Long Term Archiving with 3D PDF

3D PDF Consortium

- Jerry McFeeters – Executive Director
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3D PDF Consortium

A *community* dedicated to driving adoption of 3D PDF enabled solutions through:

- **Defining industry needs and priorities**
- **Creating reference implementations and other resources**
- **Providing input to the standards process**
- **Raising awareness**

A worldwide, non-profit, member organization

Open to all companies

3D PDF Consortium - Members

3D PDF Consortium - Organization

Board of Directors

- Governance, Recruiting

Committees

Executive

- Mission, Vision, Strategic Direction

Industry

- Define industry needs and priorities
- Develop process-based use cases
- Assign priorities to technical committee work

Technical

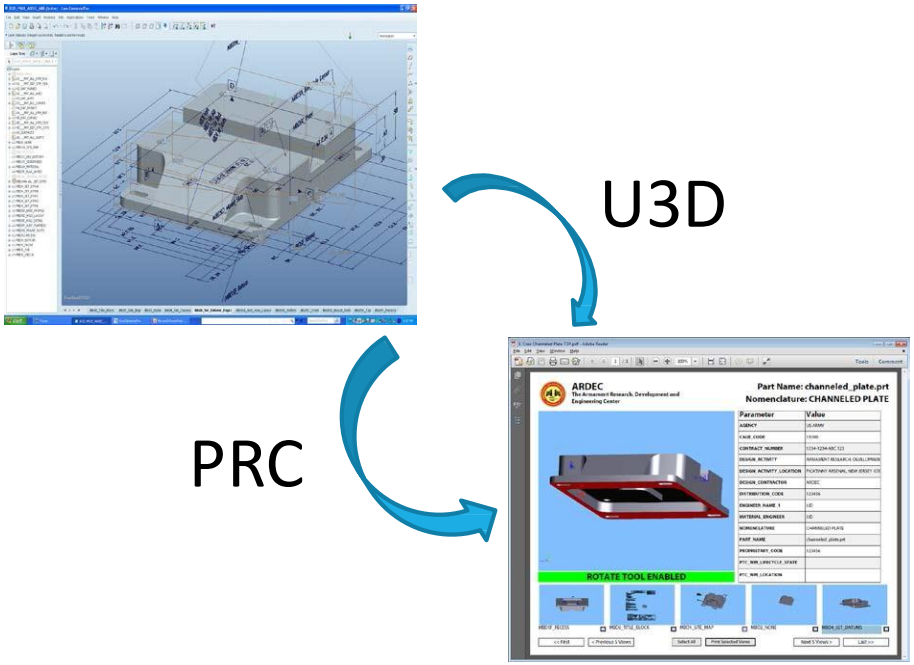
- Project goals and objectives
- Project plans, participation, funding
- Implementers forum
- ISO technical submissions

Communications

- Events planning
- Publications
- Solicit and propose case studies
- Presentations
- Blog/article submissions

What is 3D PDF?

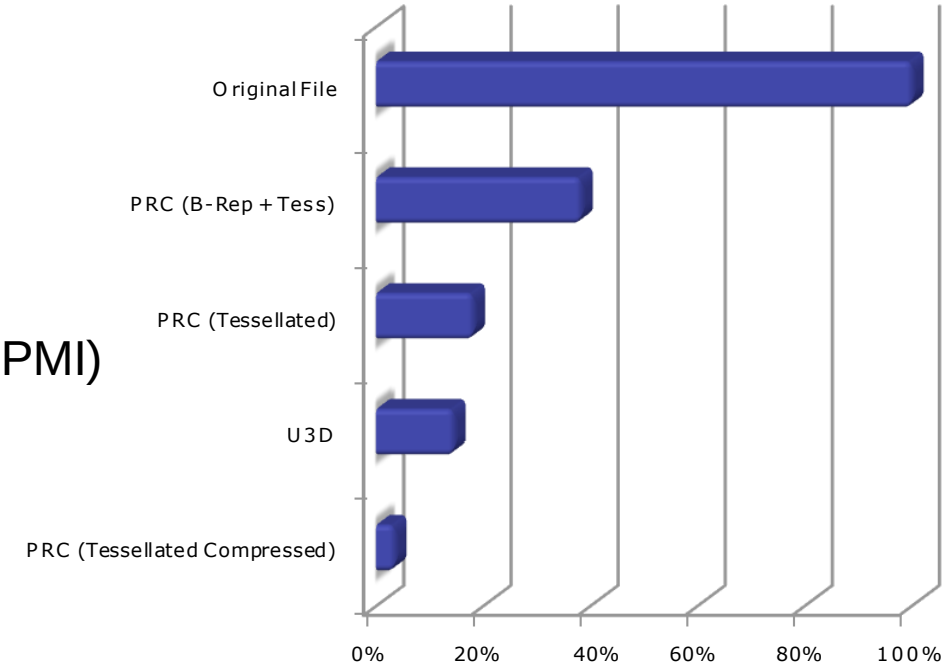
Any PDF file containing data defined in either Universal 3D (U3D), or Product Representation Compact (PRC) formats



