

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

3D PDF Consortium

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GLOBAL PRODUCT DATA INTEROPERABILITY **SUMMIT** 2016



ELYSIUM

Parker Aerospace

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The 3D PDF Consortium

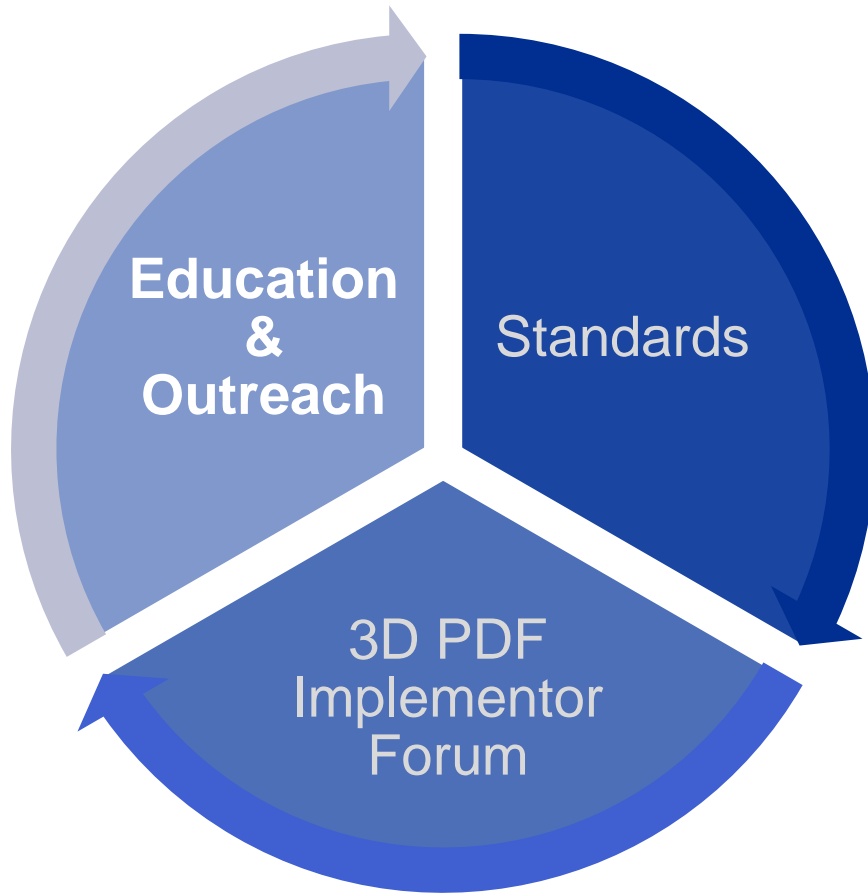
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- A world wide community of organizations representing a broad cross-section of engineering domains.
- Our membership includes end user companies, software developers, consultants, government and educational organizations.
- We are a non-profit organization,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



Education Programs

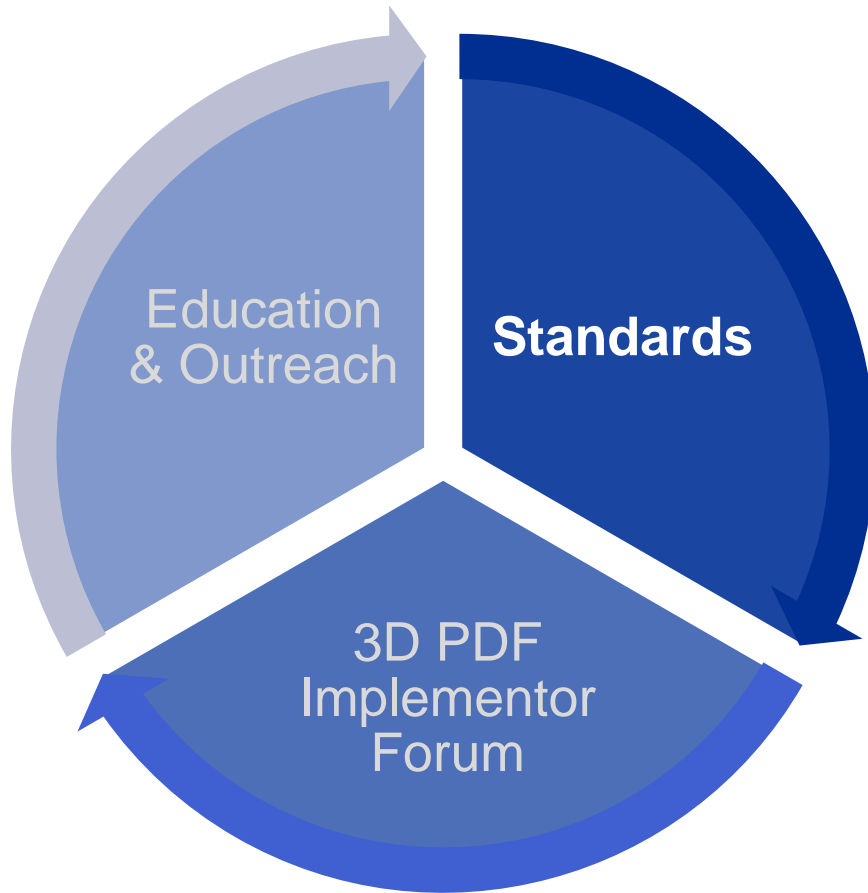
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- **We develop and deliver webinars on subjects important to our membership:**
 - 3D PDF
 - JavaScript for 3D PDF
- **Exhibit and speak world wide at conferences focused on manufacturing market**

