

Using 3D PDF with MIL-STD-31000A

BEST PRACTICES

3D PDF CONSORTIUM

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1 Introduction

3D PDF Consortium Recommended Practices are "best practices" or "guidelines" for methods, materials, or practices to give guidance to creators or users of PDF that include 3D data. These documents are intended to represent a proven industry or "leading edge" practice. Use of any or all elements of a Recommended Practice is discretionary; it may be used as stated or modified by readers to meet specific needs.

The recommendations in this document offer guidance for the packaging and exchange of Technical Data Packages (TDP) using the PDF file format. By following these practices, organizations can easily determine what content is included in a TDP, what is the quality of the 3D data included in the TDP and how all the various data and documents that comprise the TDP are organized.

2 Background

These recommended practices were developed during Test Round 2 of the 3D PDF Implementor Forum (3DPDF-IF), a part of Technical Committee of the 3D PDF Consortium. The goal of Test Round 2 was to improve the consistency, usefulness and durability of a MIL-STD-31000A TDP using 3D PDF.

At the start of the test round, the 3D PDF Consortium and PDES, Inc. executed an MOU that included an agreement to work together on projects that would explore the use of STEP and PDF. Member companies of PDES, Inc. were instrumental in the specification of the test round deliverables.

The Consortium also reached out to MBD subject matter experts (SME) at MBD360 and Action Engineering to participate in the test round. Both companies contributed to the specification of the test round deliverables and review of this Best Practices document.

The result of Test Round 2 was an example MIL-STD-31000A TDP contained in a single PDF file. The example file formed the basis for the best practices specified in this document.

3 The MIL-STD-31000A TDP

4 Best Practices for using 3D PDF with MIL-STD-31000A

4.1 Recommended PDF Reader for 3D PDF

Adobe Acrobat DC or Adobe Acrobat Reader DC are the recommended viewers for viewing of a MIL-STD-31000A compliant PDF files.

While 3D is part of the ISO specification for the PDF file format, not all PDF readers support 3D. The Adobe Acrobat software was the first to support 3D, beginning with version 7 released in 2004. While you can use any version of Adobe Acrobat from version 7 onward, we have found that the most current version of Acrobat and Acrobat Reader are the most capable viewers for 3D PDF files.

It is further recommended that the workstation version (Windows, Mac) be used when viewing 3D PDF files.

The workstation versions of the Adobe software are the only applications that currently support all of the 3D capabilities of PDF as specified in the ISO 32000 standard.

4.2 3D Streams

Starting with Acrobat 8.1, PDF files can contain 3D annotations with data streams that conform to either the Universal 3D (U3D) or PRC file format. The PRC format was designed to store CAD data and offers many advantages for engineering applications including data structures specifically for annotations (dimensions, tolerances, notes, text, and symbols). The PRC format also offers even greater compression than the U3D format. Finally, because the PRC format is an ISO standard, 3D data stored in PRC, can be reliably validated. This includes visualization data, geometry, topology, annotations and saved views,

Advantages of the PRC format includes:

- Part or assembly structure
- Saved model views
- Primary model body geometry with attributes
- 3D annotations with attributes
- Supplemental geometry such as datum coordinates, points, planes, axes, and curves, with attributes
- Supports semantic relationships between annotations and model topology or other annotations, to support ASME Y14.41 visual response

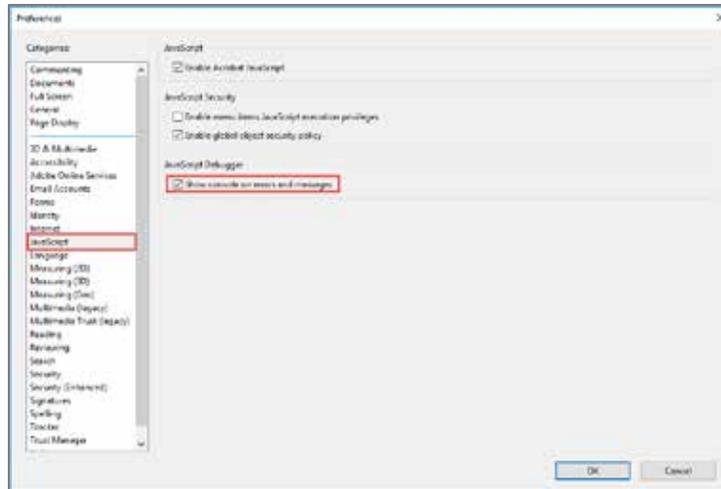
It is recommended to that all 3D annotations in a MIL-STD-31000A compliant PDF file should contain 3D data streams conforming to the PRC file format. It is also recommended that all 3D annotations and saved views (including cross section views) should be included in the PRC data.

4.3 3D Annotations

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 Query requirements of ASME Y14.41 (section 7.2.7), it is possible to satisfy the requirements by attaching custom JavaScript to a 3D annotation when creating a PDF file.

It is recommended that all 3D annotations in a MIL-STD-31000A PDF file should include JavaScript that enables the annotation query behavior as specified by ASME Y14.41. The 3D annotation's PRC_TYPE_MISC_MarkupLinkedItem and PRC_TYPE_MISC_ReferenceOnTopology data in the PRC stream should be complete and consistent with the corresponding JavaScript that enables the annotation query behavior.

All PDF files that contain JavaScript should be tested using the Acrobat JavaScript console and with supported versions of Adobe Reader. Both Adobe Acrobat Reader and Adobe Acrobat can be configured to display the JavaScript console whenever an unhandled exception occurs. To enable this functionality, select Edit > Preferences > JavaScript and check the 'Show console on errors and messages' option. Selecting this option will allow developers to catch any unwanted messages or errors before distributing a PDF file.



