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Model-Based-Definition

a key value driver for future product development

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AGENDA

- Challenges in the downstream use of technical documentation
- How Model Based Definition can help
- Traditional vs. future oriented
- What we can expect from Model Based Definition in the future
- Value focus

Derek

Aerospace Design Engineer

- Company – **jet engines manufacturer**
- Creates **designs & drawings**
- Collaborates with **4 different departments**
- Spends on average **14 hours a week documenting and communicating** iterative product designs
- He **believes** there should be a way to **work and collaborate more efficiently**

PRODUCT DEVELOPMENT

CMM

Responsibility:
Ensure that manufactured parts match their specifications

CAD

Responsibility:
Create a performing product design for a defined purpose

CAM

Responsibility:
CNC Machine Programming & tool path creation

CAE

Responsibility:
Ensure the design fulfills the performance expectations

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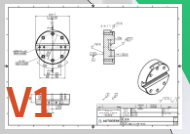

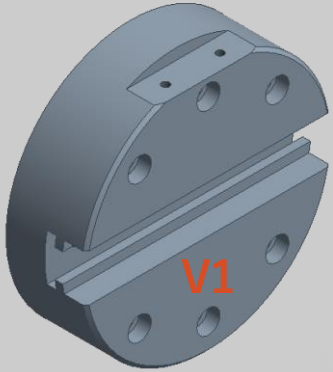

V1

Responsibility:
CNC Machine Programming & tool path creation

CAM

Responsibility:
Ensure the design fulfills the performance expectations

V1

CAE

CMM

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Responsibility:
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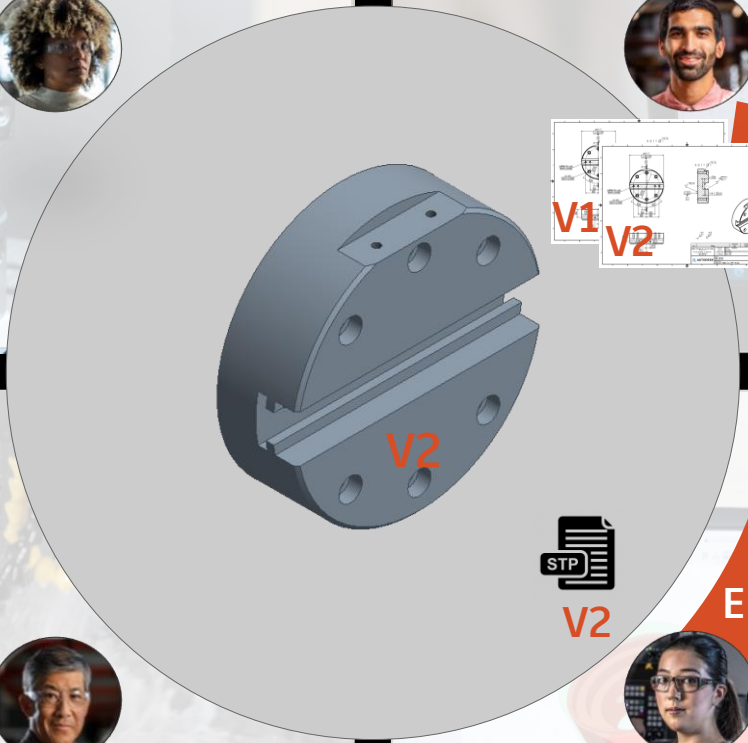
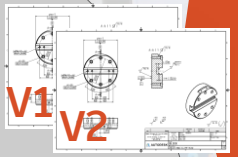