Standards

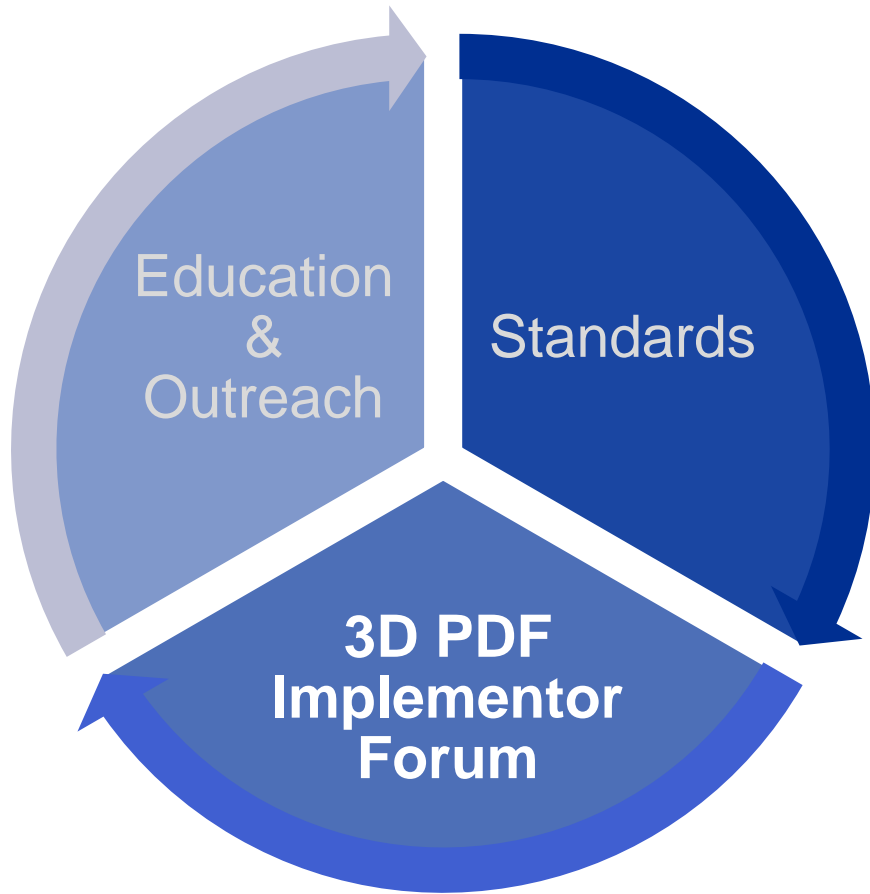
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- **Actively participate in standards development for:**
 - **ISO 32000 (PDF)**
 - **ISO 24517 (PDF/E)**
 - **ISO 14739 (PRC)**

3D PDF Implementor Forum (3DPDF-IF)

