Defining the Minimum Information Model

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The industrial collaboration journey...

Yesterday

Communications often in serial fashion

You trusted the data because you trusted the person that generated the data

Collaboration meant face-to-face communication
The **digital product definition** becomes the *conduit* in a standards-based communication process.

The product *model* is the basis for a **secure**, **authoritative** source of product definition.

You come to trust the *process* that generates product data (because the person may be unknown).
Ongoing industrial challenges

• Driving product lifecycle data with high fidelity representations
• Global competition vs. democratization of technology?
• Design/make vs. make to print (model)?
• Product complexity: combination of mechanical, electrical, and software
• Product knowledge stored with people or artifacts?
• Mobility, Collaboration, and Interfaces ➔ the social psychology of expertise
What did we put into drawings?
What do we put into models?

For many people, it is a matter of whether they are an author or a consumer. MBD is fundamental to the future of digital manufacturing, but it is more than a proxy for a drawing.
Evolution of product representations

An exercise in information flow: right place, right form, right time

- Lifecycle based
- Drawing based
- CAD based
- MBx based
- Virtual environment based

Increased sophistication in the digital product and process representations and their fidelity to the physical world.
The communications spectrum...

A complete MBD supports lifecycle communication

**SHAPE**

**BEHAVIOR**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Standard</th>
<th>Unit</th>
<th>Value</th>
<th>Testing Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Thickness</td>
<td>EN 1663-1</td>
<td>%</td>
<td>≥3</td>
<td>every four per production run 1</td>
</tr>
<tr>
<td>Density (kg/m^3)</td>
<td>EN 1663-1</td>
<td>g/cm^3</td>
<td>≤3.4</td>
<td>per production run 1</td>
</tr>
<tr>
<td>Mass Flow Rate (L/min)</td>
<td>EN 1663-1</td>
<td>mL/min</td>
<td>≤3.4</td>
<td>per production run 1</td>
</tr>
<tr>
<td>Impact Absorption</td>
<td>EN 1663-1</td>
<td>%</td>
<td>≤3</td>
<td>per production run 1</td>
</tr>
<tr>
<td>Heat Resistance (J/kg)</td>
<td>EN 1663-1</td>
<td>%</td>
<td>≤3</td>
<td>per production run 1</td>
</tr>
</tbody>
</table>

**CONTEXT**

**HUMAN TO HUMAN**

**HUMAN TO MACHINE**

**MACHINE TO HUMAN**

**MACHINE TO MACHINE**
Demographics

Minimum information model Industry field distribution.

Aerospace: 22
Defense/Military: 12
Automotive: 24
Consumer products: 14
Medical: 11
Energy/Utilities: 11
Other: 24
Respondents indicated which job area they worked in.
Workflow Distributions

Respondents workflow participation.

<table>
<thead>
<tr>
<th>Workflow阶段</th>
<th>参与人数</th>
</tr>
</thead>
<tbody>
<tr>
<td>概念到原型</td>
<td>12</td>
</tr>
<tr>
<td>原型到详细产品定义</td>
<td>15</td>
</tr>
<tr>
<td>详细产品定义到制造/生产</td>
<td>19</td>
</tr>
<tr>
<td>制造/生产到检验</td>
<td>8</td>
</tr>
<tr>
<td>我不积极参与这些工作流程</td>
<td>11</td>
</tr>
</tbody>
</table>
Data Exchange Medium

What best describes the format or medium in which product information comes to you for use?

- 2D paper drawings
- 2D electronic drawings
- 3D native CAD models
- Derivative of 3D CAD model (STEP, JT, 3D PDF, etc.)
- Other
Inhibitors of MBD

Survey participants were prompted to indicate what prevents use of models if they selected that models could not be used in place of drawings.

The functionality of the CAD tool does not readily accommodate this type of information at this stage of the lifecycle.

Uncertainty about changes in software and accessibility of data in the future prevent us from using models at this stage of the lifecycle.

It takes too much time to enter this information into a model.

The information does not easily take a form that is useful in a model at this stage of the lifecycle.

Models are too cumbersome to modify and interrogate at this stage of the lifecycle.
Inhibitor of use of 3D Models in Workflow

Respondents of the various workflows were asked to select what was inhibiting the use of models in place of drawings.

- Models are too cumbersome to modify and interrogate at this stage of the lifecycle.
- The information does not easily take a form that is useful in a model at this stage of the lifecycle.
- It takes too much time to enter this information into a model.
- Uncertainty about changes in software and accessibility of data in the future prevent us from using models at this stage of the lifecycle.
- The functionality of the CAD tool does not readily accommodate this type of information at this stage of the lifecycle.
Expansion across the lifecycle

• Initial workflows were geared towards a more design → production focus
• Need to cover more of the lifecycle to give a better view
  – Design
  – Production
  – Sustainment
  – Goal of 5 workflows in each area
• Employ Delphi technique to reach consensus