V2

ECR

V2

Responsibility:
CNC Machine Programming & tool path creation

CAM

Responsibility:
Ensure the design fulfills the performance expectations

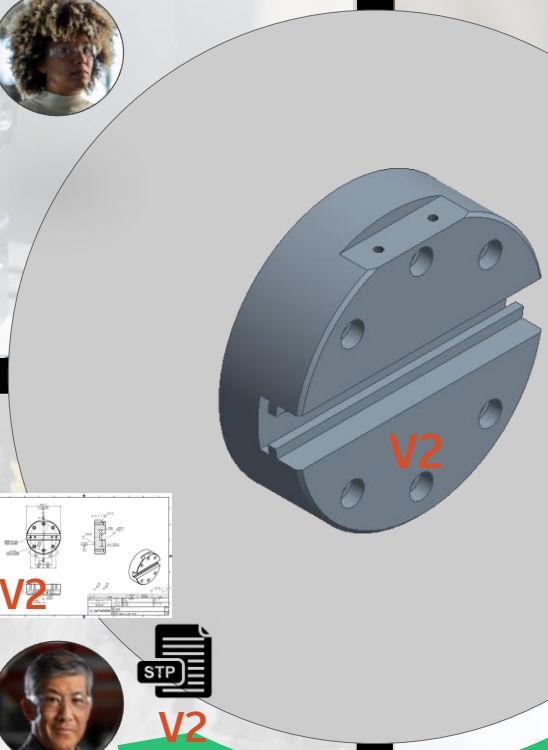
CAE

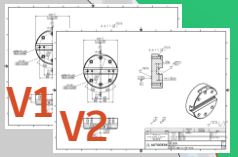
CMM

Responsibility:
Ensure that manufactured parts match their specifications

CAD

Responsibility:
Create a performing product design for a defined purpose





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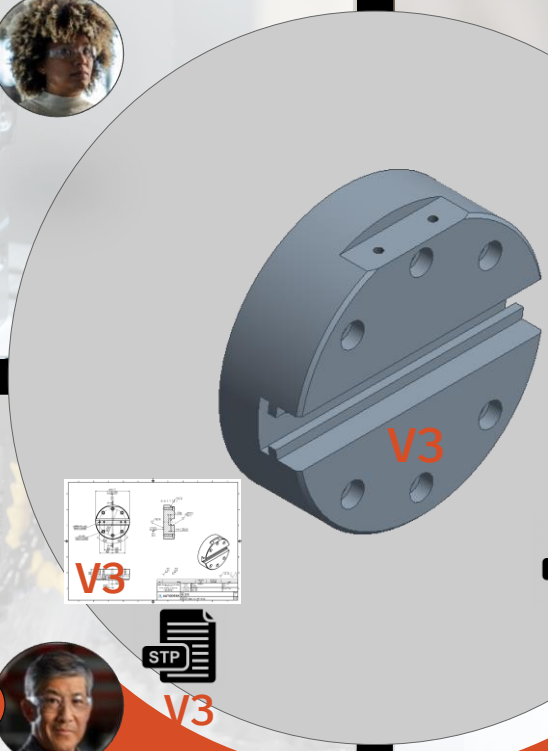
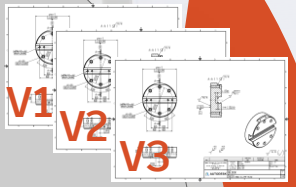




V2

Responsibility:
CNC Machine Programming & tool path creation

V3

ECR

V3

Responsibility:
Ensure the design fulfills the performance expectations

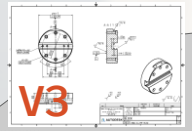
V2

CAM

CAE

CMM

Responsibility:
Ensure that manufactured parts match their specifications



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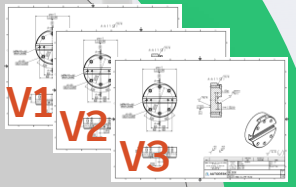

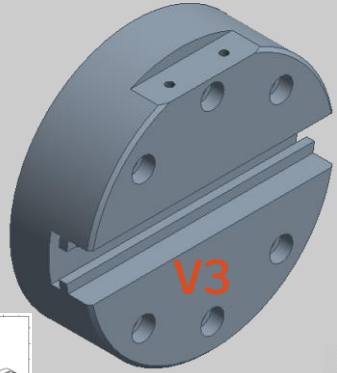

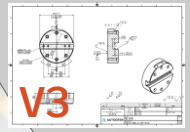

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Responsibility:
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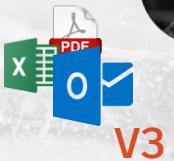