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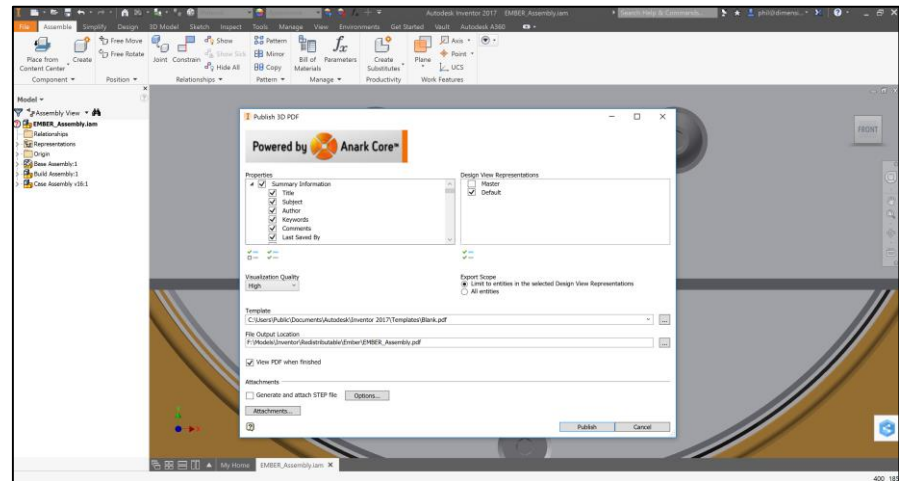
- Open to members of the 3D PDF Consortium
- Runs test rounds that are focused on creating engineering documents using PDF.
- Each participating company develops a PDF file that is validated to determine any deviations from the source CAD file
- Develops best practice documentation for any common issues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

Engineering Documentation Landscape - 2016

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- **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

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- 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

