AUTODESK. UNIVERSITY

Additive Manufacturing: A 360 Approach

Joshua Best

Technical Sales Specialist, Fusion 360| linkedin.com/in/joshmbest

@Fusion360_ Josh

About the speaker

Joshua Best is a qualified Mechanical Engineer currently working as a Technical Sales Specialist in the UK and Ireland with a core focus on Fusion 360; Autodesk's cloud Computer Aided Design, Manufacture and Engineering Platform. Josh has prior experience working within Applications Engineering and Technical Sales in the Additive Manufacturing industry in the UK and is twice published in academic papers.

Experienced in helping businesses identify the scope for revolutionizing traditional manufacturing through Computer Aided Design and Manufacture, Josh's passion stems from a desire to help form a better world through technology.

Learning Objectives

LEARNING OBJECTIVE

Understand what is involved in typical additive manufacturing workflows

LEARNING OBJECTIVE

Learn how to apply best practice to additive manufacturing strategy

LEARNING OBJECTIVE

Examine your readiness level for adopting additive manufacturing

LEARNING OBJECTIVE

Examine where additive manufacturing may be used within your business

Agenda

WHY

MOTIVATIONS FOR 3D PRINTING

- Advantages
- Business benefits
- Value add applications

First 15 minutes

WHAT

WHAT IS INVOLVED?

- Software / Hardware / Materials
- Design to Manufacture

Time Stamp 15 minutes

HOW

HOW CAN WE TAKE ADVANTAGE?

- Typical workflow demonstrations

Time Stamp 20 minutes

WHAT'S NEXT?

ADDITIONAL RESOURCES

- Getting started resources

Time Stamp 50 Minutes

Why 3D Print?

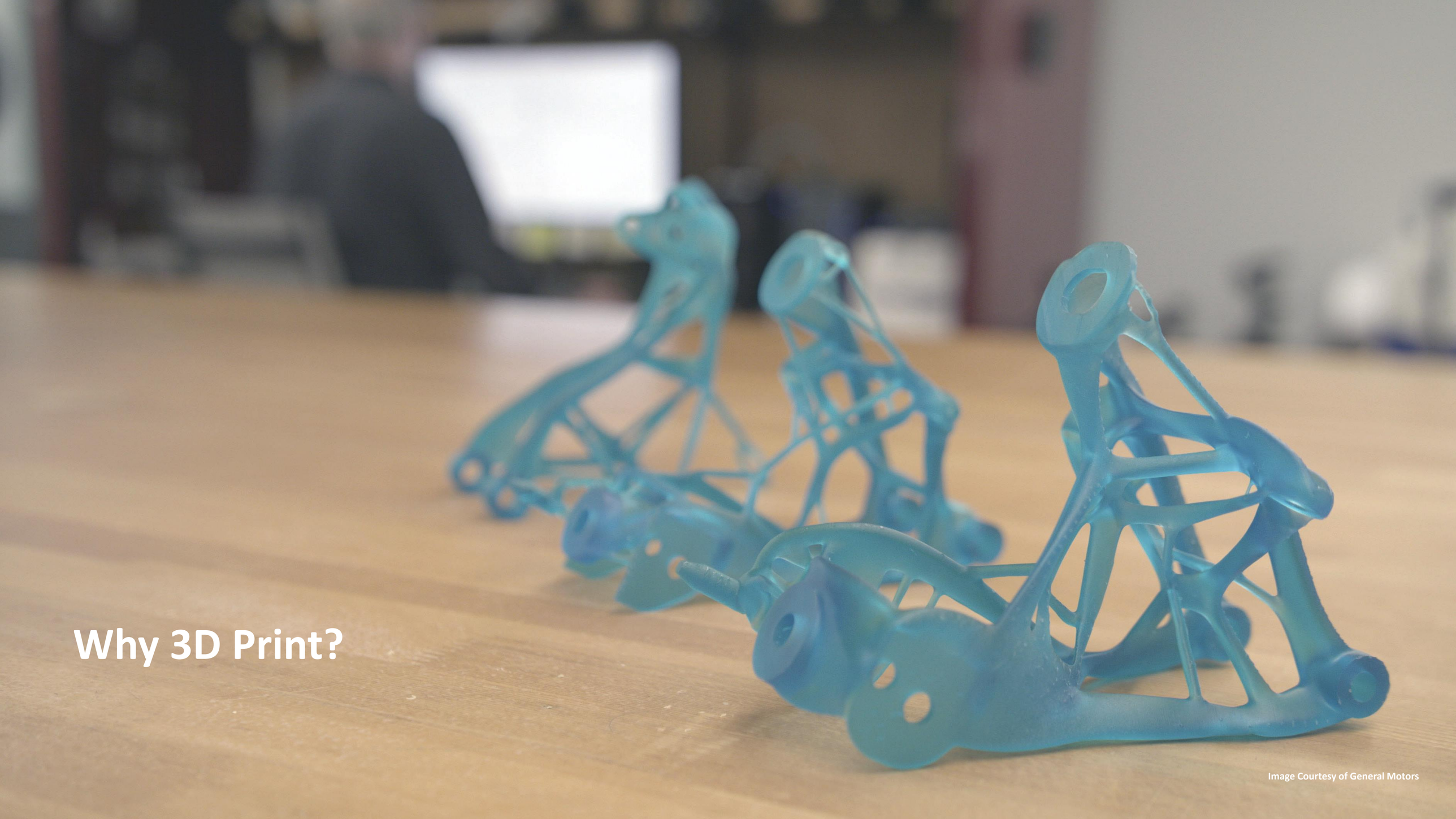
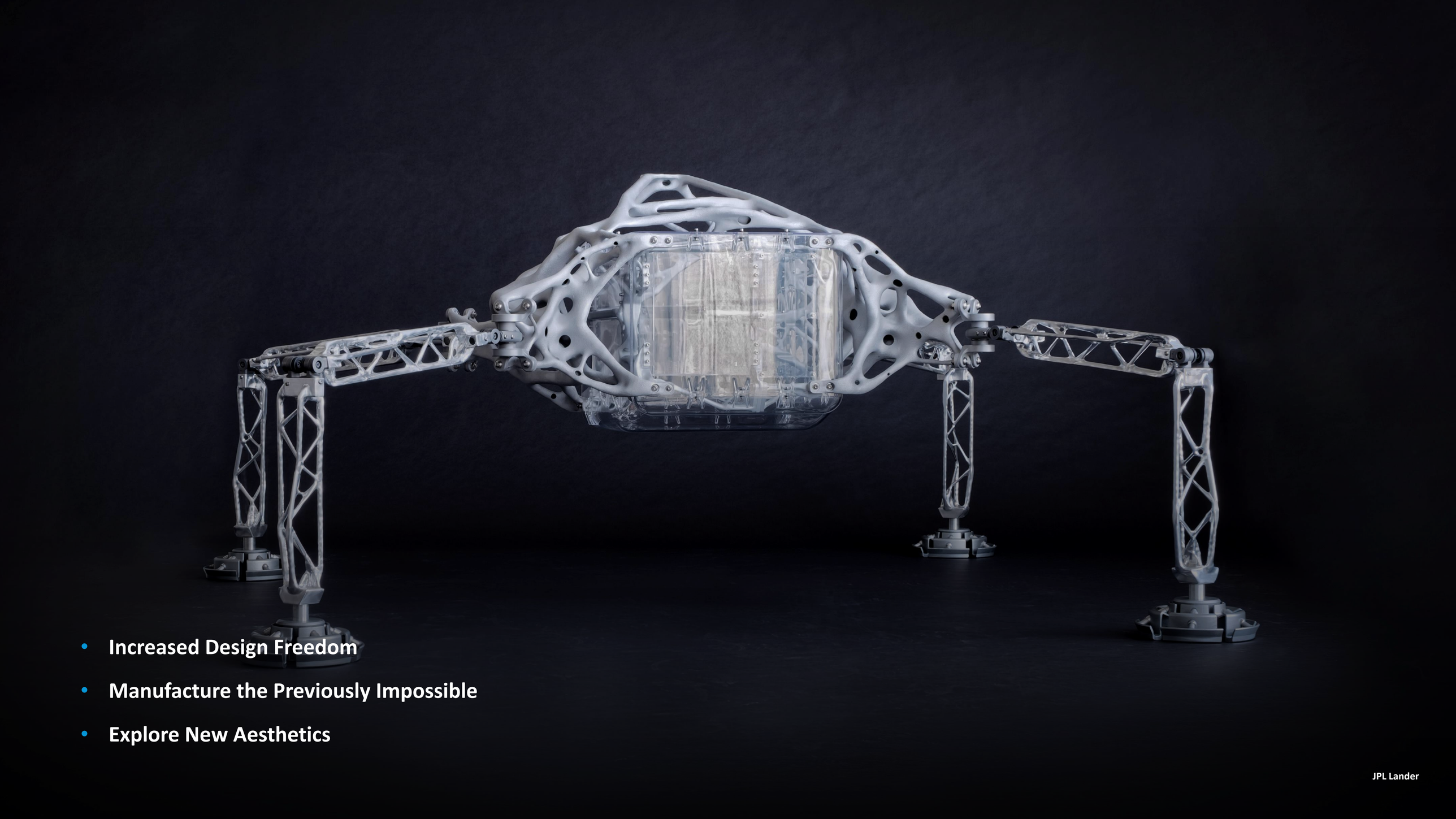