CAE

Responsibility:
Ensure the design fulfills the performance expectations


CMM
V4
Responsibility:
Ensure that manufactured parts match their specifications
CAD
Responsibility:
Create a performing product design for a defined purpose
ECR
V4
STP
V4
V4
V1
V2
V3
V4
V4
V3
STP
V3
STP
V2
Responsibility:
CNC Machine Programming & tool path creation
Responsibility:
Ensure the design fulfills the performance expectations
CAM
V3
V2
CAE

CMM

Responsibility:
Ensure that manufactured parts match their specifications

V4

V4

STP

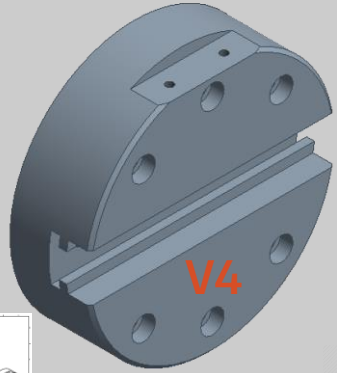
V4

ECR

CAD

Responsibility:
Create a performing product design for a defined purpose

V1 V2 V3 V4



V4

V3

STP

V3

STP

V2

Responsibility:
CNC Machine Programming & tool path creation

V3

CAM

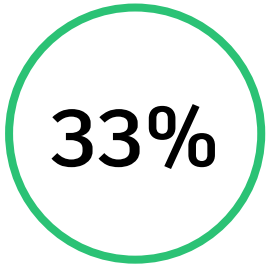
Responsibility:
Ensure the design fulfills the performance expectations

V2

CAE

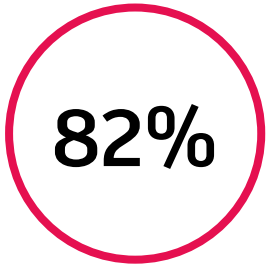
	Challenges	Consequences
CAD 	Iterative design implies repetitive updating of technical documentation	Outdated product documentation Inefficient change processes
CAE 	Difficulties to understand the design intent of the 3D model	Undetected critical design issues for product performance
CAM 	Choose the right manufacturing strategy based on product specifications	The manufactured part does not meet the intended functionality
CMM 	Manual toolpath creation is an error prone process	Undetected tolerance violations

Current State & Industry Challenges



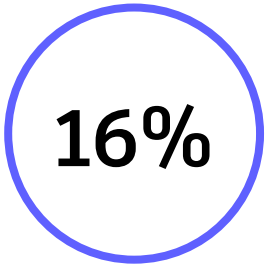
Eng. Efficiency

Design engineers spend more than one third of their time creating and updating 2D drawings and documentation



Automation

Up to 82% of time in manufacturing is spent on tasks that can be potentially automated



Quality

16% of manufacturing companies have a cost of poor quality that is higher than 4% of their annual sales revenue

Project

45% of product development projects are overdue being on average 20% behind schedule

CMM

Responsibility:
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V4

ECR

CAD

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V1

CAM

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CNC Machine Programming & tool path creation