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

Mattie Stepanek

The Team

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3D PDF Implementor Forum

PROSTEP

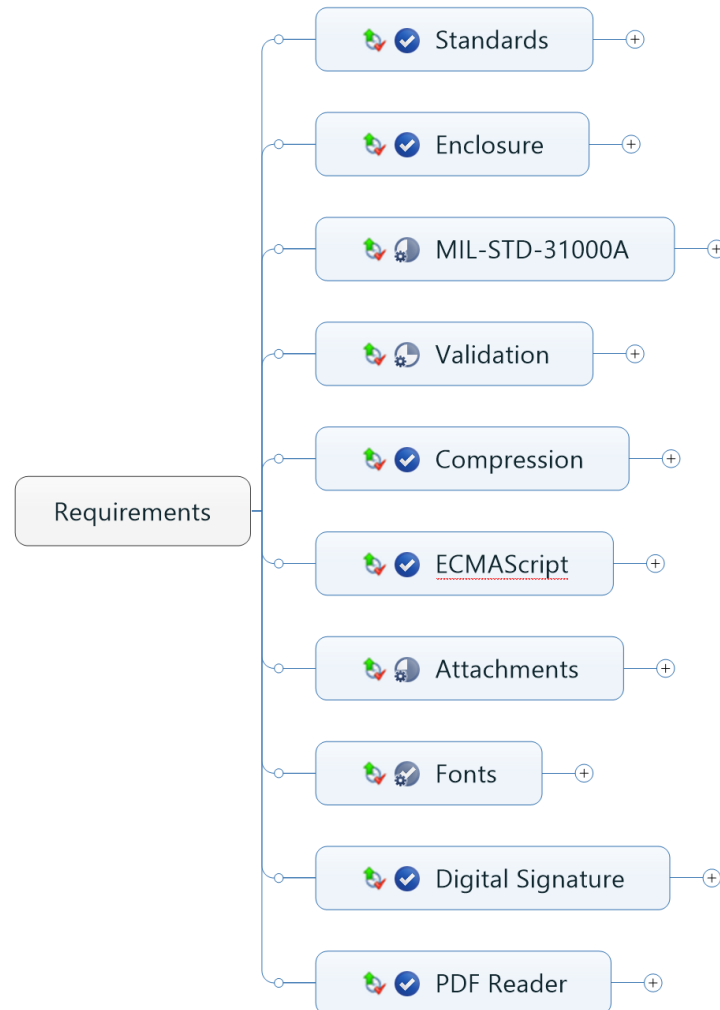


Partners




The Requirements

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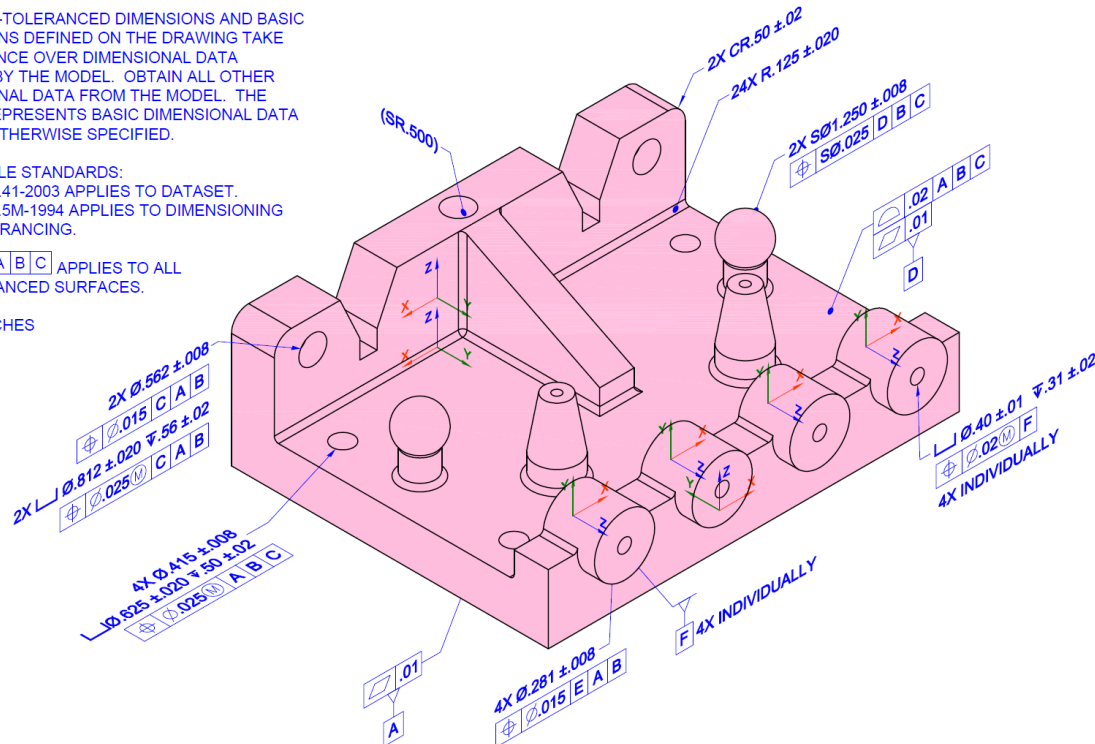