Image Courtesy of General Motors

- Localized Supply Chains
- Rapid Prototyping
- Increased Automation

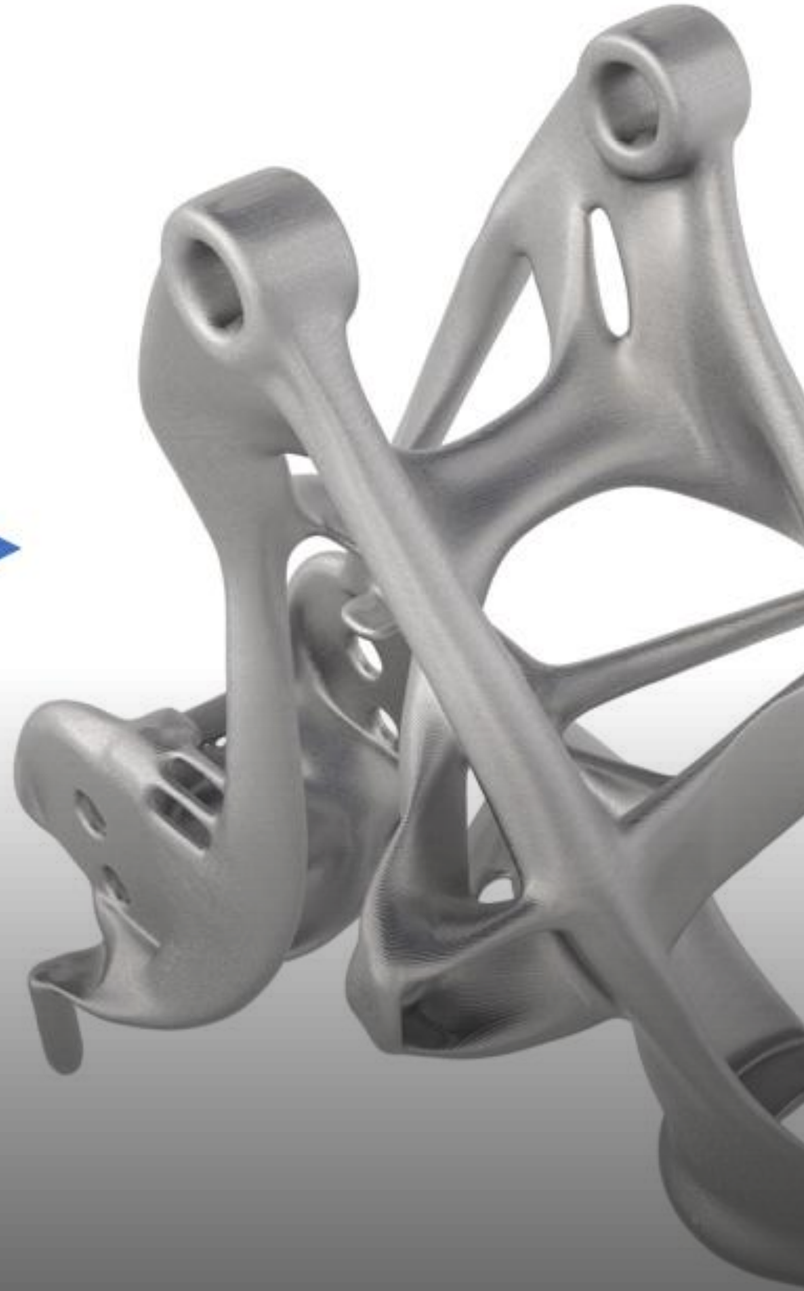


- Increased Design Freedom
- Manufacture the Previously Impossible
- Explore New Aesthetics

JPL Lander

Generative Design & Additive Manufacturing

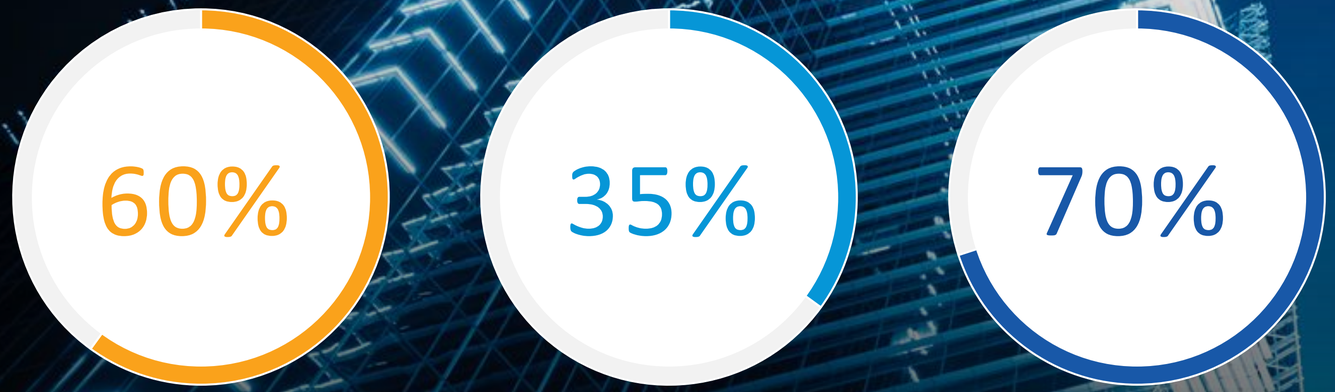
8 components into 1 part
40% lighter
20% stronger



