Optimizing Process-Definition Datasets
Using 3D Product Definition to Improve and Automate Downstream Processes

Bryan R. Fischer
President/Consultant/Trainer

MBD360 LLC
Training – Consulting – R&D

- 3D Model-Based Product Definition (3D MBD)
- 3D Model-Based Business Processes (3D MBx)
- 3D MBx Implementation & Optimization
- Drawing and Modeling Standards
- Product Definition & Development
- PMI, GD&T, and Tolerance Analysis

About Us
3D Model-Based Materials

“Digital Data Sets and 3D Solid Modeling”

“3D Model-Based Product Definition and Model-Based Enterprise Overview Workshop”
MBD360 LLC, 2013

About Us

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Other Major Works

“Mechanical Tolerance Stackup and Analysis”
CRC Press

“The Journeyman’s Guide to GD&T”
Advanced Dimensional Management Press

“GD&T Visual Glossaries”
Advanced Dimensional Management Press

“Drawing Requirements Manual”
11th Ed., IHS Global

“GD&T Update Guide: ASME Y14.5-2009”
Advanced Dimensional Management Press

About Us
Definitions

Product Definition Data
Defines a product and its requirements
Not how it is made, used, etc.

Product Definition Dataset
Computer files that define a product and its requirements

Primary Authoring
Definitions

Process Definition Data
Defines a process related to a product

Process Definition Dataset
Computer files that define a process

- Procurement
- Estimating
- Planning
- Analysis
- Manufacturing
- Inspection
- Assembly
- Tooling
- Operation
- Maintenance
- Project Management
- Etc.

Secondary Authoring
A lot of work has been done on **Product Definition Data** and **Product Definition Datasets**

- Standardization
- R&D
- Testing
- etc.

**CAD-to-CAD is important, but it is only the first step**

**Highest Priority**

*How to use Product Definition Data*

There are right ways and wrong ways to use this data
Examples of Product Definition Data

Part Definition Datasets

Assembly Definition Datasets

Installation Definition Datasets

Part and Assembly Dataset Examples
Semantically-Modeled PMI vs. Visually-Displayed PMI
Visually-Displayed PMI / Annotation

• Defined on 2D drawings or improperly in 3D
• Visual content only

Semantically-Modeled PMI

• Properly associated to model
• Defined in predictable, understandable structure
• Computer sensible
Main Benefits of Semantically-Modeled PMI

• Can be used by automated and semi-automated processes
• Can be used directly in downstream processes
• Helps eliminate disconnected derivative datasets
• Improves process validation
• Facilitates feedback
• Ensures product quality
• Significant productivity increase with proper use
Product Definition

Process Definition

Process Definition

Use Case
Visually-Displayed PMI

The only use case for visible PMI is human interpretation

All uses yield disconnected derivative data

NOTES (UNLESS OTHERWISE SPECIFIED):
1. MATERIAL: .075 THICK (14GA) 304 SERIES SST.
2. OBTAIN DIMENSIONAL DATA FOR ALL UNDIMENSIONED SURFACES FROM CAD MODEL 12345010-1, REVISION A.
3. ALL INSIDE BEND SURFACES = 0.04 A B C
4. APPLICABLE STANDARDS:
   ASME Y14.5-2009
Visually-Displayed PMI

Only result of human use:

Recreate data in a process that is not linked to product definition data

We must eliminate disconnected use cases
Product Definition vs. Process Definition

A properly modeled Product Definition Dataset completely defines a product

Product is defined by

• Linked / embedded requirement definitions
• Geometry
• Annotation (PMI)
• Attribute data
• Metadata
• Reference to standards, specifications, etc.
Product Definition vs. Process Definition

A properly modeled Process Definition Dataset defines processes related to a product

Processes are defined by

- Links to Product Definition
- PMI
- Attribute data, metadata
- Tooling and fixture models and characterization data
- Path, sequence, tool data, tool life, etc.
- Conformance to requirements, validation data
- Execution (who, when, where, how, duration…)
- Links to product definition
Product Definition vs. Process Definition

Today – often no link between process and product data it is intended to satisfy

Product data presented on 2D drawings or non-semantically

Humans must process presentation data to perform tasks (time, errors, cost…)

Downstream tools cannot use presentation data

Requirements are lost between initial concept, design, and production

Disconnected Datasets
Process Definition Data should be derived from & linked to Product Definition Data

- Eliminates redundant data
- Reduces errors
- Facilitates process validation
- Facilitates understanding and managing cost of satisfying product requirements
- Eliminates unnecessary process steps
- Improves quality and throughput
- Facilitates automation
- Facilitates feedback loops
Examples

Datasets

Connected and Disconnected
NOTES (UNLESS OTHERWISE SPECIFIED):
1. MATERIAL: 304 SERIES SST.
2. OBTAIN DIMENSIONAL DATA FOR ALL UNDIMENSIONED SURFACES FROM
   CAD MODEL 12345010-1, REVISION A.
3. □ 0.04 A B □ APPLIES TO
   ALL UNTOLERANCED SURFACES.
4. APPLICABLE STANDARDS:
   ASME Y14.5-2009
   ASMEY14.41-2012.

3D Model-Based Product Definition
Model Contains Implicitly-Defined Geometry and Explicitly-Defined PMI
Complete Product Definition

Product Definition Dataset
Process Definition Dataset - Manufacturing Plan - Option 5.1
Model Contains Implicitly-Defined Geometry and Explicitly-Defined PMI
Geometric Data and PMI Consumed from Model
Process Definition Dataset - Inspection Plan - Option 5.1
Model Contains Implicitly-Defined Geometry and Explicitly-Defined PMI
Geometric Data and PMI Consumed from Model

Product Definition Dataset - Inspection
Contact

3D Model-Based Business Processes
Methods — Standards — Optimization — Software
Training, Consulting, and Implementation

Bryan R. Fischer
President, Author

16004 SW Tualatin-Sherwood Rd. #163
Sherwood, OR 97140

Get-it-Right!™

contact@mbd360.com
www.mbd360.com
1.503.625.2480

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Thank You