PDF – 3D Content

PRC

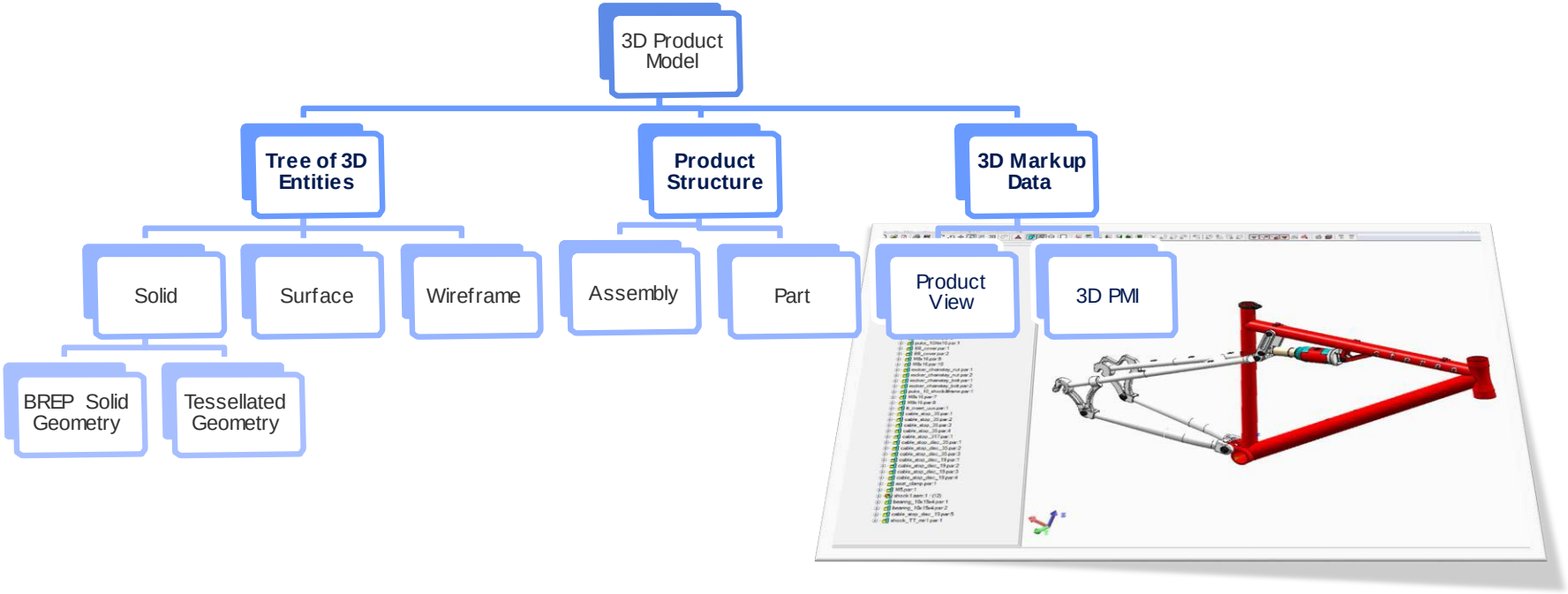
- **Engineering Format**
  - Product Structure
  - Tessellation
  - Precise B-Rep
  - Product and Manufacturing Information (PMI)
  - Highly compact



U3D

- **Presentation Format**
  - ECMA standard (ECMA 363-3)
  - Only supports tessellated data
  - No longer actively developed

What is “Product Structure?”