NIST PMI Test Models - 2014

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



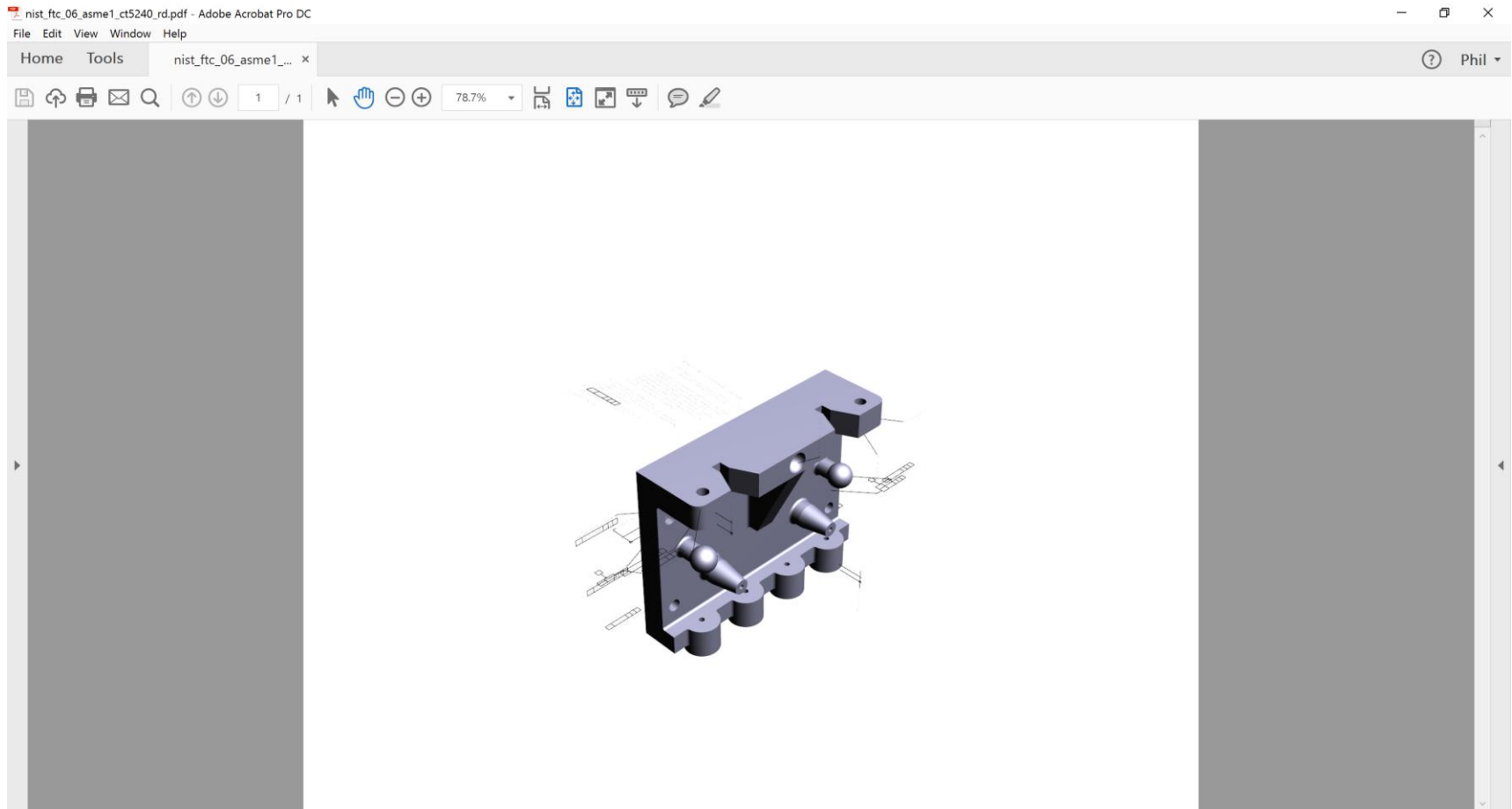
PMI Fully-Toleranced Test Case 6 - View A
Includes Atomic Test Cases - 52, 53, 72, 87, 88, 89

Rev D

nist ftc 06 asme1 rd

The 3D PDF file

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The STEP AP242 file

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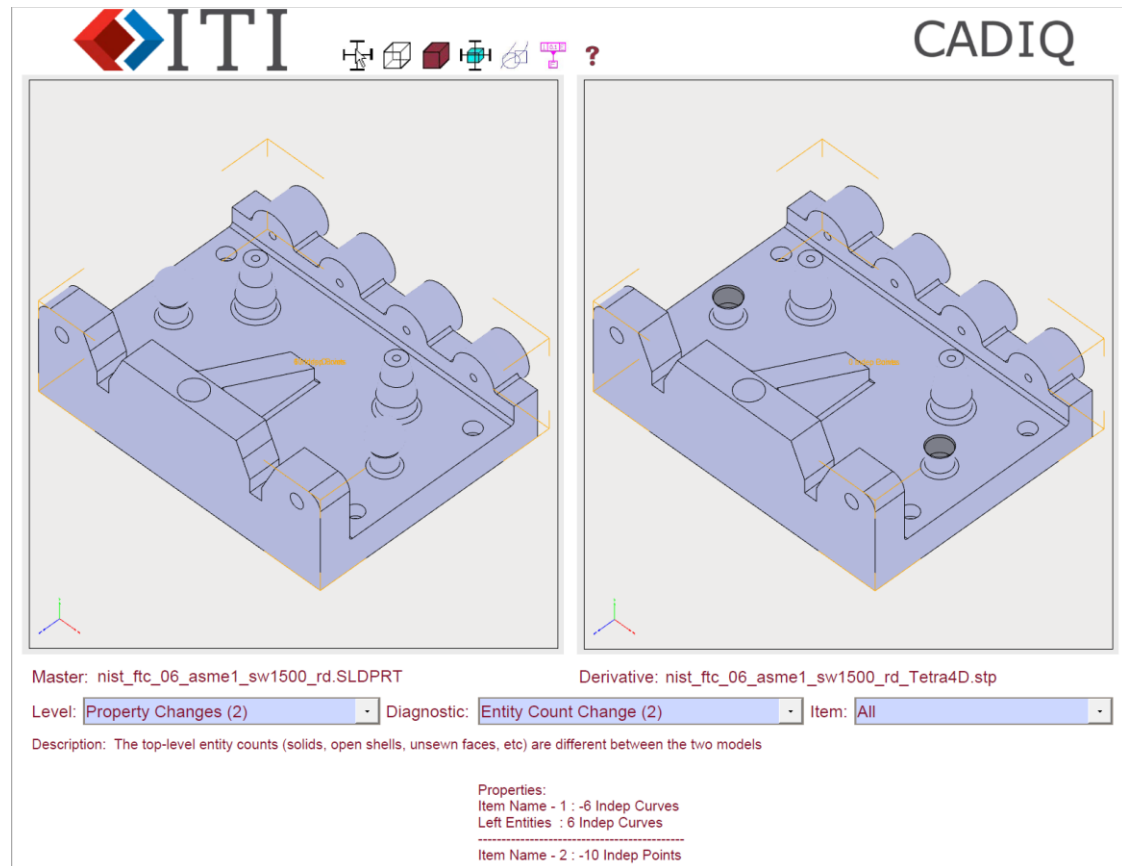
- **Precise B-Rep**
- **PMI Representation**
- **PMI Graphic Presentation**
- **PMI Representation linked to Presentation**
- **Validation Properties**