V3

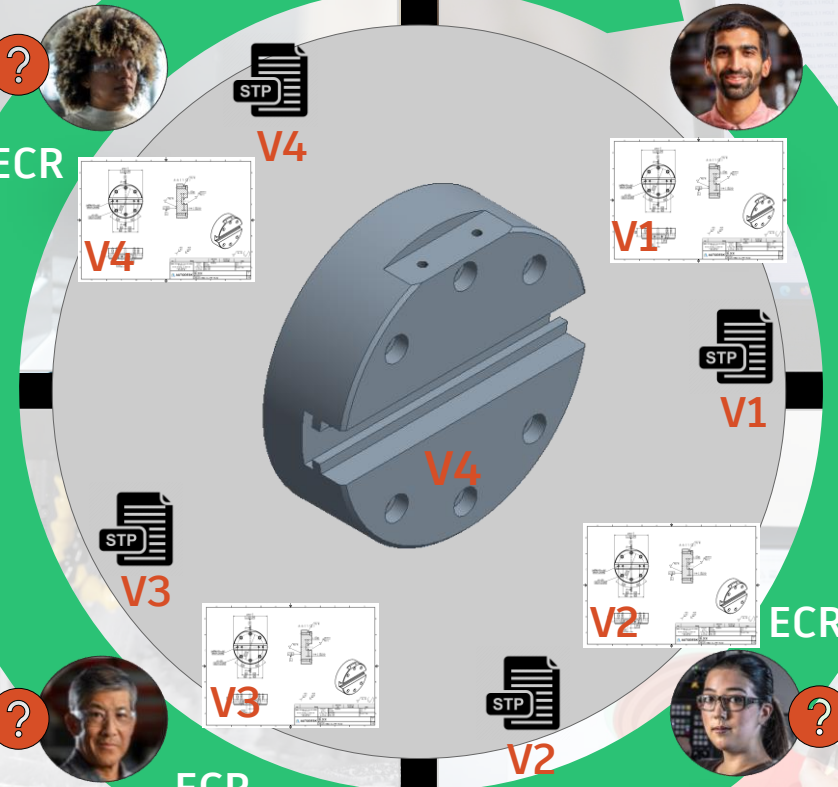
ECR

CAE

Responsibility:
Ensure the design fulfills the performance expectations

V2

ECR



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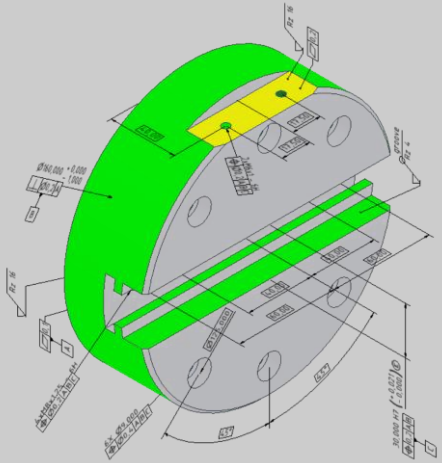

ECR

ECR

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CAM

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CAE

MODEL BASED DEFINITION - MBD
is an approach to creating **3D MODELS** so that they effectively contain **ALL** the **DATA** needed to **DEFINE A PRODUCT**

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MBD is a powerful set of tools for adding annotations, GD&T, and other manufacturing information directly to a 3D part

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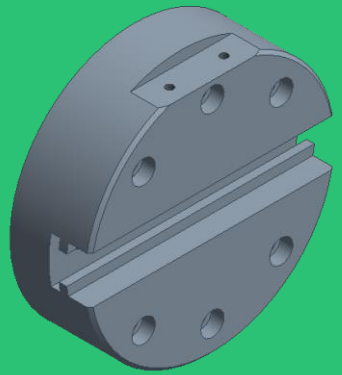
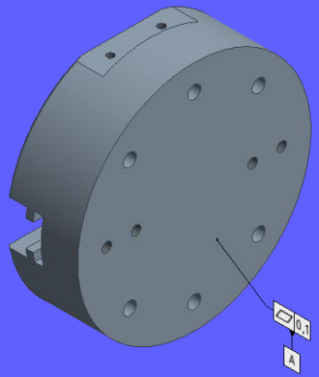
Geometry