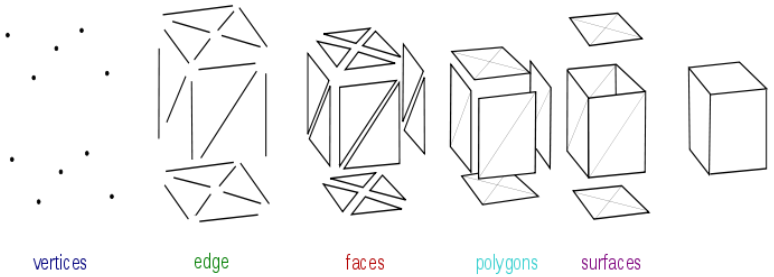
PRC Content - Physical

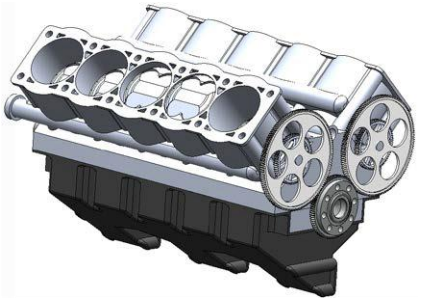
Topology

- **Complete topological description**

Geometry

- **Designed to represent geometry from ALL CAD systems**
- **Points, coordinate systems, polyhedra, curves, surfaces**
- **Maintains period and parametric definitions of curves and surfaces**

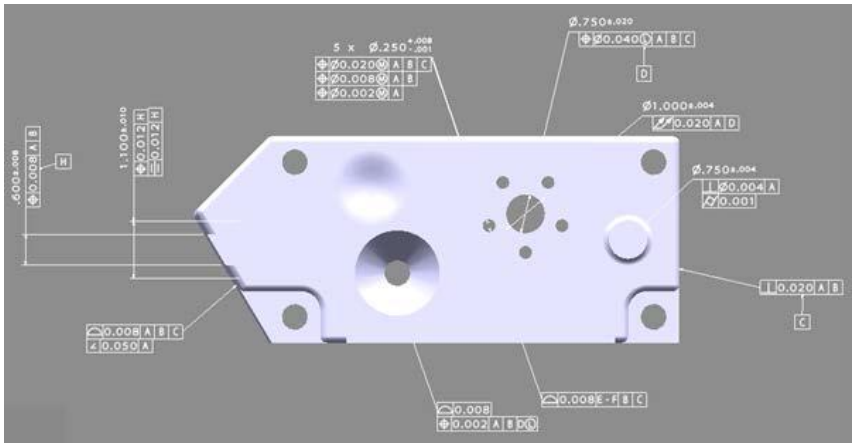




PRC Content - PMI

Full visual PMI

- **Annotations and symbols**
- **Can be associated to 3D elements**



PRC Content - Metadata

Name

- Key value pairs representing attributes (i.e. author, creation date, release date)

