROSTEP

Theorem Solutions

ITI
International TechneGroup

BOEING

TETRA 4D

datakit

TECH SOFT 3D
Dependable. Dynamic. Durable.

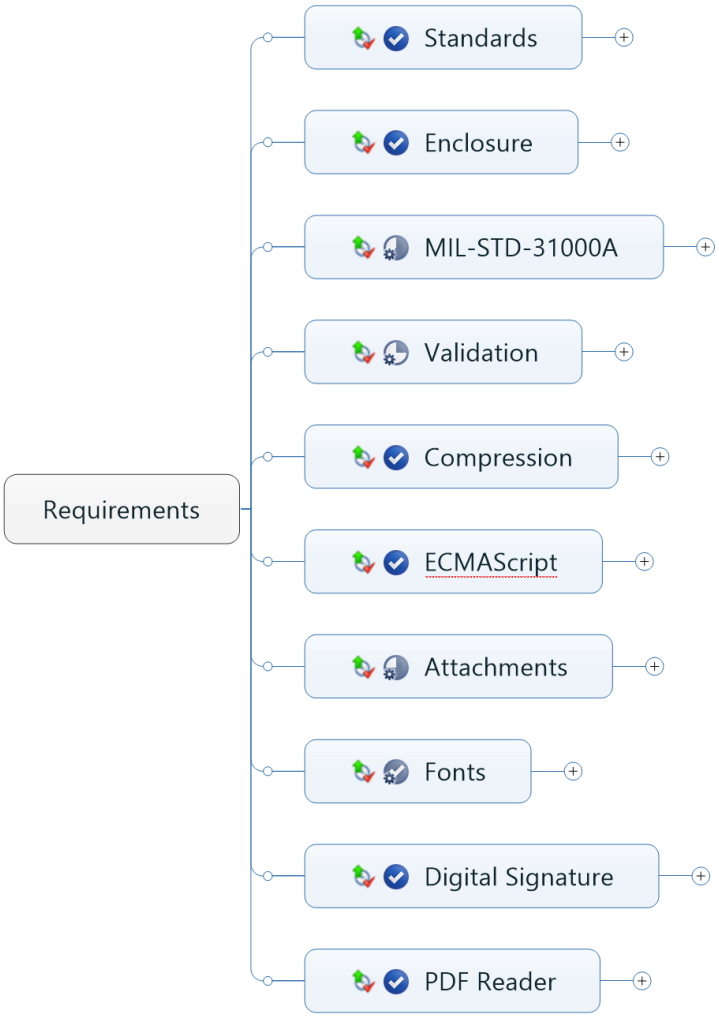
Partners