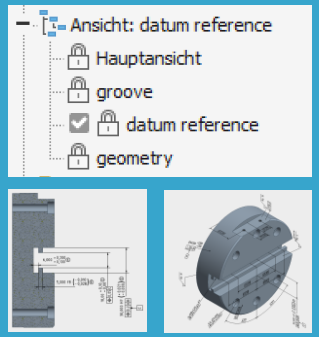


Annotation

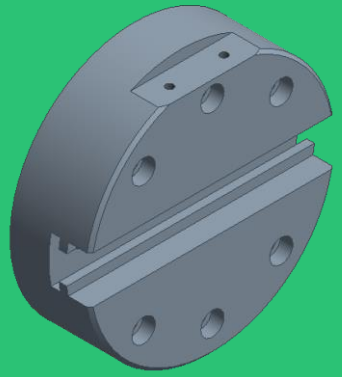


Metadata

Views



Geometry



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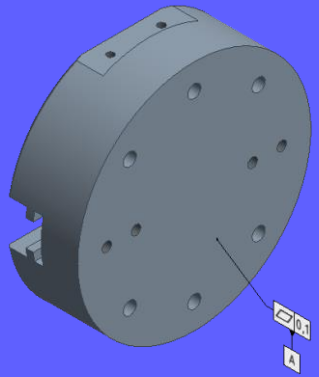

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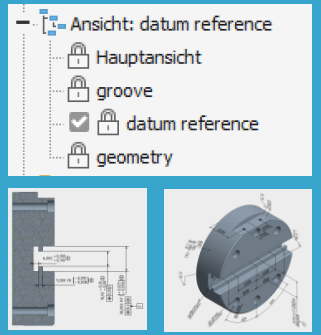
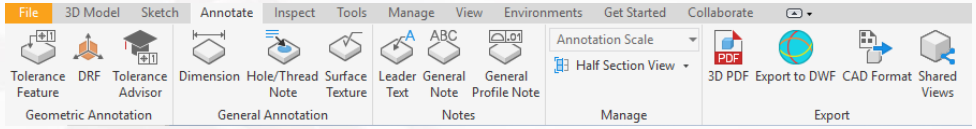


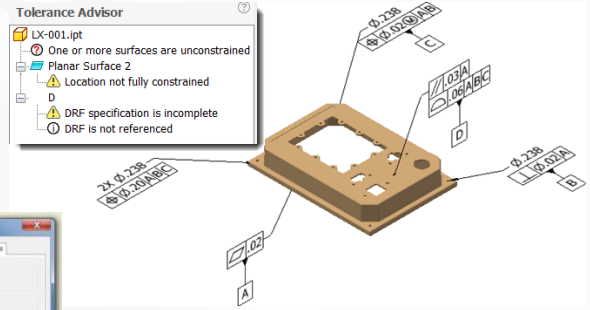
Human readable

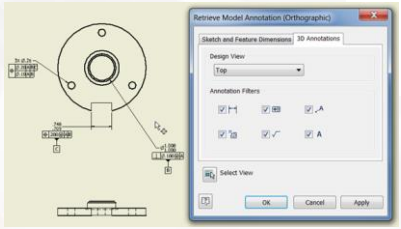
Machine readable

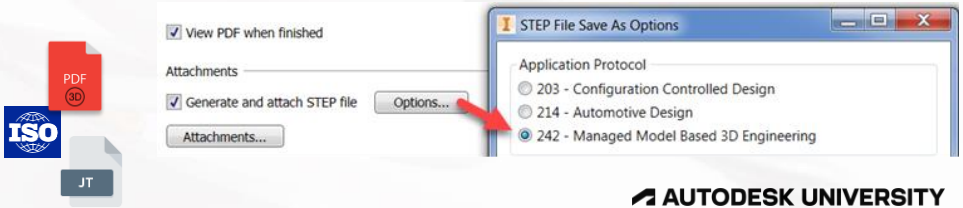
Model Base Definition - Workflow

- **Geometric Dimensioning and Tolerancing**
  - Complete support for GD&T in way of part design.
- **Tolerance Advisor**
  - Guides you through creating a fully constrained design.
- **Drawings**
  - Retrieve Annotations in Drawings
- **Export MBD**
  - Used in downstream manufacturing operations
  - Sharing Design to Mobile Platforms









DEMO - Comparison of methodologies

What

- Compare the traditional approach of defining an assembly with 2D drawings vs. the future oriented MBD approach