Persistent ID

- Two types of unique identification

Style

- Transparency, rendering mode, materials

Layer

- Logical grouping of elements

Show/hide

- Enables visibility

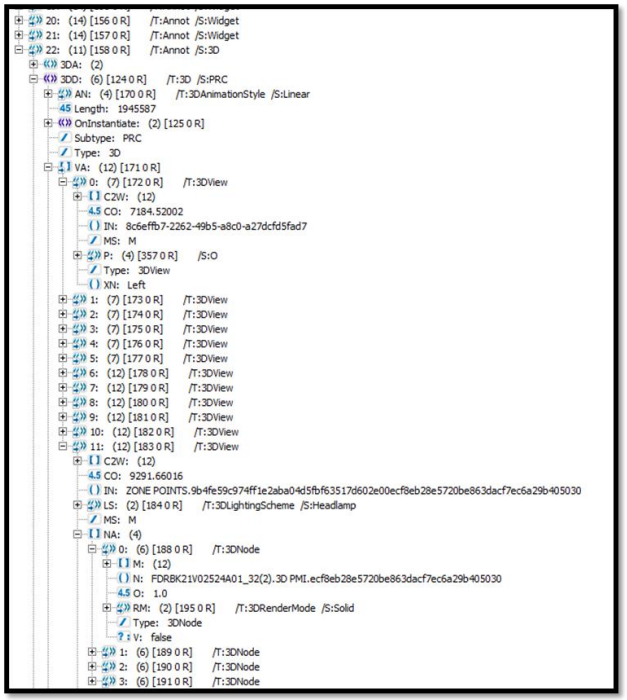
Coordinate systems

- Part based or local based

Stored as XML

- Ease of access

PDF Structure with 3D

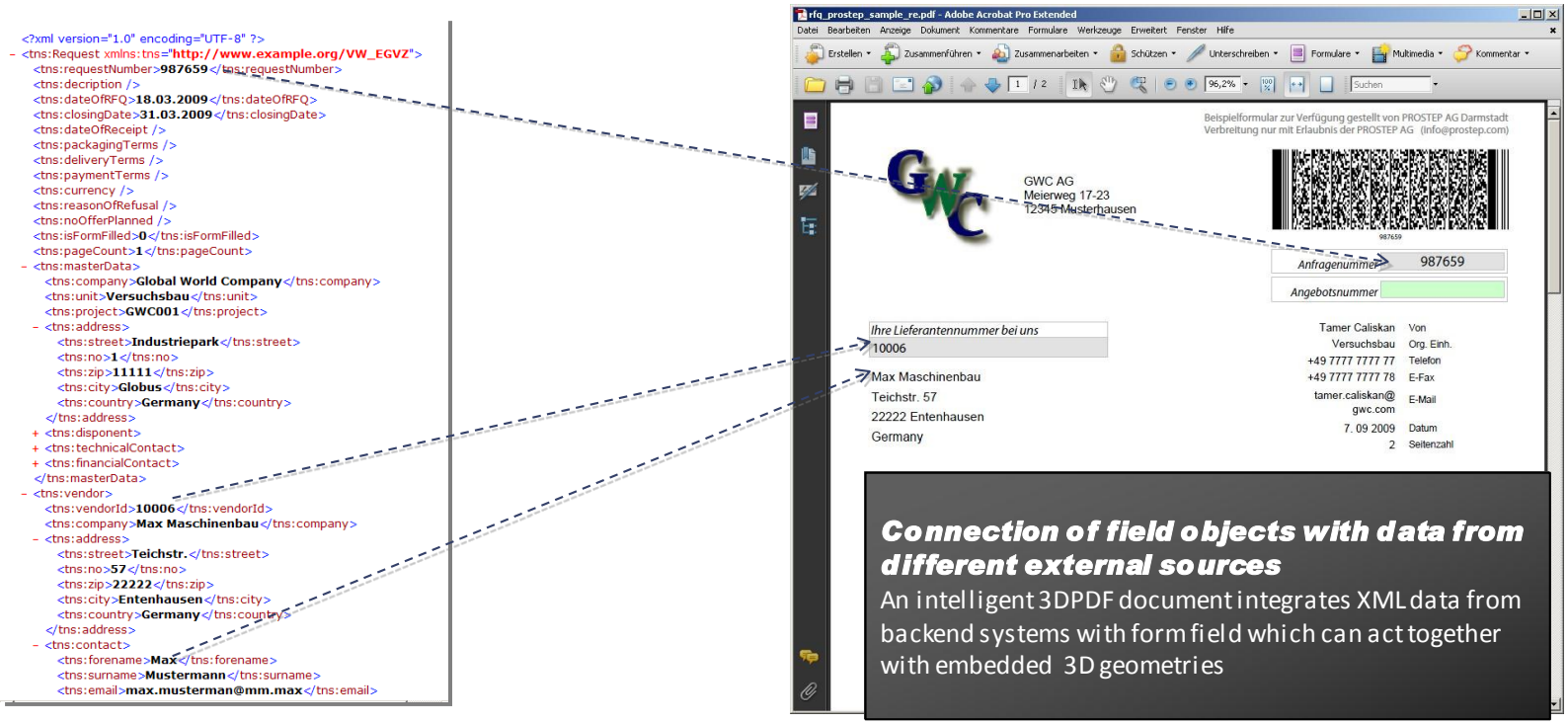


3D data is a stream within the PDF

Geometry data is sequential binary; other data is XML and accessible

Tools exist to do the conversion from authoring system and placement in PDF file

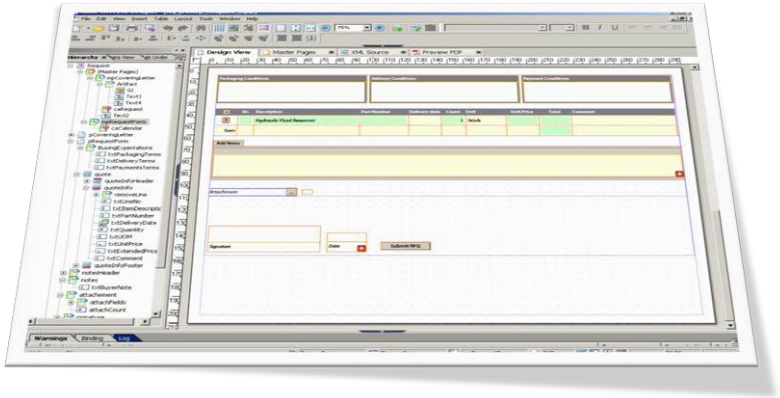
Data binding



Templates

Predetermines layout

- Where objects are placed
- How data binding is realized
- How objects behave



Visible content

- Text
- 2D and 3D
- Form objects (editable)
- Control elements (buttons, lists)