- **Part Consolidation**
- **Increased Performance**
- **Lightweighting**

Image Courtesy of General Motors

HOW DOES THIS IMPACT YOUR BUSINESS



Time to Market

Print on Demand

Localised Supply Chains

Reduced Downtime

Cost Reduction

Reduced Material Usage

Increased Automation - Reduced Labour

Reduced Shipping Costs

Reduced Inventories

Product Lifetime Value

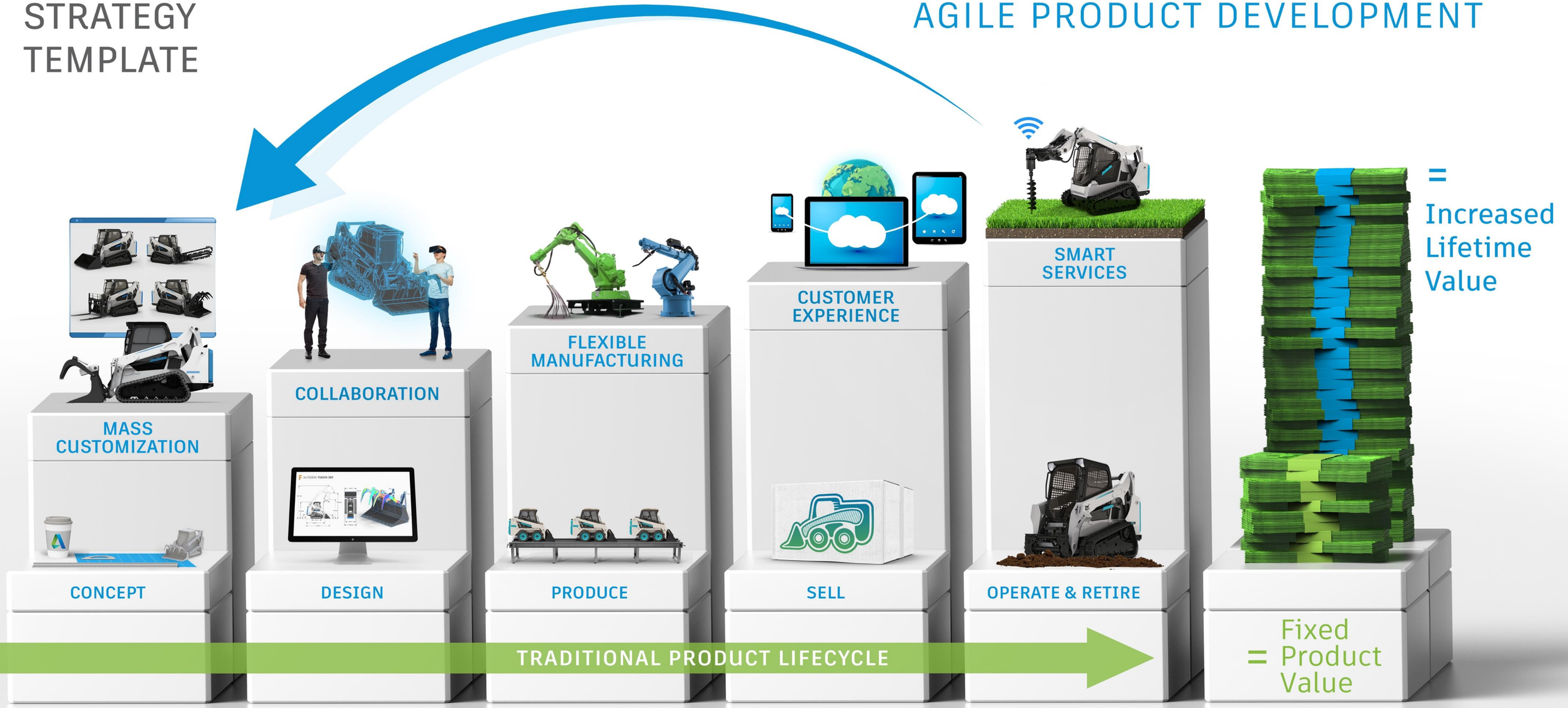
Mass Customization

Flexible Manufacturing

Increased Performance

DIGITAL STRATEGY TEMPLATE

AGILE PRODUCT DEVELOPMENT



AUTODESK.

Key Challenges / Barriers to Adoption

KNOWING THE REQUIREMENTS

What software, hardware, materials, skills and training will I need to get started?