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

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



The screenshot displays the ITI CADIQ software interface. At the top, the ITI logo and a toolbar with various icons are visible. The main area shows two side-by-side 3D models of a mechanical part, with orange lines indicating differences between the two. Below the models, the following information is displayed:

Master: nist_ftc_06_asme1_sw1500_rd.SLDPRT
Derivative: nist_ftc_06_asme1_sw1500_rd_Tetra4D.stp

Level: Diagnostic: Item:

Description: The top-level entity counts (solids, open shells, unsewn faces, etc) are different between the two models

Properties:
Item Name - 1 : -6 Indep Curves
Left Entities : 6 Indep Curves


Item Name - 2 : -10 Indep Points

The 2D Drawing

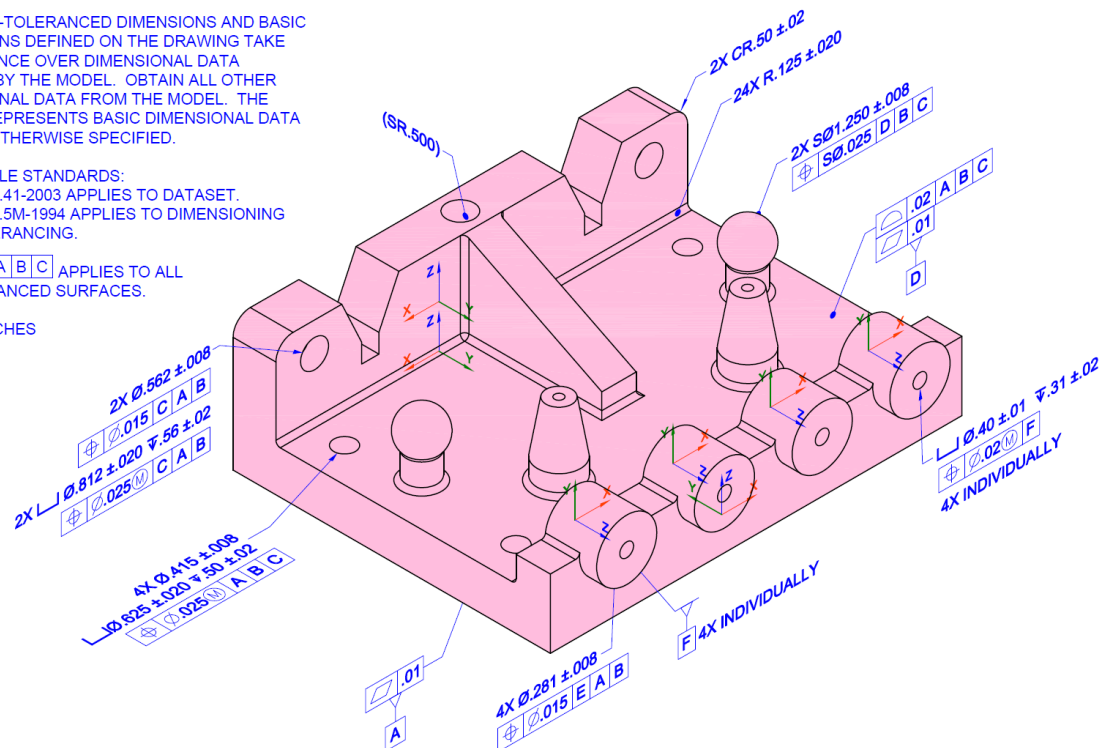
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NIST PMI Test Models - 2014