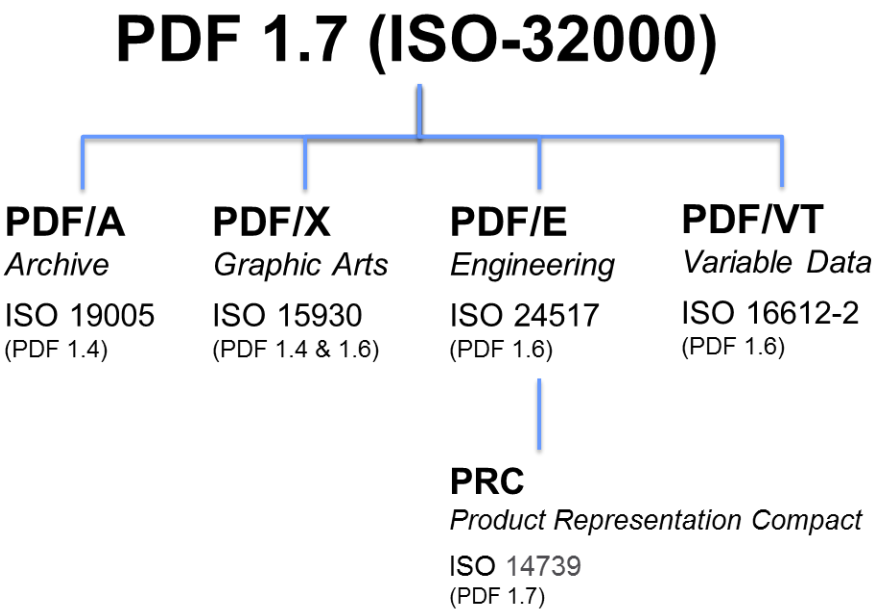
Data content

- XML data

Control logic

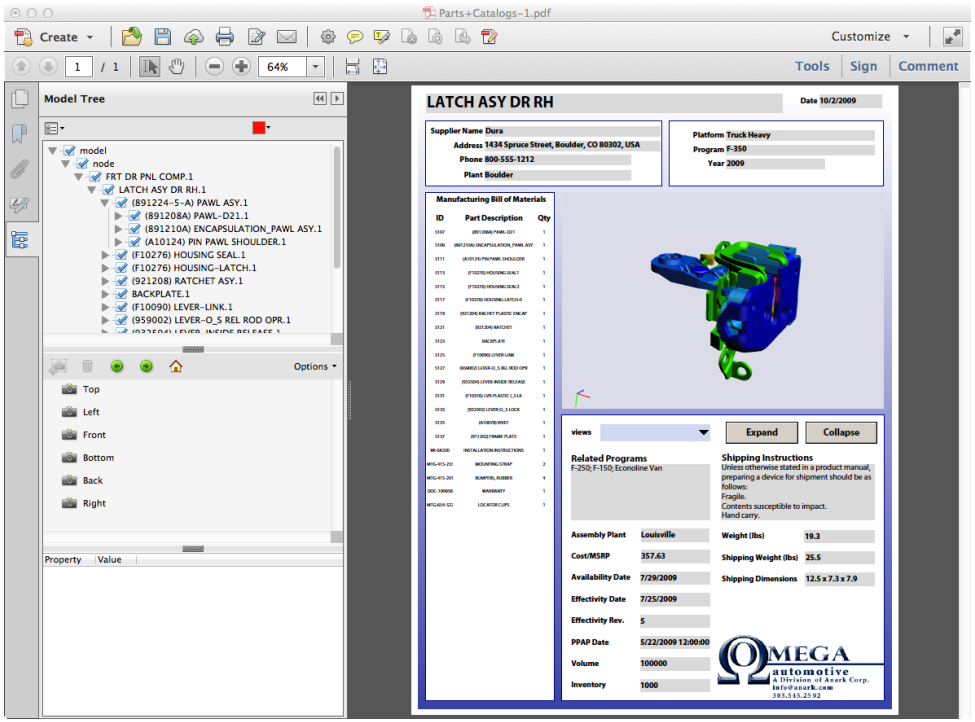
- JavaScript
- FormCalc
- Flash apps

PDF standards



What is PDF/E?

The engineering document format



Why develop an engineering version of PDF?

Engineering today is mostly done in 3D

Multiple proprietary CAD data formats exist

- **AutoCAD, CATIA, Siemens NX, PTC Creo, etc.**

Tools for proprietary formats are expensive

Existing open standards for CAD data are too old (IGES) or do not have a standard viewer available (STEP, JT)

Estimated that there is up to 4 times the demand for CAD data outside the engineering department – RFI/RFQ, assembly instructions, maintenance manuals, marketing, etc.

PDF/E (ISO 24517-1:2008)

Based on PDF (ISO 32000-1)

Covers 3 primary areas:

- Incorporation of complex engineering data into compact PDF (3D, object-level data, etc.)
- Accurate printing of engineering drawings
- Support for secure exchange/management of annotation and markup data

Constrained to provide predictability

- All fonts MUST be embedded
- No external resources; self contained
- 3D, Layers, Multimedia

The need to archive PDF/E

Long life cycle products

- Airplanes
- Ships
- Automobiles
- Buildings
- Nuclear Power Plants
- Off Short Platforms
- Etc.