UNDERSTANDING APPLICATIONAL SCOPE

Prove ROI to justify initial investment

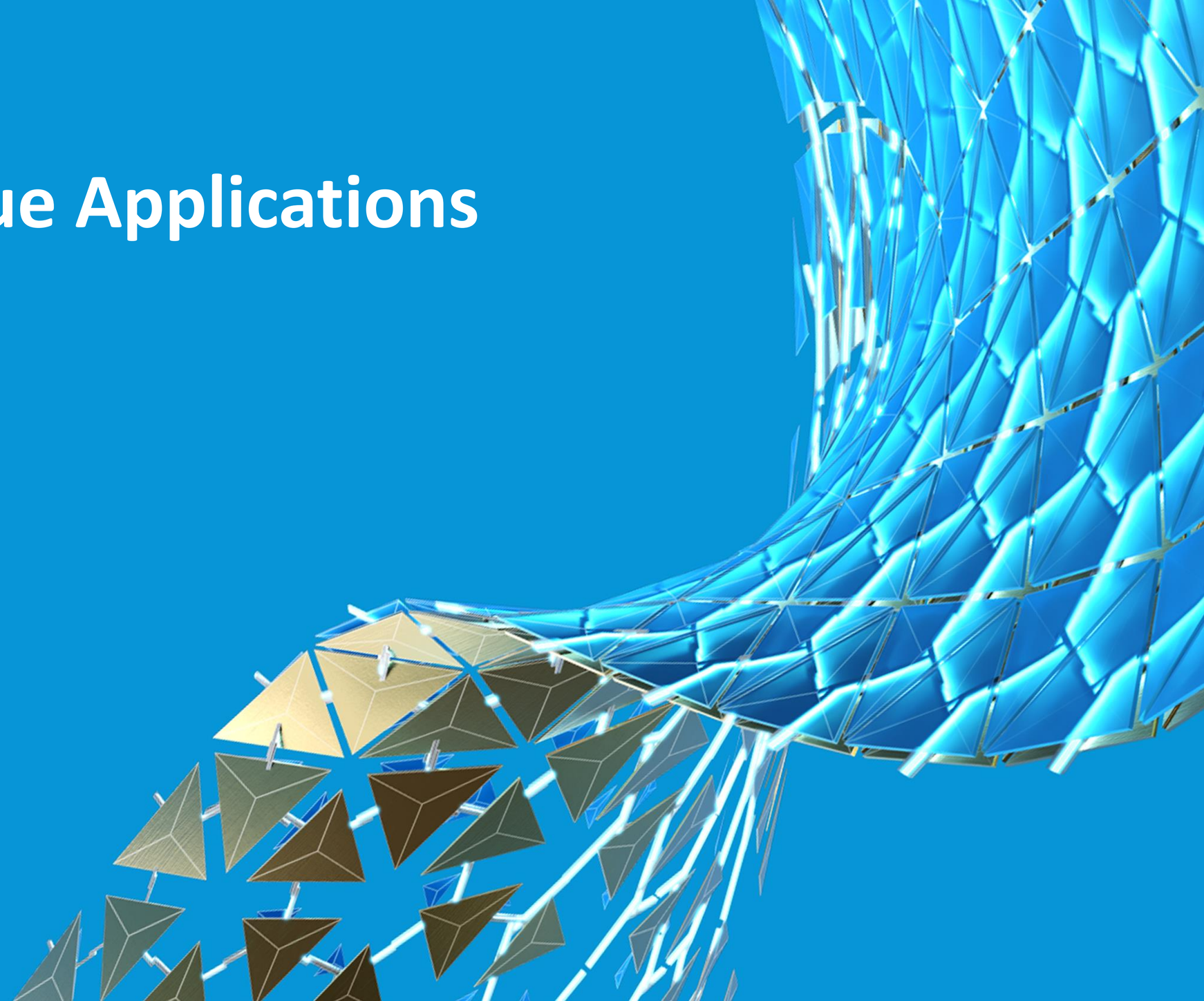
UNDERSTANDING RESOURCE ALLOCATION

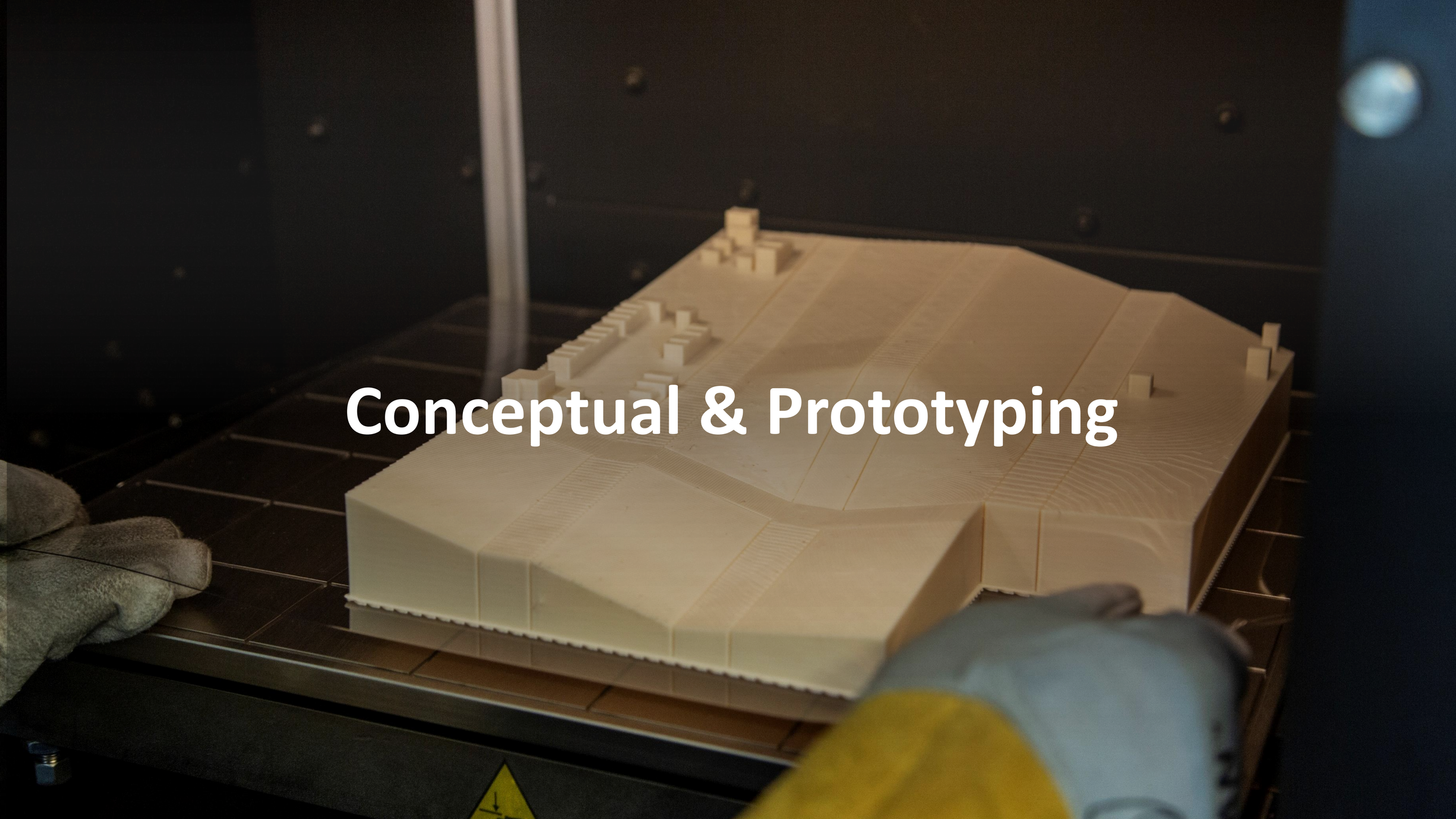
What resources will need to be allocated to address the skills gap in additive manufacturing?

UNDERSTANDING FEASIBILITY

How do I design for the process? What manufacturing constraints do I need to work to? What best practice can we follow to ensure we maximize on investments?