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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



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

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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. <input type="checkbox"/> CONCEPTUAL LEVEL <input type="checkbox"/> DEVELOPMENTAL LEVEL <input type="checkbox"/> PRODUCTION LEVEL		B. REMARKS:	
2. DELIVERABLE DATA PRODUCTS (X ALL THAT APPLY AND COMPLETE AS APPLICABLE)			
TYPE		FORMAT	
A. <input type="checkbox"/> 2D DRAWINGS		<input type="checkbox"/> NATIVE CAD <input type="checkbox"/> ISO 32000 PDF <input type="checkbox"/> HARD COPY <input type="checkbox"/> OTHER FORMAT (SPECIFY):	
B. 3D MODELS: <input type="checkbox"/> 3D Digital MODELS ONLY <input type="checkbox"/> 3D Digital MODELS W/ ASSOCIATED 3D DRAWINGS		<input type="checkbox"/> NATIVE CAD (specify level of annotation) <input type="checkbox"/> MODEL ORGANIZATION SCHEMA (specify Appendix B or other) <input type="checkbox"/> NEUTRAL FORMAT (SPECIFY, e.g. ISO 10303 APxxx) <input type="checkbox"/> OTHER FORMAT (SPECIFY, e.g. 3D PDF, JT)	
C. <input type="checkbox"/> METADATA (Specify in Section 9)		<input type="checkbox"/> ASCII TEXT - PIPE DELIMITED <input type="checkbox"/> ISO 10303 (SPECIFY, e.g. APxxx & DEX) <input type="checkbox"/> JEDMCS (DLF) <input type="checkbox"/> OTHER FORMAT (SPECIFY):	
D. <input type="checkbox"/> ASSOCIATED LISTS (See Sect 7)		<input type="checkbox"/> NATIVE FORMAT <input type="checkbox"/> ISO 32000 PDF <input type="checkbox"/> HARDCOPY <input type="checkbox"/> OTHER FORMAT (SPECIFY):	
E. <input type="checkbox"/> 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. <input type="checkbox"/> CONTRACTOR CAGE & DOCUMENT NUMBERS <input type="checkbox"/> 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)			
<input type="checkbox"/> CONTRACTOR FORMAT <input type="checkbox"/> GOVERNMENT FORMAT			
REMARKS:			
5. TDP ELEMENTS AND ASSOCIATED DATA REQUIRED (X ALL THAT APPLY)			
<input type="checkbox"/> CONCEPTUAL DESIGN DRAWINGS / MODELS <input type="checkbox"/> DEVELOPMENTAL DESIGN DRAWINGS / MODELS AND ASSOCIATED LISTS <input type="checkbox"/> PRODUCT DRAWINGS / MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIAL INSPECTION EQUIPMENT (SIE) DRAWINGS, MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIAL TOOLING (ST) DRAWINGS, MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIAL PACKAGING INSTRUCTIONS (SPI) DRAWINGS, MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIFICATIONS AND/OR STANDARDS (SPECIFY) <input type="checkbox"/> SOFTWARE DOCUMENTATION (SPECIFY) <input type="checkbox"/> QUALITY ASSURANCE PROVISIONS (QAP) (SPECIFY) <input type="checkbox"/> METADATA (SPECIFY) <input type="checkbox"/> 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. <input checked="" type="radio"/> CONCEPTUAL LEVEL <input checked="" type="radio"/> DEVELOPMENTAL LEVEL <input checked="" type="radio"/> PRODUCTION LEVEL		B. REMARKS	
2. DELIVERABLE DATA PRODUCTS (X all that apply and complete as applicable)			
TYPE		FORMAT	
A. <input type="checkbox"/> 2D DRAWINGS		<input type="checkbox"/> NATIVE CAD <input type="checkbox"/> ISO 32000 PDF <input type="checkbox"/> HARD COPY <input type="checkbox"/> OTHER FORMAT (specify)	
B. 3D MODELS: <input type="checkbox"/> 3D DIGITAL MODELS ONLY <input type="checkbox"/> 3D DIGITAL MODELS W/ ASSOCIATED 2D DRAWINGS		<input type="checkbox"/> NATIVE CAD (specify level of annotation) <input type="checkbox"/> MODEL ORGANIZATION SCHEMA (specify Appendix B or other) <input type="checkbox"/> NEUTRAL FORMAT (specify, e.g. ISO 103030 APxxx) <input type="checkbox"/> OTHER FORMAT (specify, e.g. 3D PDF, JT)	
C. <input type="checkbox"/> METADATA (specify in Section 9)		<input type="checkbox"/> ASCII TEXT - PIPE DELIMITED <input type="checkbox"/> ISO 10303 (specify, e.g. APxxx & DEX) <input type="checkbox"/> JEDMCS (DLF) <input type="checkbox"/> OTHER FORMAT (specify)	
D. <input type="checkbox"/> ASSOCIATED LISTS (see Section 7)		<input type="checkbox"/> NATIVE FORMAT <input type="checkbox"/> ISO 32000 PDF <input type="checkbox"/> HARD COPY <input type="checkbox"/> OTHER FORMAT (specify)	
E. <input type="checkbox"/> 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. <input type="checkbox"/> CONTRACTOR CAGE & DOCUMENT NUMBERS <input type="checkbox"/> 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)			
<input type="checkbox"/> CONTRACTOR FORMAT <input type="checkbox"/> GOVERNMENT FORMAT			
REMARKS			
5. TDP ELEMENTS AND ASSOCIATED DATA REQUIRED (check all that apply)			
<input type="checkbox"/> CONCEPTUAL DESIGN DRAWINGS / MODELS <input type="checkbox"/> DEVELOPMENTAL DESIGN DRAWINGS / MODELS AND ASSOCIATED LISTS <input type="checkbox"/> PRODUCT DRAWINGS / MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIAL INSPECTION EQUIPMENT (SIE) DRAWINGS, MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIAL TOOLING (ST) DRAWINGS, MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIAL PACKAGING INSTRUCTIONS (SPI) DRAWINGS, MODELS AND ASSOCIATED LISTS <input type="checkbox"/> SPECIFICATIONS AND/OR STANDARDS (SPECIFY) <input type="checkbox"/> SOFTWARE DOCUMENTATION (SPECIFY) <input type="checkbox"/> QUALITY ASSURANCE PROVISIONS (QAP) (SPECIFY) <input type="checkbox"/> METADATA (SPECIFY) <input type="checkbox"/> SUPPLEMENTARY TECHNICAL DATA (SPECIFY)			