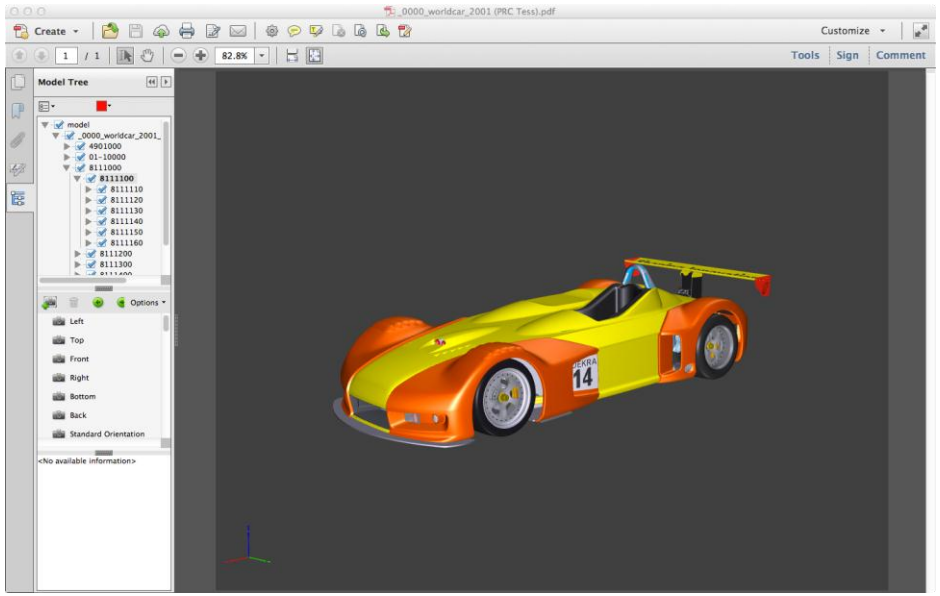
Need to maintain / repair / operate these designs throughout their lifecycle