Common Value Applications



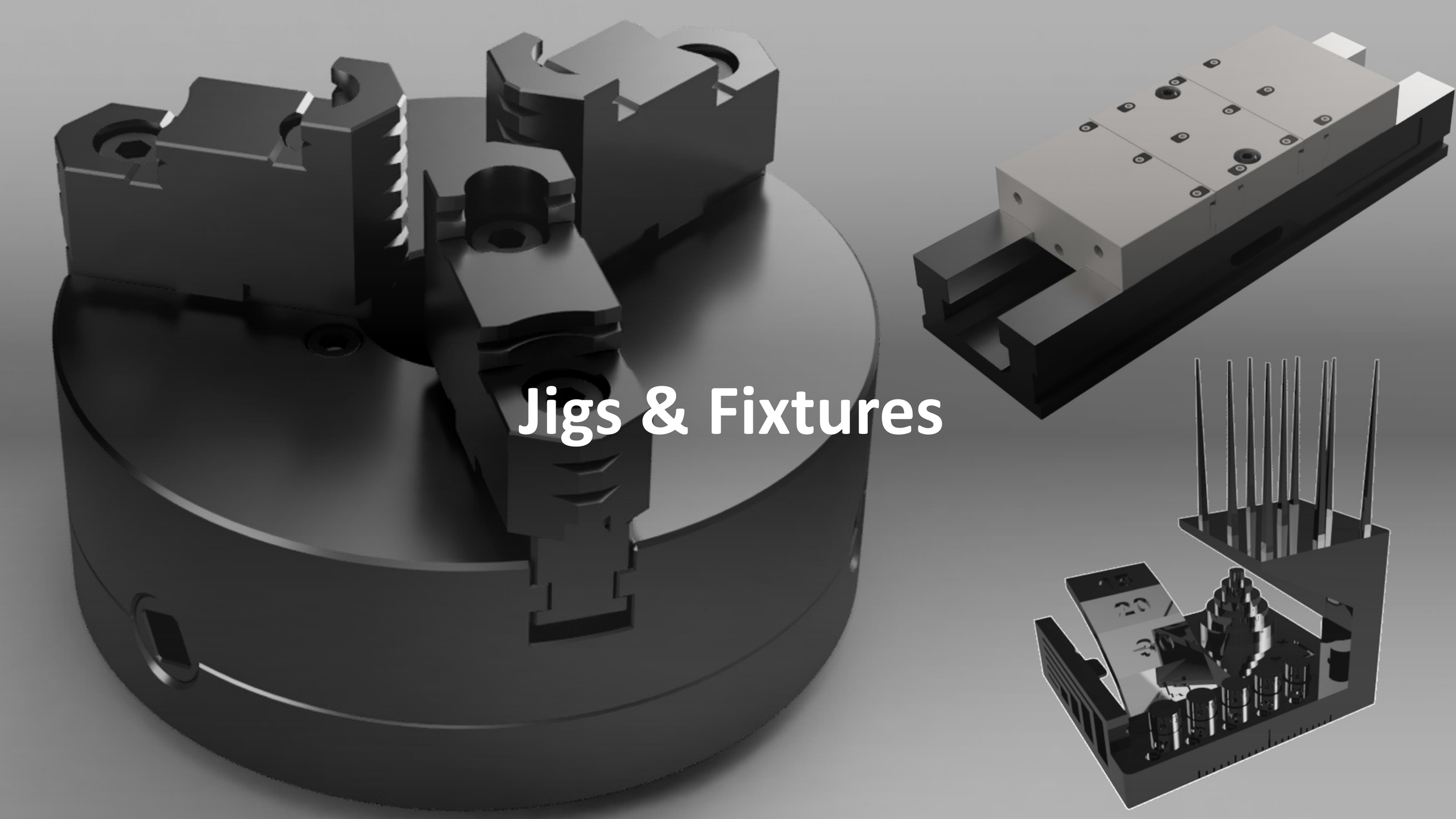


Conceptual & Prototyping


Form, Fit & Function


Tooling

Jigs & Fixtures



Additive Manufacturing Workflows

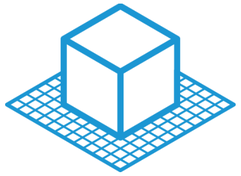
Knowing The Requirements

3D DATA

A DIGITAL MODEL

Computer Aided Design Software

- Design from scratch
- Using reference data (2D drawing / physical model measurements)
- Use 3D reference data (imported models / 3D scan data)



PRINT PREPARATION

SLICING CAPABILITIES

Computer Aided Design / Slicing Software

- Part setup within machine footprint
- Process g-code to send to 3D printer

HARDWARE & MATERIALS

3D PRINTER & MATERIALS

Typical 3D Printing Technologies:

- Material Extrusion
- VAT Photopolymerization
- Material Jetting
- Binder Jetting
- Powder Bed Fusion
- Direct Energy Deposition
- Sheet Lamination