4.4 Poster Images

When a 3D model is not active, or disabled, a 2D poster image is displayed in place of the 3D artwork. Adding poster images to a PDF file helps users to quickly identify 3D content and enhances the usability of the file.

It is recommended that all 3D artwork includes a 2D poster image of an initial or default 3D view.

4.5 Fonts

There are fourteen fonts that are “system” fonts for PDF documents. These fonts are called the *base 14 fonts*. Adobe Acrobat Reader can natively display these fonts. Using the base 14 fonts helps keep file sizes small. The base 14 fonts include:

- Times (regular, italic, bold, and bold italic)
- Courier (regular, oblique, bold and bold oblique)
- Helvetica (regular, oblique, bold and bold oblique)
- Symbol
- Zapf Dingbats

Other fonts can be embedded in the PDF file (if the font permits embedding). Embedding fonts prevents font substitution from occurring when viewing or printing the file. The entire font can be embedded or just a subset of the font used in the file. Most of the common digital font formats can be embedded in a PDF files. This includes Type 1, TrueType, and OpenType fonts. Embedding of fonts usually increase a files size only slightly, unless a CID font is embedded. CID fonts are often used with Asian languages.

To ensure visual integrity, it is recommended that only fonts that are legally embeddable in a file for unlimited, universal rendering should be used in a MIL-STD-31000A TDP. Other than the base 14 fonts, all fonts used in a MIL-STD-31000A PDF file should be embedded in the PDF file. This includes all fonts used for annotations.

4.6 Portfolios and Attachments

A PDF portfolio collects a group of files into a single PDF container. The ISO 32000 standard refers to this as a collection. A portfolio can include any number and type of files; including CAD models, CAD

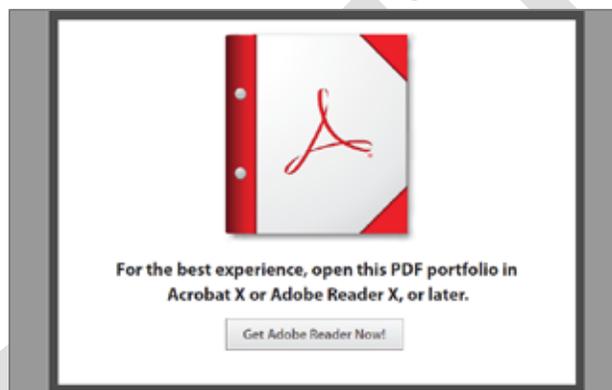
drawings, validation reports, Microsoft Office files, links to web content and other PDF files. Each file in the portfolio can be opened, viewed (for supported formats) and saved independently.

Portfolios can be organized using folders. Each folder has a user defined name and description. Data should be organized in a clear, logical manner to best suit the specific types of product data that are required for the TDP.

Files can either be added to a portfolio at the root level, or to a folder. When a file in a portfolio is selected, a preview of the file is displayed. The Adobe Acrobat Reader software can preview PDF, SWF, TXT and HTML files.

4.6.1 Cover Sheet

A portfolio has a cover sheet that is displayed when an application does not support viewing of the portfolio. The default cover sheet is:



It is recommended that the default portfolio cover sheet be replaced with a cover sheet that is updated to refer to Adobe Acrobat DC. This cover sheet can also be customized to include contact information or other information as necessary.

4.6.2 Initial Document

What document is displayed when a portfolio is initially opened is a configurable feature in PDF.

It is recommended that the initial document displayed when opening a PDF data package is a text or PDF document that details the classified information and technical data markings as specified in MIL-STD-31000A sections 4.8 and 4.9.

4.7 Recommended Standards

It is recommended that the following standards be used when creating MIL-STD-31000A compliant TDP's using the PDF file format:

4.7.1 PDF

ISO 32000-1:2008

Document management -- Portable document format -- Part 1: PDF 1.7

Version 1 of ISO 32000 was first published in 2008. This is the most recent version of the standard and is recommended that the PDF data contained in a technical data package conforms to this standard.

Shortly before the publication of the ISO 32000-1:2008 standard, Adobe released a set of extensions and implementation notes for PDF. The document detailed file format changes that were used by Adobe in their Acrobat product line but were not documented in the first version of the standard. The document was titled *Adobe® Supplement to the ISO 32000, BaseVersion: 1.7, ExtensionLevel: 3*. This document added some useful extensions for 3D data, most notably the use of PRC in 3D Annotations.

It should be noted that in addition to the ISO 32000 (PDF) standard, ISO 19005 (PDF/A) and ISO 24517 (PDF/E) were also considered for the TDP. Restrictions in the PDF/A and PDF/E formats ruled out their use for the 3D PDF portion of the TDP; PDF/A specifically disallows 3D content and PDF/E disallows JavaScript. While either of these formats can be used for files attached to the TDP, neither format is recommended for the 3D PDF data of the TDP.

All PDF data contained in a MIL-STD-31000A compliant TDP should conform to both the ISO 32000:1 standard and *Adobe® Supplement to the ISO 32000, BaseVersion: 1.7, ExtensionLevel: 3* document.

4.7.2 PRC

ISO 14739-1:2014

Document management -- 3D use of Product Representation Compact (PRC) format --
Part 1: PRC 10001

All 3D annotations in a MIL-STD-31000A compliant PDF files that contain PRC 3D data streams should conform to the ISO 14739-1:2014 standard.

4.7.3 U3D

ECMA-363, 3rd Edition
Universal 3D File Format

U3D is not the preferred format for use in a MIL-STD-31000A compliant PDF file. If it is used then it is recommended that all U3D 3D data streams should conform to the ECMA-363, 3rd Edition standard.

5 Out of Scope

5.1 Security

5.2 Compression