PDES, Inc.®
Connecting the Digital Enterprise

ACTION ENGINEERING

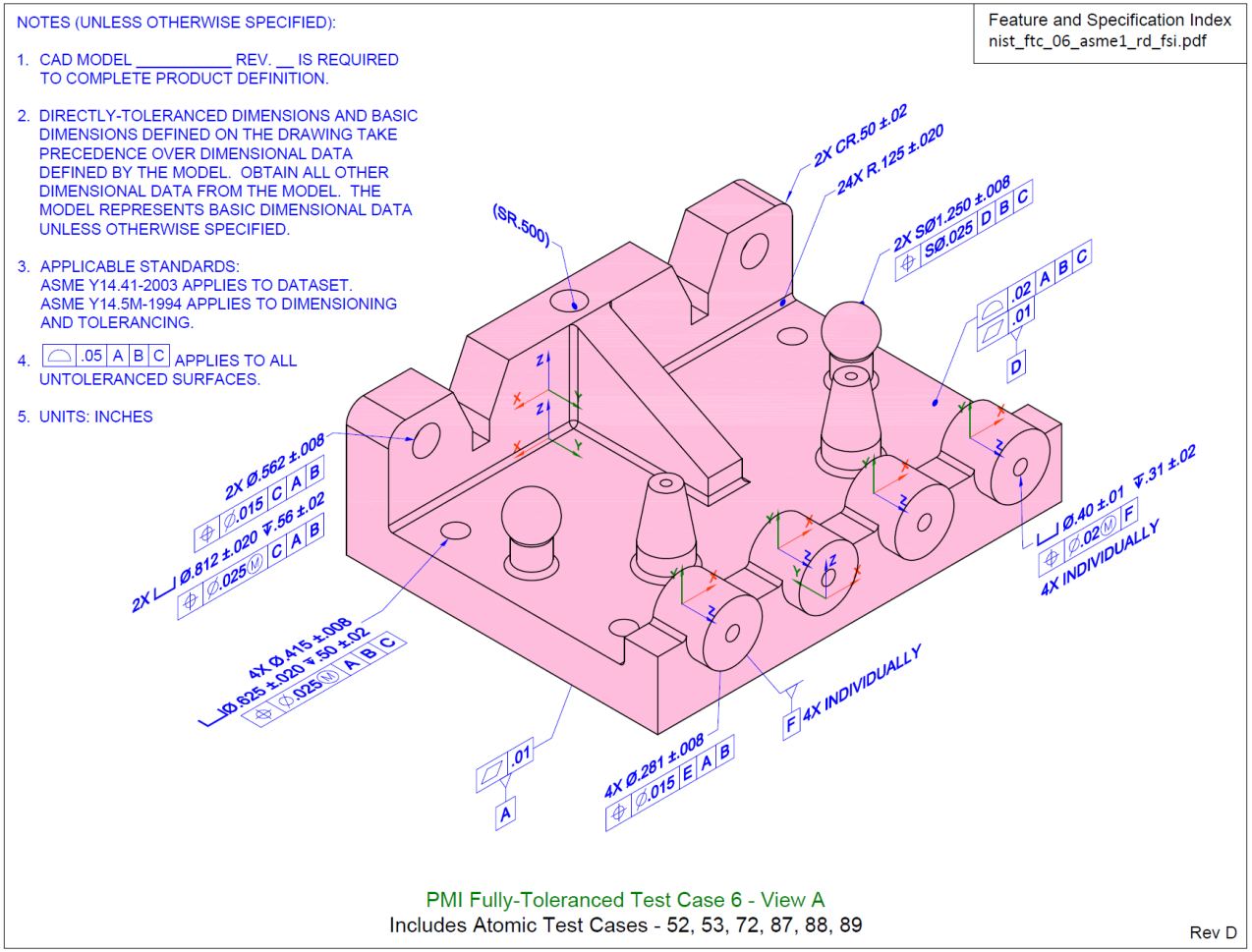
MBD 360®

The Requirements

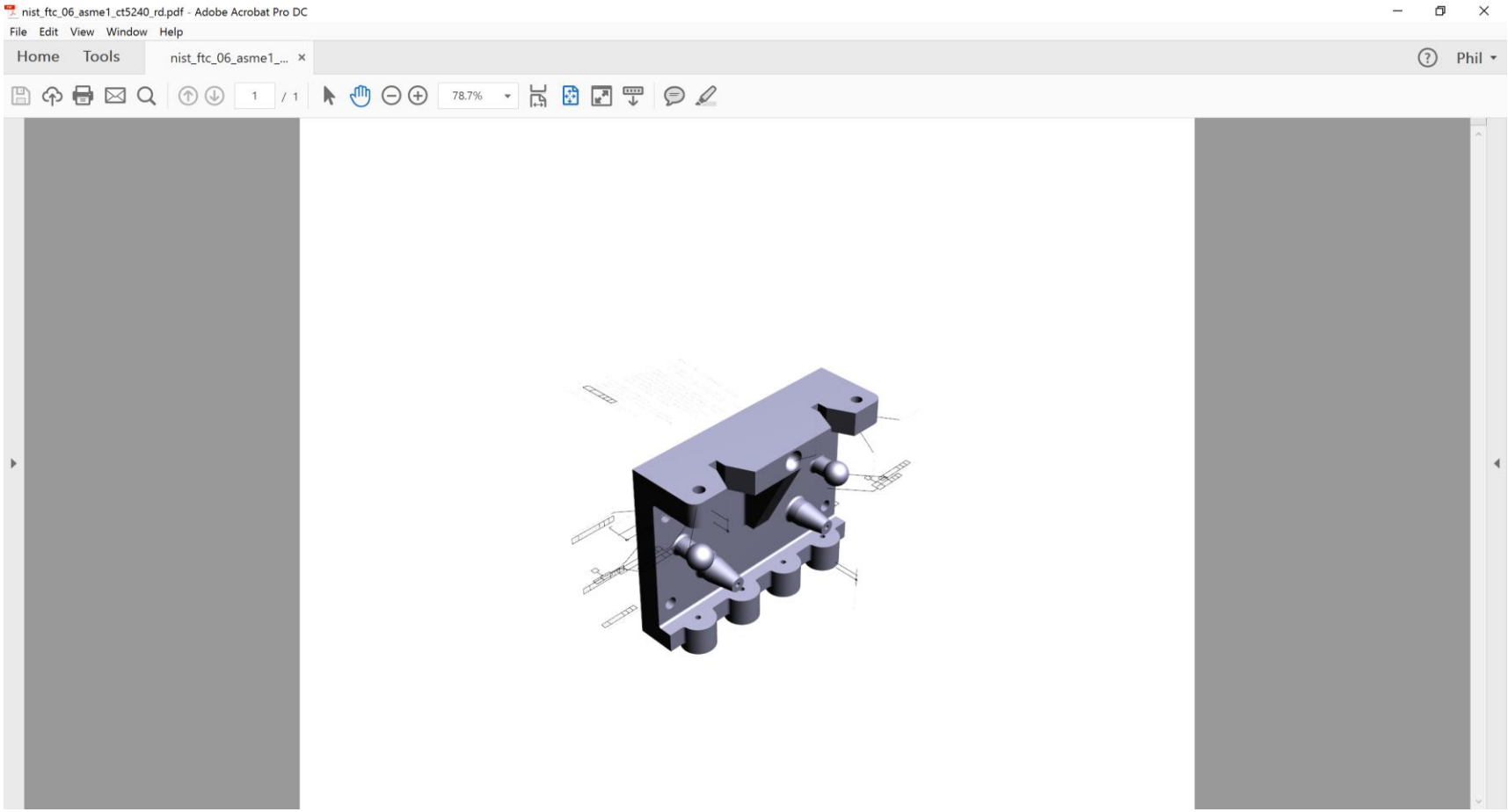