Polymers, Metals, Composites among others

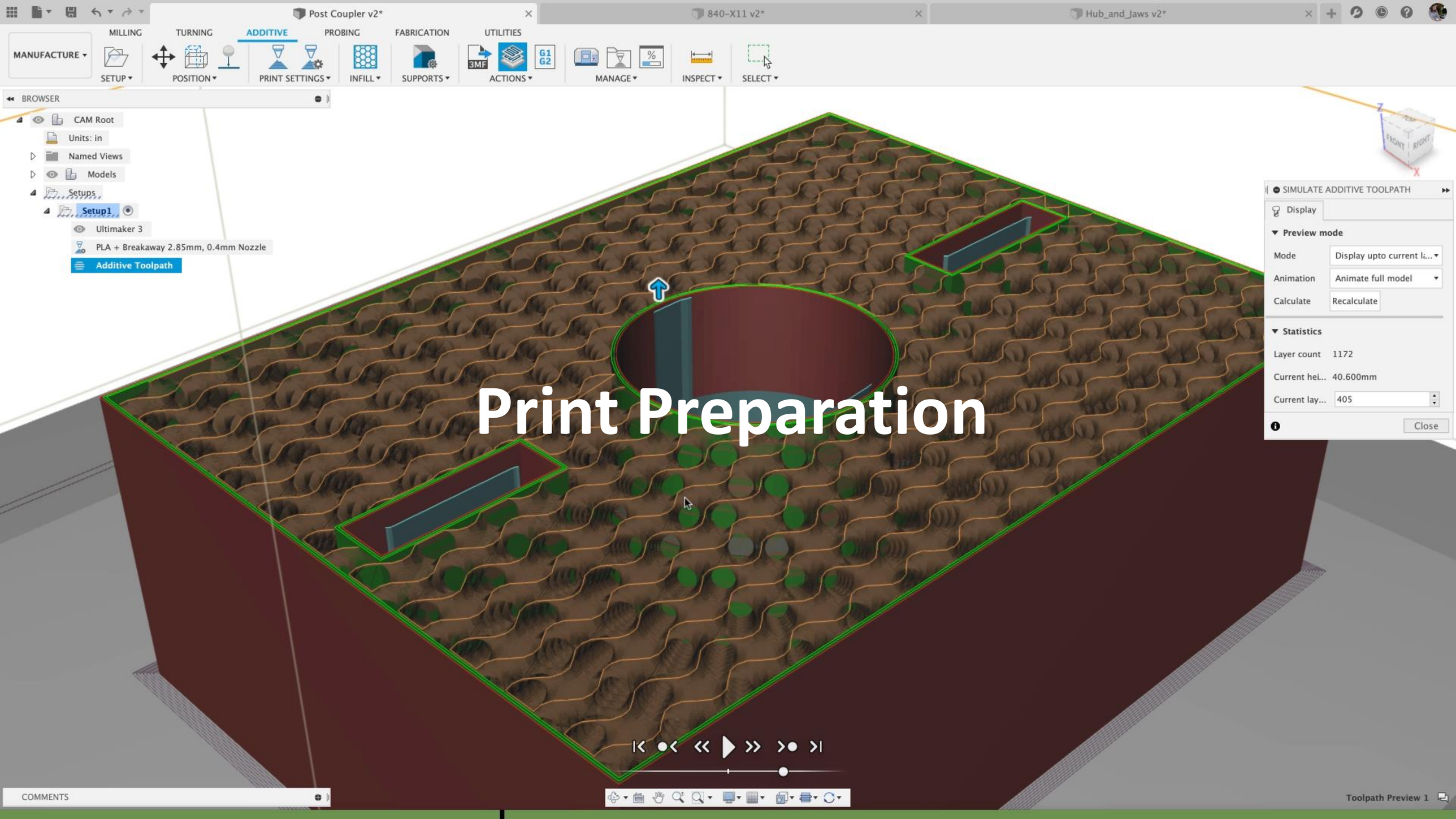
POST PROCESSING

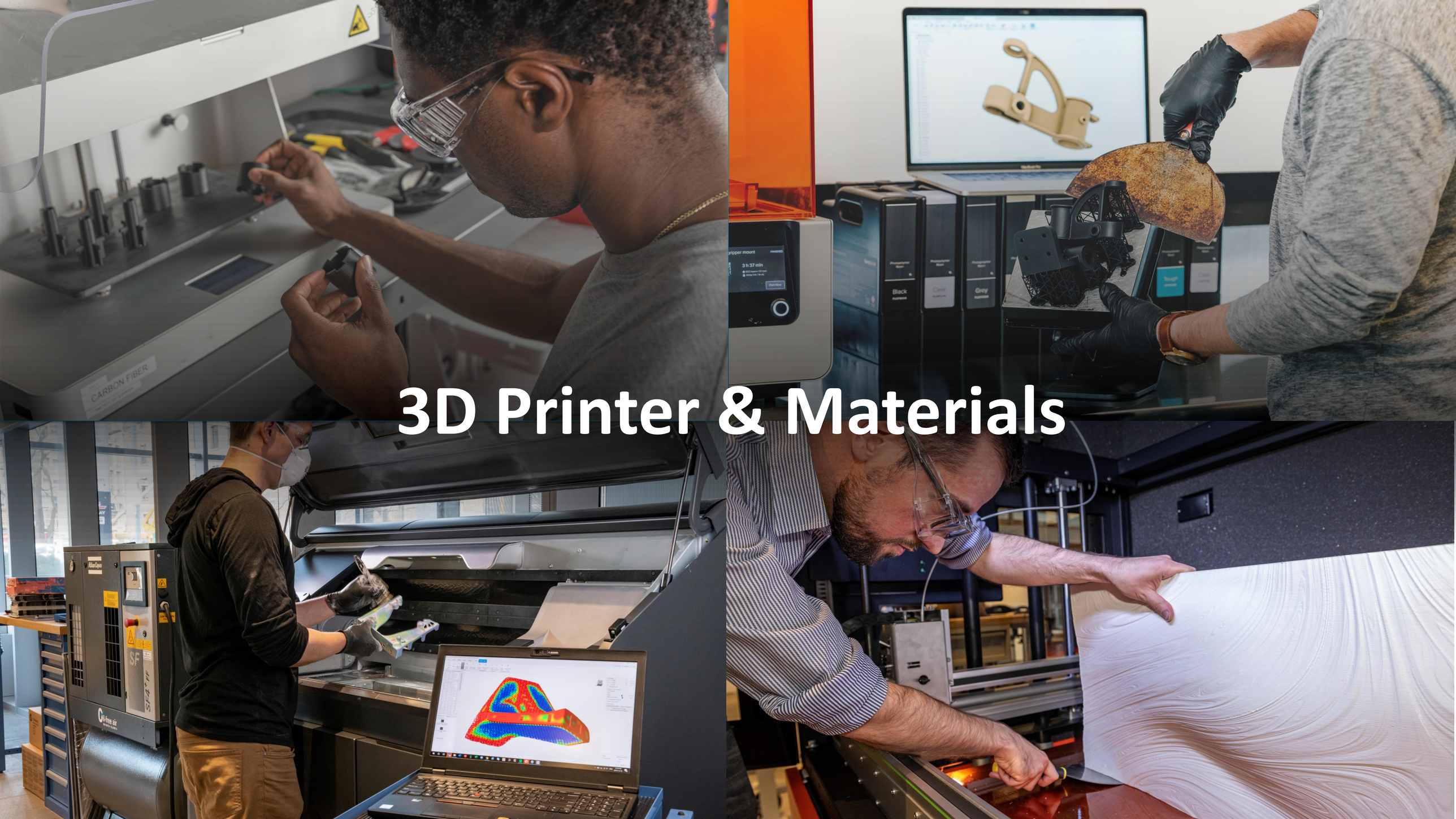
POST PRINTING

Typical post processing operations (Manual or Automated):

- Excess Material Removal
- Smoothing, Sealing, Applying Coatings
- Assembly / Hardware Addition
- Finishing – Hybrid Manufacturing

Computer Aided Design


Post Coupler v2*
840-X11 v2*
Hub_and_Jaws v2*
MILLING
TURNING
ADDITIVE
PROBING
FABRICATION
UTILITIES
MANUFACTURE
SETUP
POSITION
PRINT SETTINGS
INFILL
SUPPORTS
ACTIONS
MANAGE
INSPECT
SELECT
BROWSER
CAM Root
Units: in
Named Views
Models
Setups
Setup1
Ultimaker 3
PLA + Breakaway 2.85mm, 0.4mm Nozzle
Additive Toolpath
Print Preparation
SIMULATE ADDITIVE TOOLPATH
Display
Preview mode
Mode
Display upto current li...
Animation
Animate full model
Calculate
Recalculate
Statistics
Layer count
1172
Current hei...
40.600mm
Current lay...
405
Close
COMMENTS
Toolpath Preview 1



3D Printer & Materials

Post Processing


Post Processing

Applications / Feasibility / Resource

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AFTER PRINTING

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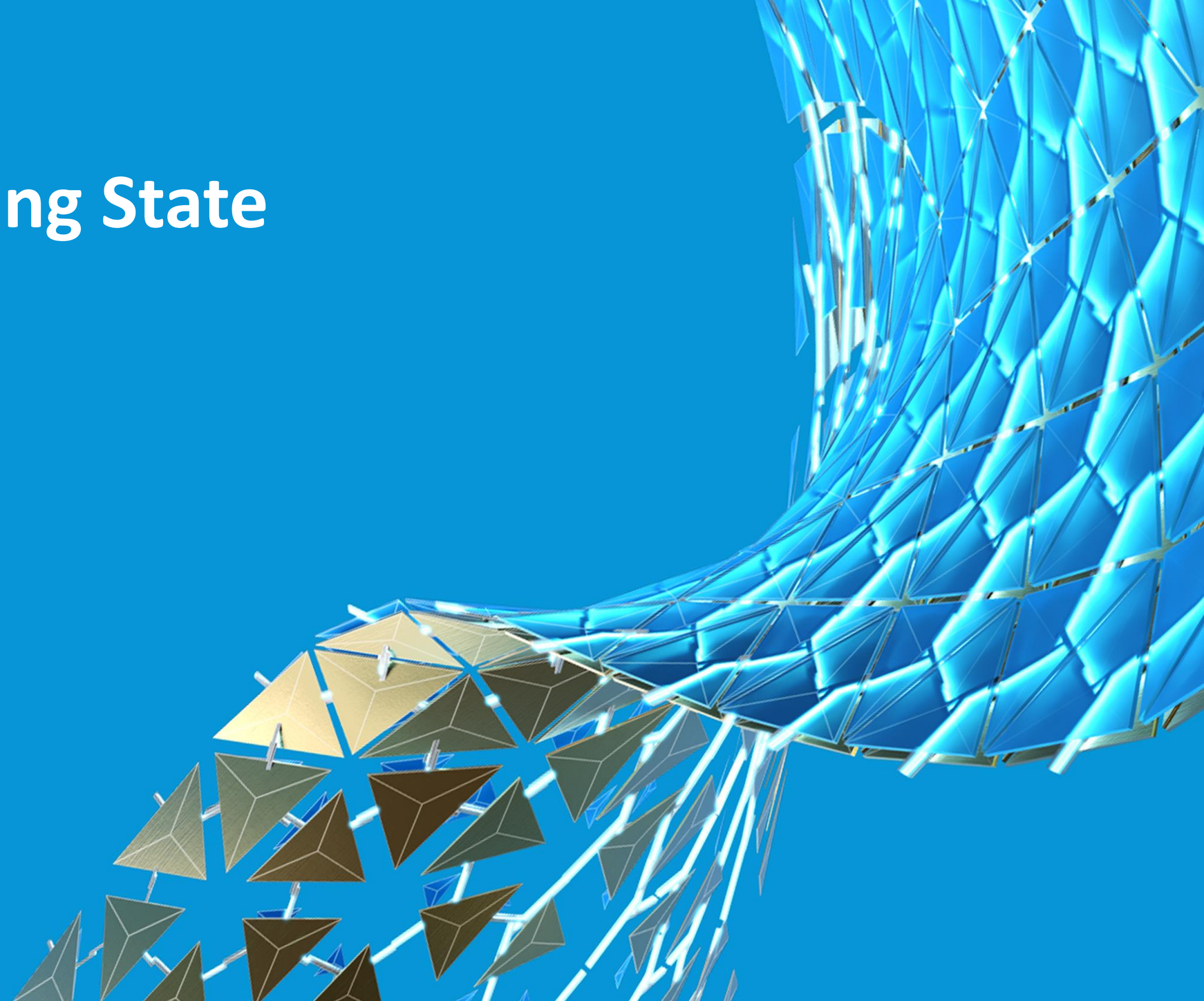
- Leverage the Benefits of Connected Digital Workflows
- Consider Process Constraints & Apply DfAM Principles to Maximise Efficiencies