Engineering archival requirements

Model has to maintain it's original form

Relationships between multiple objects must be preserved

- **Assemblies / Subassemblies / Parts**



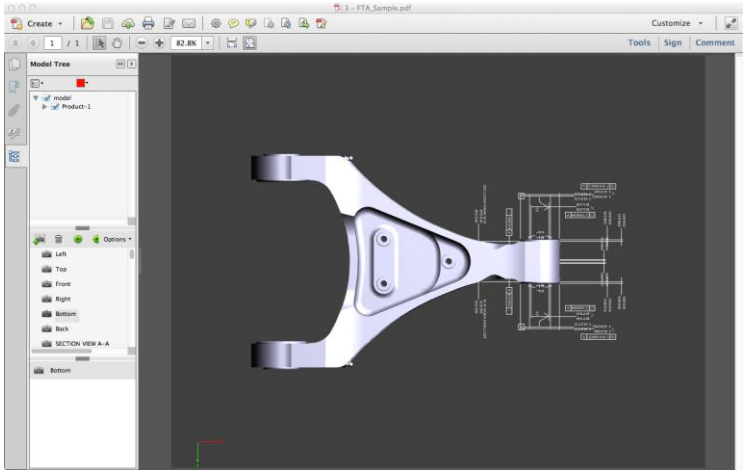
Engineering archival requirements

Preserve attribute data that is associated to the model

- **Properties – materials**
- **Manufacturing Information - PMI**

Preserve views of the model

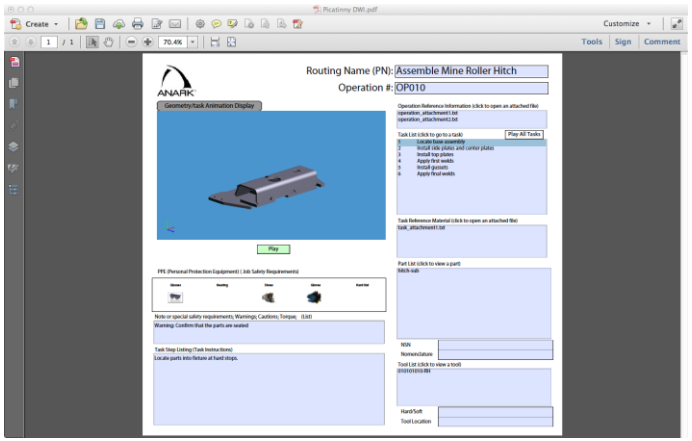
- **Camera, Hide/Show, Sections, etc.**



Engineering archival requirements

Preserve relationships between the model and associated data

- Inspection data
- Bill of Materials (BOM)
- Animations
- Visual Response

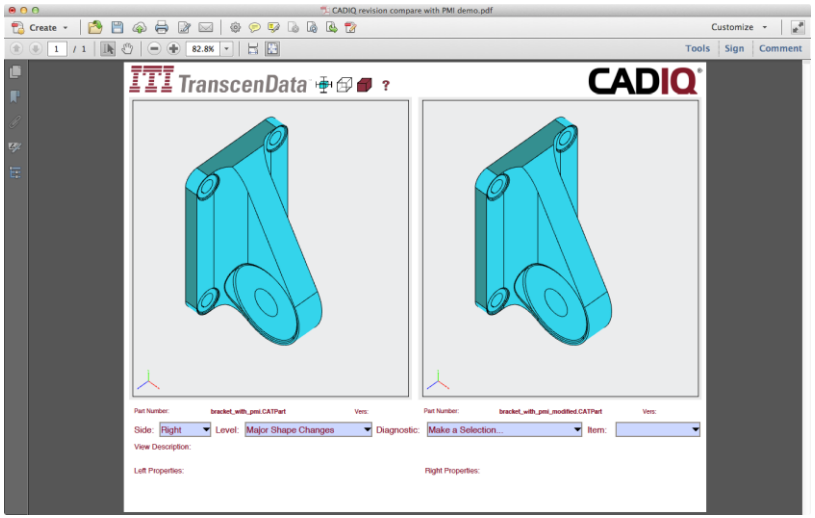


Engineering archival requirements

Preserve validation information

Preserve Digital Rights (DRM)

Preserve associated business information (attachments)



PDF/E-2 (ISO 24517-2)

The Engineering Archival Format

- **Aligned with ISO 32000-2 (PDF 2.0) for engineering features**
- **PRC (ISO 14739-1)**
  - Compact, precise engineering data
- **Geospatial (GIS)**
- **2D & 3D Measurements**
- **3D JavaScript**

Currently under development

Benefits of the PDF Platform

Access

- through Acrobat Reader

Multi-type

- 3D, 2D, image, text, audio, video, enterprise data

Fit for purpose

- JavaScript support, templates, forms, portfolios

Infrastructure

- existing systems and resources already support PDF

Neutrality

- Investment protection

Value

- Low investment threshold with high payback

PDF/A vs PDF/E:2

PDF/A

- **Multiple versions (1 – 4)**
- **Each version less restrictive**
- **Developed for archivist community**
- **No 3D**

PDF/E:2

- **Developed as archival standard for engineering PDF**
- **Confusing name**

ISO Standards

PDF/E

Portable Document Format - Engineering

ISO 24517:2