The 3D Model

NIST PMI Test Models - 2014



The 3D PDF file

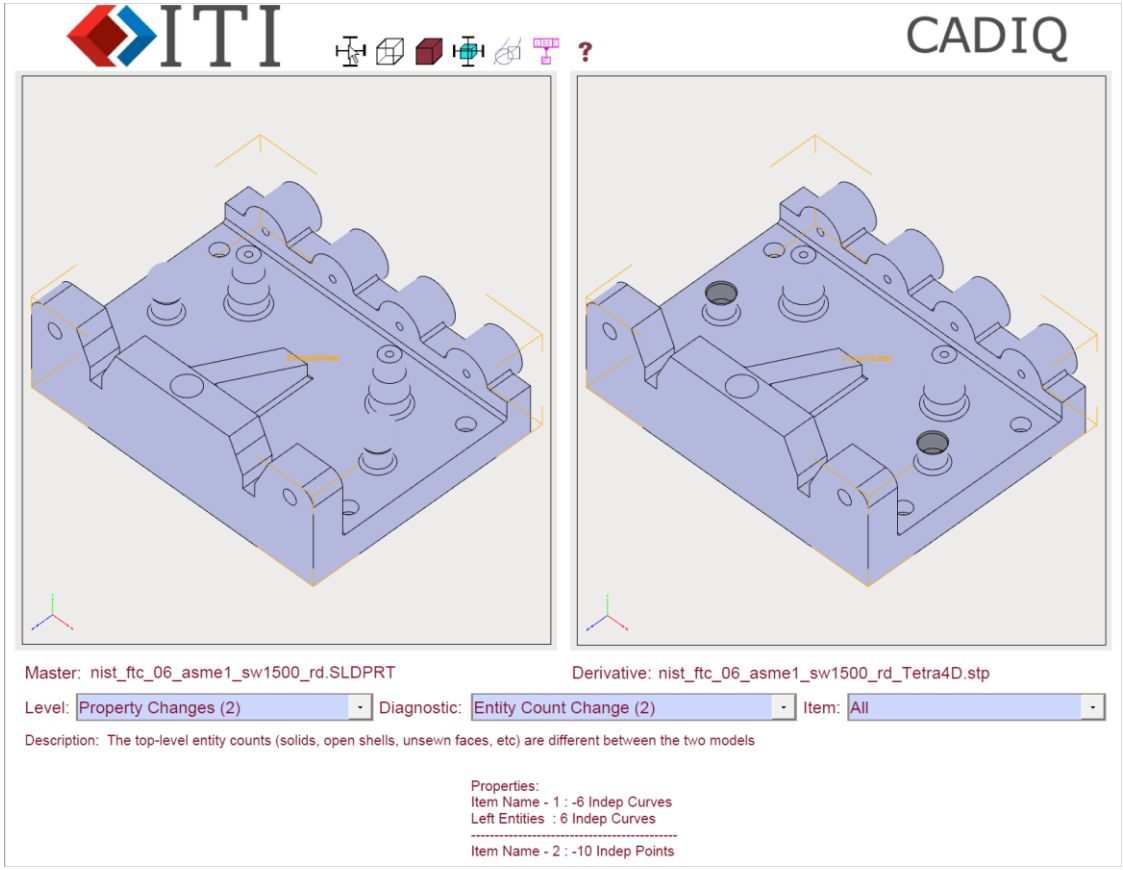


The STEP AP242 file

- **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.