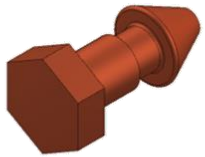
Why

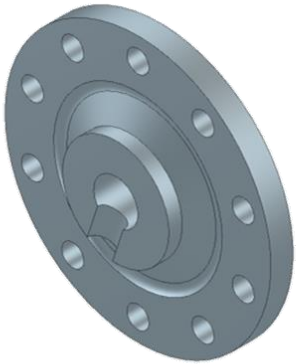
- Capture the net gain & benefits of using MBD
- Quantify the potential outcomes

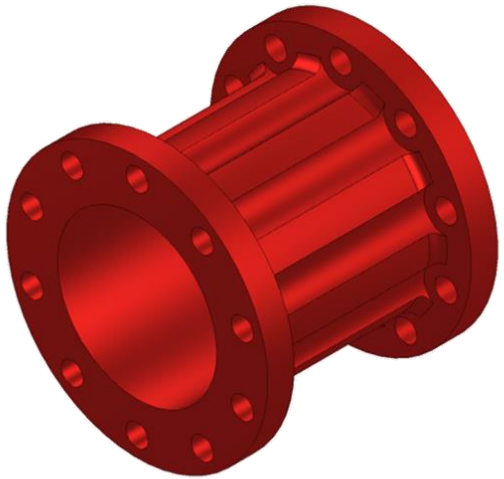
How

- Subassembly – 3 parts
- Complete technical documentation for downstream use
- Focus on time & clicks, usability, complexity