DfAM – Starting State



Additive Manufacturing Workflow

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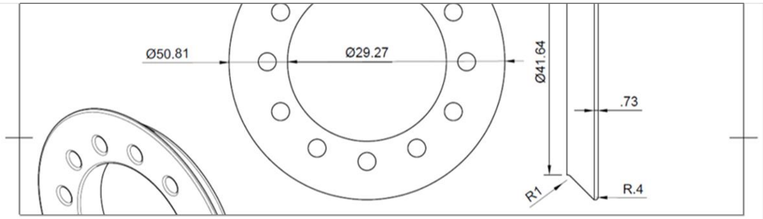


2D Reference Data (Drawings)

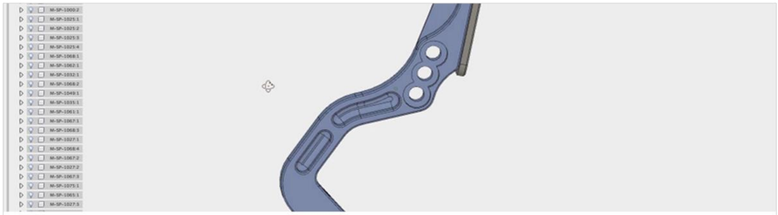
Replicating a component when supplied with a 2D Engineering drawing

- Paper Copy - Printed
- Digital (PDF, DWG...)
- Converting 2D to 3D data via Computer Aided Design (CAD)

Reference Data (Physical Model)

Reverse engineering from a physical model, taking measurements of physical dimensions

- Building a 3D model via Computer Aided Design (CAD)
- Parametric sketching and modelling



3D Reference Data (Imported)

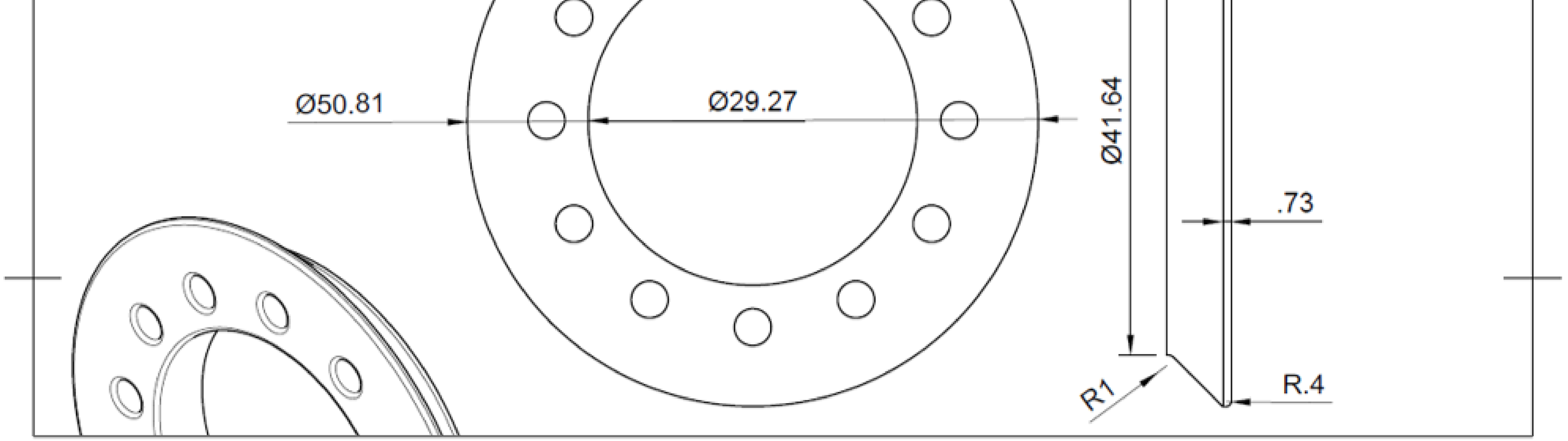
Working with 3D model data created by someone else

- Downloaded / imported
- Supply chain / customer generated
- Part catalogues

3D Reference Data (Scan Data)

Working with Mesh Data in Typical Reverse Engineering Workflows

- Using Mesh Data AS IS
- Mesh Repair, Manipulation & Conversion to Manifold Geometry
- Pulling Sketch Cross Sections
- T-Splines



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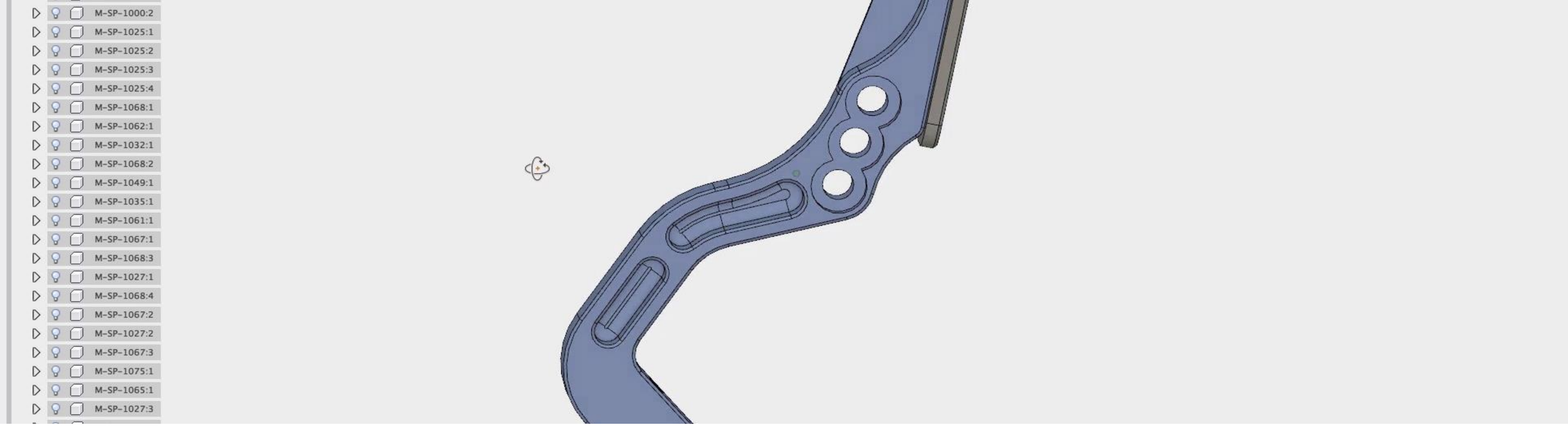