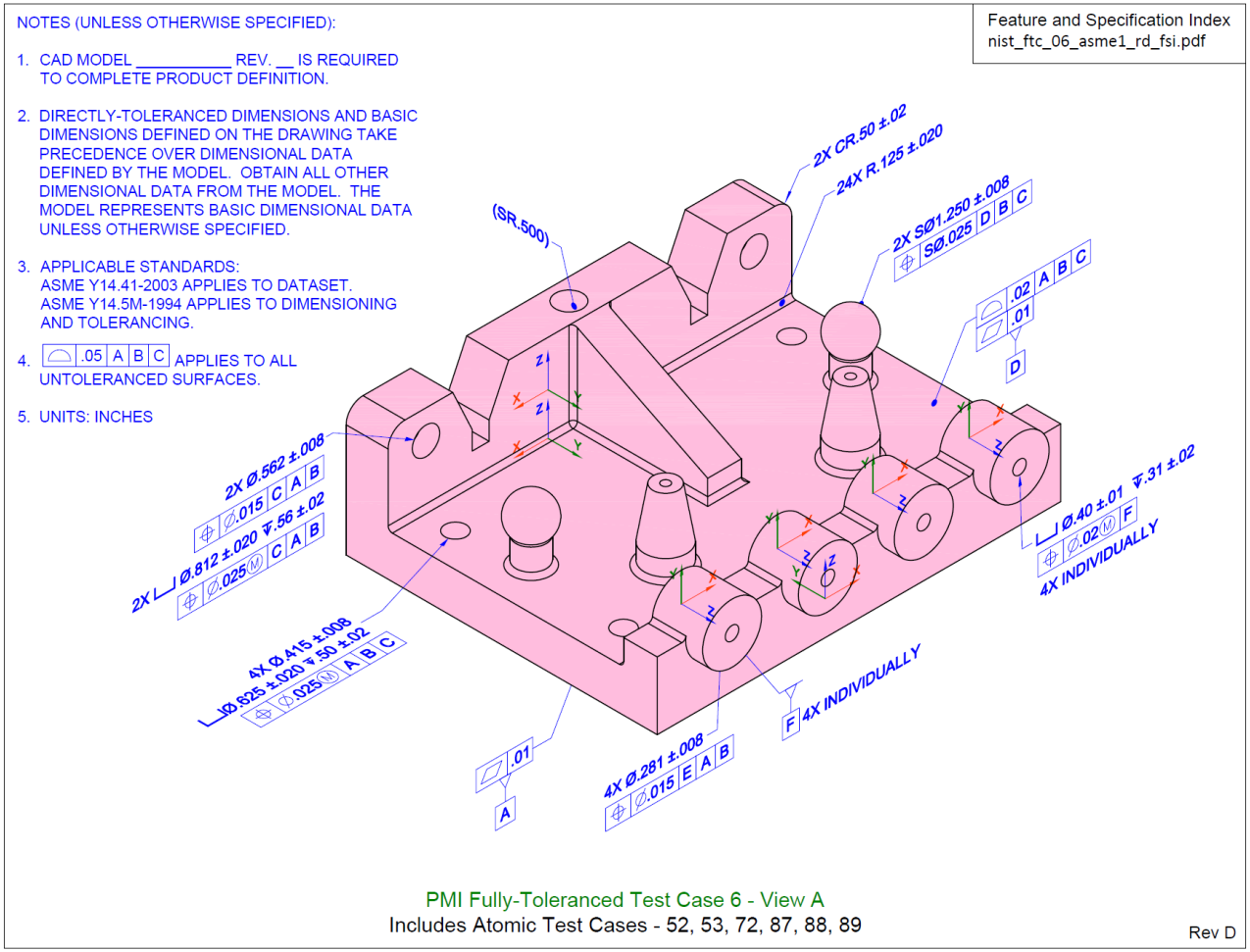
Validating the 3D Models

- **ITI CADIQ**
  - **Native CAD File**
  - **PDF file**
  - **STEP File**



The 2D Drawing

NIST PMI Test Models - 2014



The TDP Options Selection Sheet

Global Product Data Interoperability Summit | **2016**

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

A. CONTRACT NO.	B. EXHIBIT/ATTACHMENT#	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
◉ DEVELOPMENT 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 103030 