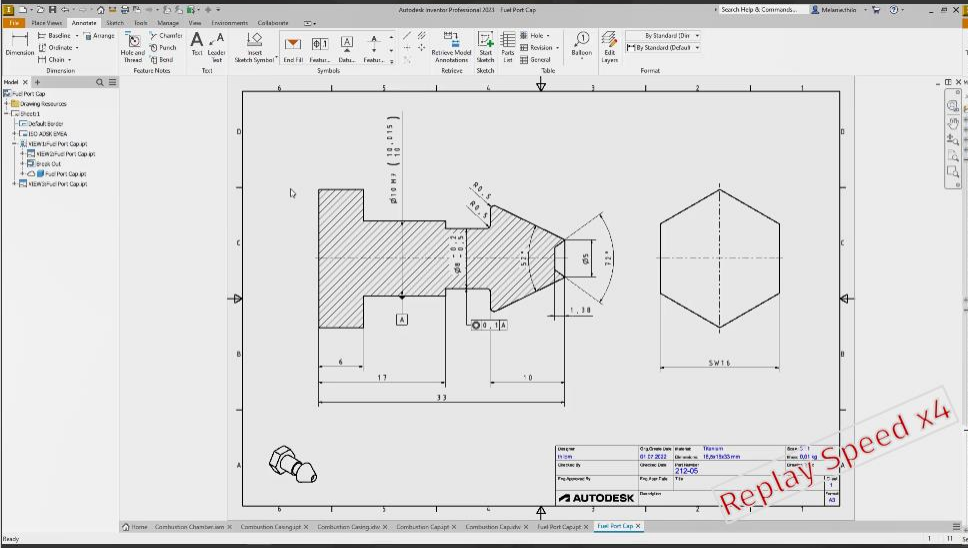
DEMO - Comparison of methodologies

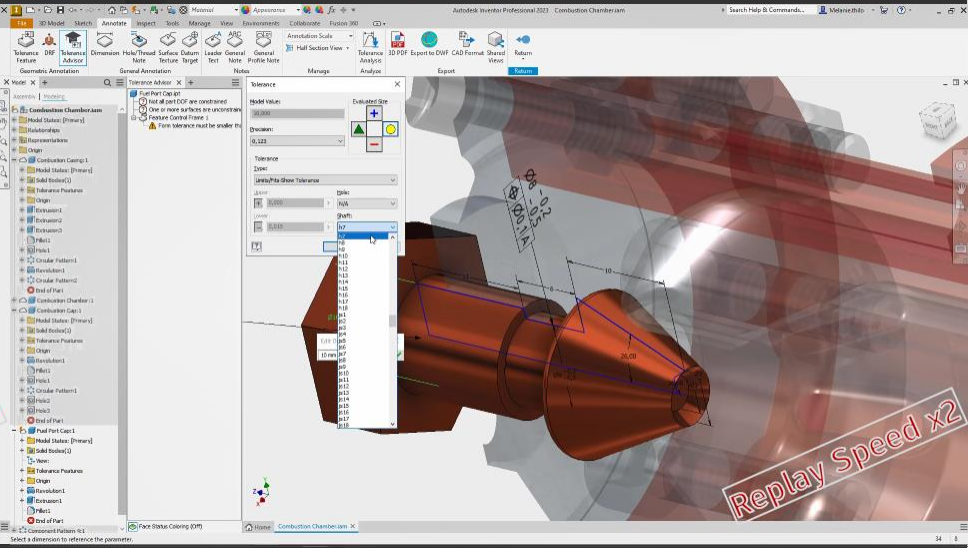




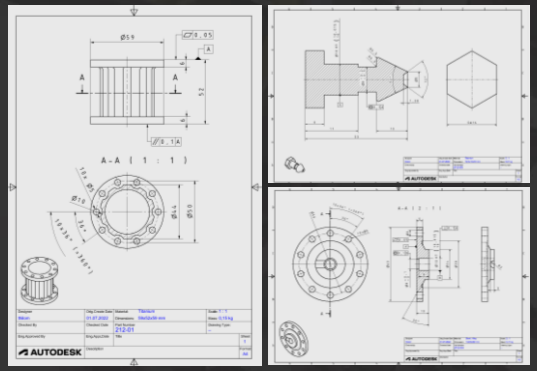


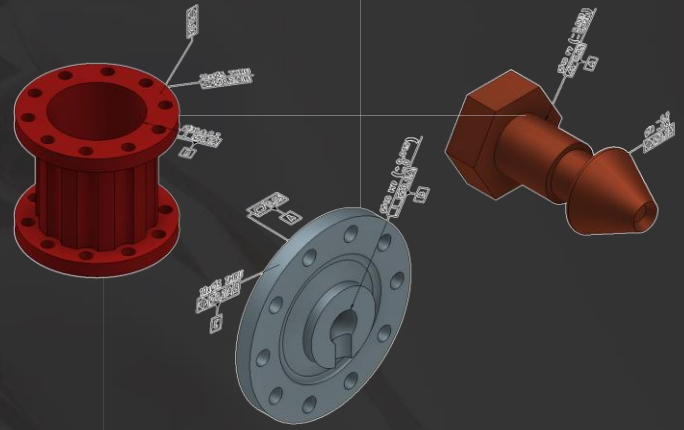
Without MBD vs. With MBD





Without MBD vs. With MBD





Without MBD		With MBD
30 minutes	77% time savings	7 minutes
3 derivates	30% less documents	1 CAD model
579 mouse clicks	79% less mouse clicks	122 mouse clicks
Manual update of 2D drawings	Process Automation	Automated change propagation
Human-readable	Manufacturing Automation	Machine-readable

WHAT'S NEXT?

Inventor

to

Fusion 360

Inventor

to Autodesk Make

PowerMill PowerInspect FeatureCAM

Inventor

NC Toolpaths

to

Forge App Code

Forge

CMM Paths

Third Party Workflows

Import Results back into QIF

QIF Model

Export FAI to Excel

View Bill of Characteristics

Potential Benefits & Outcomes

Efficiency

- Clear **product definition** via **3D model**
- **Single source** of truth
- **Faster & easier** approach
- **Manufacturing** automation

Cost

- Streamlined **product development**
- Less **engineering hours**
- Reduction of **waste, scrap & rework**
- Lower **cost of product development**

Quality

- Complete **product definition**
- **Compliant** with **industry standards**
- **Improved guidance** with GD&T Advisor & Tolerance analysis
- Less **warranty claims & returns**

Value & Key Learnings

...Streamlined

Process

Faster product definition

High automation potential

Single source of truth

...Less resources

People

Easier & faster approach

Accessible data to everyone

Less manual and repetitive tasks

...Better

Product

Consistency & standardization

Norm compliance

Less room for errors

ROADBLOCKS