3D-Model Based Enterprise
a SASIG initiative

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SASIG is a global consortium of automotive standards organizations.
Effective Collaboration is Key to Optimal Operations
What is 3D GD&T?

3D GD&T (Model Based Definition) is a system in which product details are captured directly in the 3D model.
Embedded GD&T (EGDT) is the capability to create precise model-based definitions of dimensional tolerance requirements, associate those tolerances to features of a part/assembly model, and display that information within a 3D CAD model.
Why 3D GD&T?

IMPROVE COMMUNICATIONS

Drawings

Where is my Datum A?
(Difficult to Communicate GD&T Content)

3D GD&T

The highlighted area is Datum A
(Easy to Communicate GD&T Content)
Why 3D GD&T?
MANAGE GD&T

Drawings

How many Datums do I have?
(Difficult to manage GD&T Content)

I have Datums A, B, C, D, F
(Easy to manage GD&T Content)
Why 3D GD&T?

IMPROVE GD&T QUALITY

Drawings

Do I have any GD&T Mistakes?
(No Quality GD&T Check)

I have a Problem With Datum A
(Automatic GD&T Quality Checks)
Why 3D GD&T?
QUALITY – Intelligent Content w/Quality Checks

Intelligent system → 1. GD&T quality → 2. engineer’s GD&T skills
Why 3D GD&T?
QUALITY – Checking Inter-level zone dependencies

Weld Zones in **Part Drawing**

Product Details Managed on Separate Drawings

Weld Callouts in **Assembly Drawing**

Component details not visible at the assembly level
Child/Parent datum alignment can **Easily be checked Systematically using 3D GD&T**

Drawings needed for Datum B

All GD&T is contained in 3D Model

Sub-Level Assembly GD&T Datum B Feature

Top Level Assembly GD&T Datum B Feature
Why do we need 3D MBE?

- Drawings Limitations/Issues
- 3D Product Definition Model Benefits
- 2D Skills in a 3D World
3D-MBE Vision

To Promote the implementation of the 3D-MBD Model to enable seamless sharing of Product information within the extended enterprise and the Automotive industry.

Current State

- **Design**
  - CAD: 3D+2D
  - Viewer: Reference

- **Production/Supplier**
  - CAD: 3D Only
  - Viewer: Reference

3D-MBE Vision:

- **Style Design**
- **Mechanical Design**
- **Testing**
- **Manufacturing Engineering**
- **Quality**
- **Purchasing**
- **Logistics**
- **Marketing & Sales**
- **Service**
- **Planning**
3D-MBE Maturity Index

**Drawing Centric**
- 2D Master Drawing – 3D model not verified or configuration controlled

**Model Centric**
- 2D Master Drawing w/ associative 3D model (Model is verified and configuration controlled)

**Model Based Definition**
- 3D Master CAD Model with 3D annotations – Fully leveraged by the Enterprise

**Model Based Enterprise**
- All Product Information

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**Product Data Creation**

**Validation**
- Geometry Validation
- Name
- EME Validation
- Checker
- 

**Consumption**
- (Downstream Usage)
- CAD
- PMI
-

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<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
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**Drawing Authority**

**Model Authority**

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SASIG
Strategic Automotive Product Data Standards Industry Group
# 3D-MBE Benefits

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<tr>
<th>Category</th>
<th>Key Enablers</th>
<th>Typical Range</th>
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<tr>
<td>Designer Efficiency</td>
<td>• GS&amp;T advisor supported GD&amp;T information added to 3D model</td>
<td>10 - 30%</td>
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<td>Engineering Efficiency</td>
<td>• Reduced involvement in repeat drawing creation iterations for GD&amp;T information checking and validation</td>
<td>5 – 10%</td>
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<td>Engineering effectiveness improvement</td>
<td>• Productivity gains to effectiveness</td>
<td>10 – 20%</td>
</tr>
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<td>Reduced need for manufactured part checking</td>
<td>• Access to correct GD&amp;T information for manufacturing process planning</td>
<td>15 - 25%</td>
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<td>Reduced Rework and Scrap</td>
<td>• Access to correct product information</td>
<td>10 – 20%</td>
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<td>Improved win rate (and margins) through higher quote confidence</td>
<td>• Sufficient time for cost estimation and sourcing based on timely and accurate PMI data availability</td>
<td>TBD</td>
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<td>Quality of Life Improvement</td>
<td>• Eliminate non-value work</td>
<td>Intangible but Significant</td>
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<td>Risk mitigation against significant product fulfillment error</td>
<td>• Single source of product information • Access to correct product information to all stakeholders</td>
<td>Significant</td>
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Target: Reduction in physical parts and testing by 50%
What is role of Drawing?

Current State

Future State

Too big of a jump

All major OEMs have been trying for the past 10 years to implement full 3D.
What to do about operations that was always done in 2D?

Start transition to 3D models

- Address issues in the transitioning stage
- Addressing 2D drawing for legal compliance
  - Document for submission to government agencies
  - Contracts with suppliers
  - Drawing mark-ups made at work site
    - Circulated by physically providing on site in paper
  - Being able to see the whole drawing at once
  - Paper drawings spread out line side
  - Size reduction to send files
  - No tools necessary (PCs not needed)
  - Management of approved information

3D Only

- 3D + Automatic 2D

3D+2D (2D+3D)

Automatic 2D

Continue 2D operations in the transitioning stage

- 2D drawing operation
- Disposed

To address the 2D drawing processes

• 2D drawing automatically created with 3-view drawings and layout of views

Future

3D penetration rate
3D MBD Utilization

Visualization CAD

Native CAD

3D PDF

JT

Prototype Part

Eng.

AMEs

AQEs

Suppliers

Design

Eng.

Suppliers

Tool Shop

Purchasing

Costing

Etc,

AMEs

Tool Shop

Insight. Expertise. Results.
An OEM study validated a 50% man-hour reduction using 3D Annotated Models.
Virtual verification (Compare a scanned part to 3D GD&T model) Higher priority for profile and position based callout in GD&T compare

Virtual verification can significantly reduce PPAP cost and be a powerful tool in 6 sigma studies
Model Based Dimensional Analysis

Development
“ROBUST DESIGN”
Product Development Based
Driven by:
Engineering Defined & Validated GD&T
Benefits:
Proactive DFMA Strategy
Enables Build Anywhere
Reduces Late Changes
Challenges:
Release Cycle Extension
Manage Variation as an element of the Product Definition

Product Lifecycle Stage
“VARIATION MGT”
Process Engineering Based
Driven by:
Manufacturing Updated GD&T
Benefits:
Process Driven Approach
Closer to the Build Issues
Challenges:
Less Iteration Flexibility
Manage Variation as an element of the Manufacturing Process Definition

Production
“FUNCTIONAL BUILD”
Plant Quality Based
Driven by:
Part Measurements
Benefits:
Based on Actual Variation
Challenges:
Reactive not Proactive
Manage Variation as an element of the Launch and Build Quality Process

Dimensional Engineering
Technical Data Package
Release to Release GD&T Compare

New Annotations
Old Annotations

Supplier BOM Package
3D Master: Important points to be considered

- Cultural Change
  - Think 3D and not 2D
- Impacts on internal Processes
- Evolution of certification
- Impacts on Supply Chain
- Communication and Collaboration
- Departments Barriers

Think 3D and not 2D