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 Section 7)	☐ NATIVE FORMAT ☐ ISO 32000 PDF ☐ HARD COPY ☐ 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:

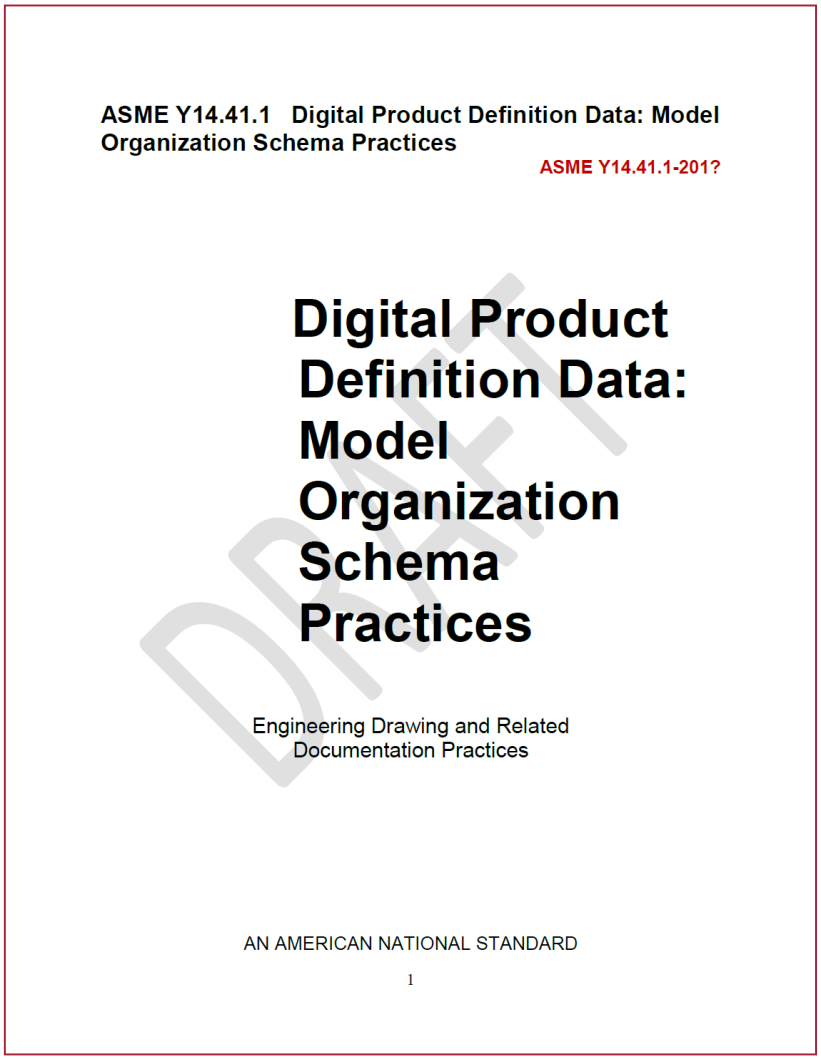
4. DRAWING FORMATS (check one and complete as applicable)

☐ CONTRACTOR FORMAT ☐ GOVERNMENT FORMAT
REMARKS

5. TDP ELEMENTS AND ASSOCIATED DATA REQUIRED (check 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)

Metadata



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

ASME Y14.41.1-201?