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

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MIL-STD-31000A TDP.pdf - Adobe Acrobat Pro DC

File Edit View Window Help

Home Tools MIL-STD-31000A T... x

Phil

Name	Description	Modified	Size	Order	Created	Compressed size
MIL-STD-31000A TDP Option Selection Worksheet.pdf	Interactive form of the TDP Option...	9/22/2016 9:01:37 AM	773.65 KB	0	9/22/2016 9:01:37 AM	723 KB
nist_ftc_06_asme1_ct5240_rd.pdf	3D PDF	9/13/2016 9:26:40 AM	234.46 KB	4	9/13/2016 9:26:40 AM	220 KB
2D Drawings	Folder for drawings	9/15/2016 12:07:36 PM		6	9/15/2016 12:03:21 PM	
3D Models	Folder for 3D models (native, STEP,...	9/15/2016 12:10:12 PM		8	9/15/2016 12:04:04 PM	
Metadata	Folder for associated metadata	9/15/2016 12:04:28 PM		9	9/15/2016 12:04:28 PM	
Associated Lists	Folder for associated lists	9/15/2016 12:04:35 PM		10	9/15/2016 12:04:35 PM	
Supplemental Technical Data	Folder for other technical data (suc...	9/15/2016 12:12:03 PM		11	9/15/2016 12:11:40 PM	

MIL-STD-31000A TDP Option Selection Worksheet.pdf

Open Document

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. <input checked="" type="radio"/> CONCEPTUAL LEVEL <input type="radio"/> DEVELOPMENT LEVEL <input type="radio"/> PRODUCTION LEVEL	B. REMARKS This TDP is for testing purposes only and not manufacture or design		
2. DELIVERABLE DATA PRODUCTS (X all that apply and complete as applicable)			

What did we learn?

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- **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

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- **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

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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

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- 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 Suguro/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...

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