Started in 2002

- **Content**
  - 3D (precise and tessellated)
  - Product Structure
  - PMI
- **Use Cases**
  - MBD
  - 3D Visualization
  - Archiving
- **Increasing usage in Model Based Enterprise**

JT

Jupiter Technology

ISO
Started in 1990

- **Content**
  - 3D (precise and tessellated)
  - Product Structure
  - PMI
- **Use Cases**
  - 3D Visualization
  - DMU
  - Archiving
- **Increasing usage in Engineering**

STEP

Standard for the Exchange of Product data

ISO 10303
Started in 1984

- **Content**
  - 2D/3D (precise)
  - Product Structure
  - PMI
  - Additional life cycle data
- **Use Cases**
  - CAD/PLM Data Exchange
  - Various AP
  - LOTAR
- **High usage and wide dissemination**

STEP - Strengths / Weaknesses

Strengths

- **LOTAR**
- **Designed to be the "digital thread" for engineering**
  - Process automation
- **Wide adoption by engineering applications**

Weaknesses

- **No visualization data**
- **Few viewers available**
- **File size**
- **No document capabilities**

JT- Strengths / Weaknesses

Strengths

- **Siemens / Teamcenter**
- **Visualization**
- **Compressable**

Weaknesses

- **No adoption by some major engineering software developers**
- **No standardized geometry representation**
- **Weak document capabilities**

PDF:E - Strengths / Weaknesses

Strengths

- **Designed to archive documents, not just data**
- **Forms / Templates**
- **Scripting**
- **Audio / Video**
- **Drawings**
- **Highly Compressed**

Weaknesses

- **Geometry not read by engineering applications**
- **Weak process automation capabilities**

Complementary Archiving Standards

Use strengths of one format to offset weaknesses of another

STEP + PDF

- **PDF used as containing document**
  - Visualization
  - Documentation
- **STEP file attachment**
  - Geometry
  - Process automation