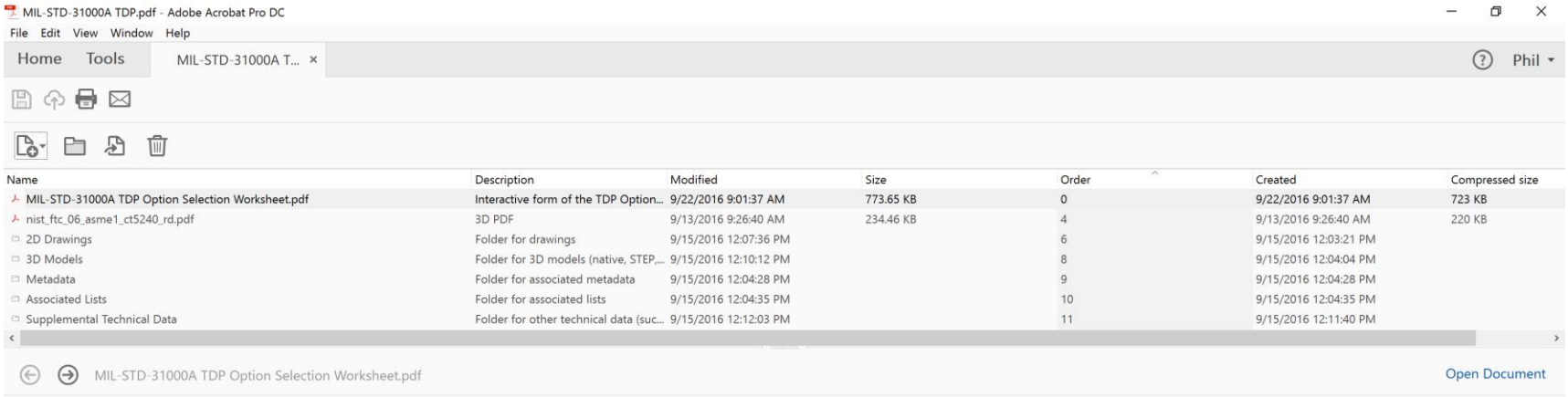
Digital Product Definition Data: Model Organization Schema Practices

Engineering Drawing and Related Documentation Practices

AN AMERICAN NATIONAL STANDARD

1

Transforming a TDP



MIL-STD-31000A

TDP OPTION SELECTION WORKSHEET			
SYSTEM PDF Consortium Testing		DATE PREPARED 9/19/16	
A. CONTRACT NO.	B. EXHIBIT/ATTACHMENT#	C. CLIN	D. CDRL DATA ITEM NO(S)
ABC123	1	N/A	N/A

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.		B. REMARKS
(•)	CONCEPTUAL LEVEL	This TDP is for testing purposes only and not manufacture or design
( )	DEVELOPMENT LEVEL	
( )	PRODUCTION LEVEL	

2. DELIVERABLE DATA PRODUCTS (X all that apply and complete as applicable)

What did we learn?

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

What's next

- **Document Best Practices**
  - **PMI Cross Highlighting**
  - **Metadata**
  - **Embedding Fonts**
  - **Compression**
- **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**
  - **3D XFDF**
  - **ECMAScript**

PDF – ISO Update

PDF-2 (ISO 32000-2)

- Currently in DIS
- Expect to be published in 2017

PDF/E-2 (ISO 24517-2)

- Currently in DIS
- Expect to be published in 2017

ECMAScript, ECMAScript 3D

- Currently in WD

PRC-2 (ISO 14739-2)

- Pre WD

Find out more

- **Attend a Consortium member's session**
- **Attend the 3D PDF Consortium general session**
- **Visit our website – www.3dpdfconsortium.org**

Day	Time	Model Based Systems Engineering & Analysis **Suguaro/Cholla**	Computer Aided Manufacturing & Sourcing Yucca	SOA, Cloud, High Performance Computing Geronimo	Product Delivery, Support, Test & Validation Palos Verde	Computer Aided Design **Cochise**	3D PDF Consortium Annual Meeting **Sedona**
Tuesday	9:50 - 10:30		Standards-Based Interoperability for Design to Manufacturing and Quality in the Supply Chain **ITI**			TDP Made Easy **Tech Soft 3D**	
	11:30 - 12:10			Extending advanced 3D MBE Publishing & Collaboration to Cloud & Mobile Applications **Anark**		Today's Formats for Documenting Engineering Data **Theorem Solutions**	
Wednesday	10:40 - 11:20	MBSE and the Business of Engineering **Aras**					
	1:00 - 1:30						General Session **3D PDF Consortium**

Thanks…