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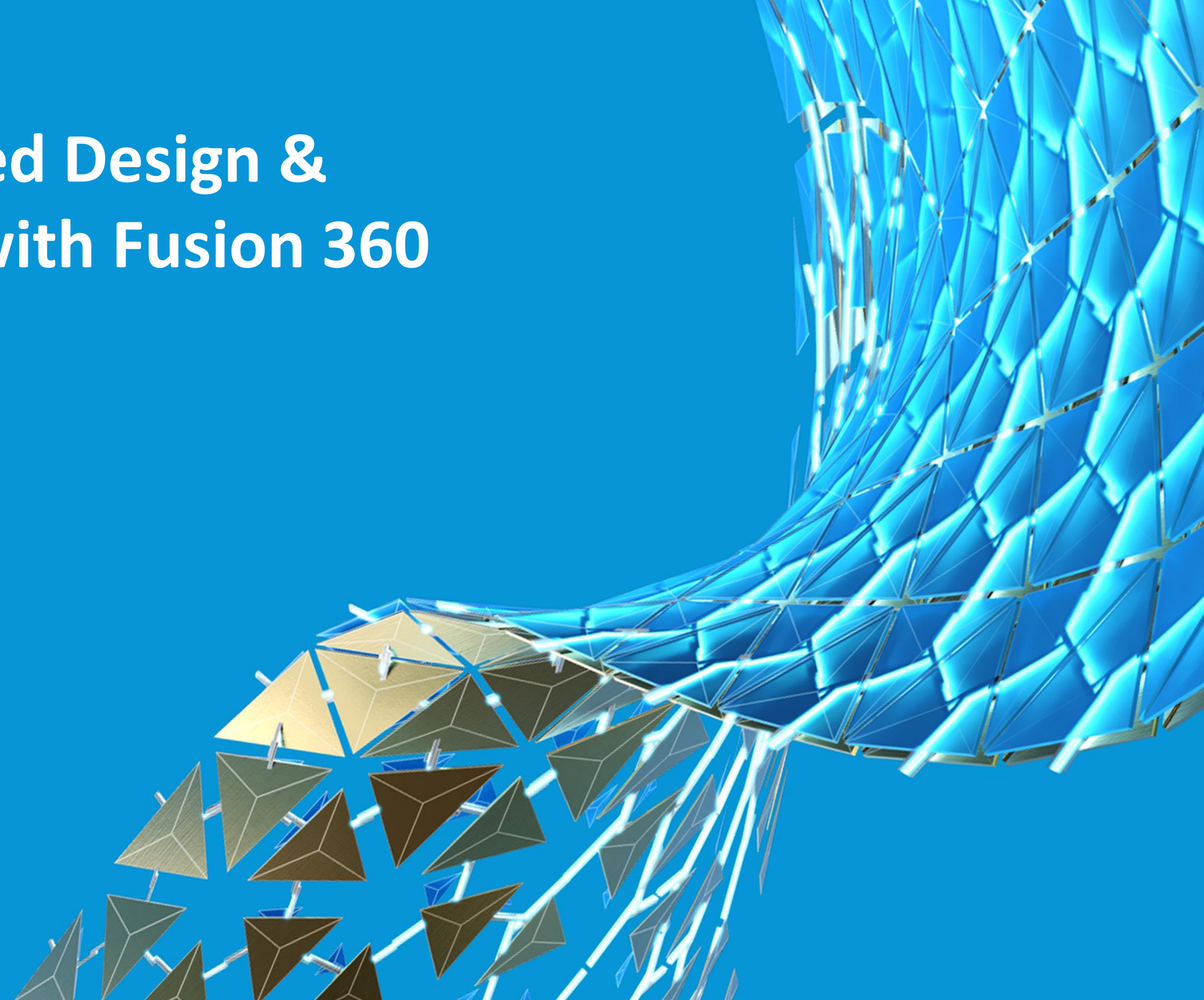
Image courtesy of PrintCity.

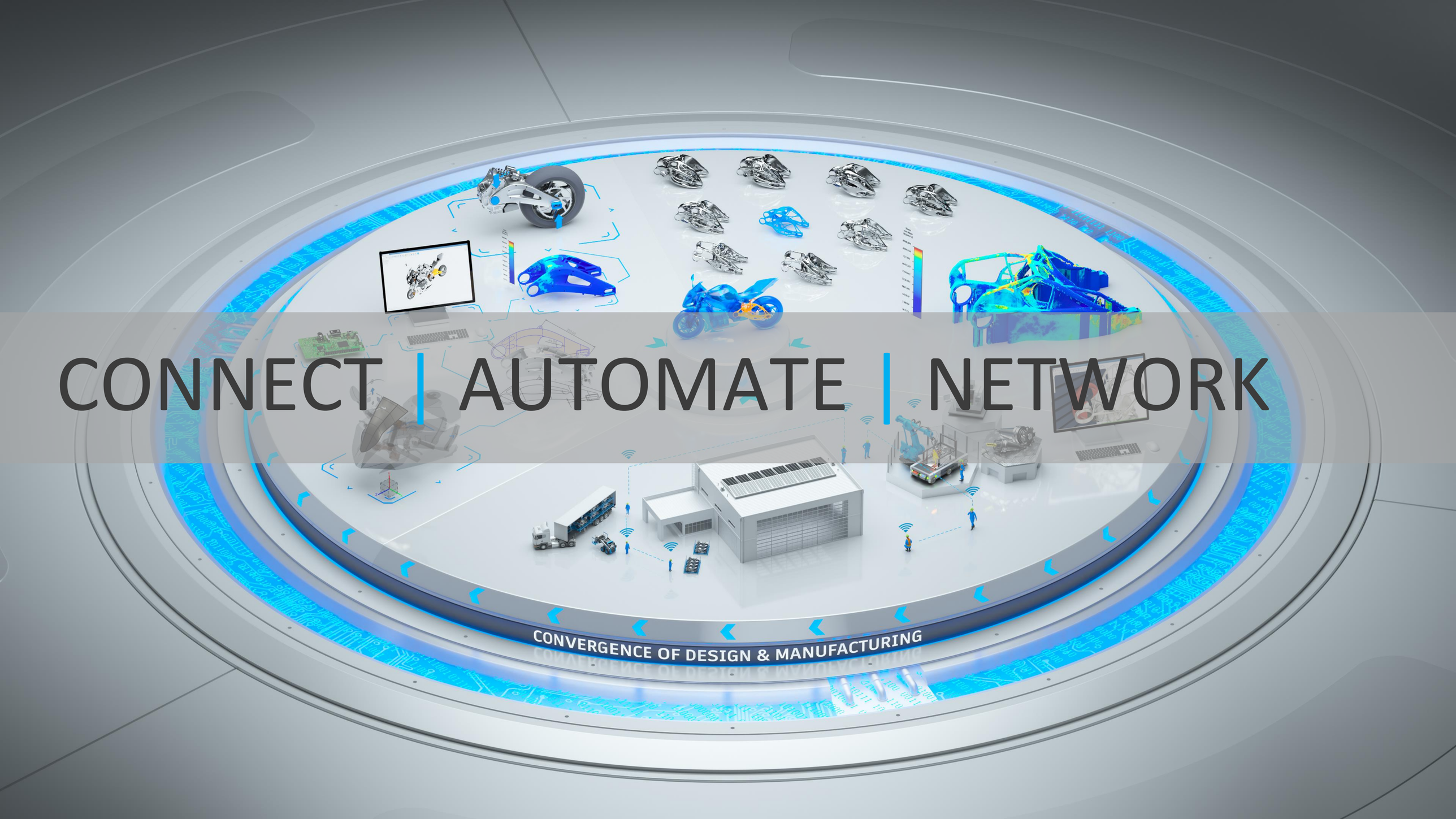
Design Inspiration

Scenario – function and constraints are known but form doesn’t yet have definition

- **Concept modelling**
- **Generative Design**

Computer Aided Design & Manufacture with Fusion 360

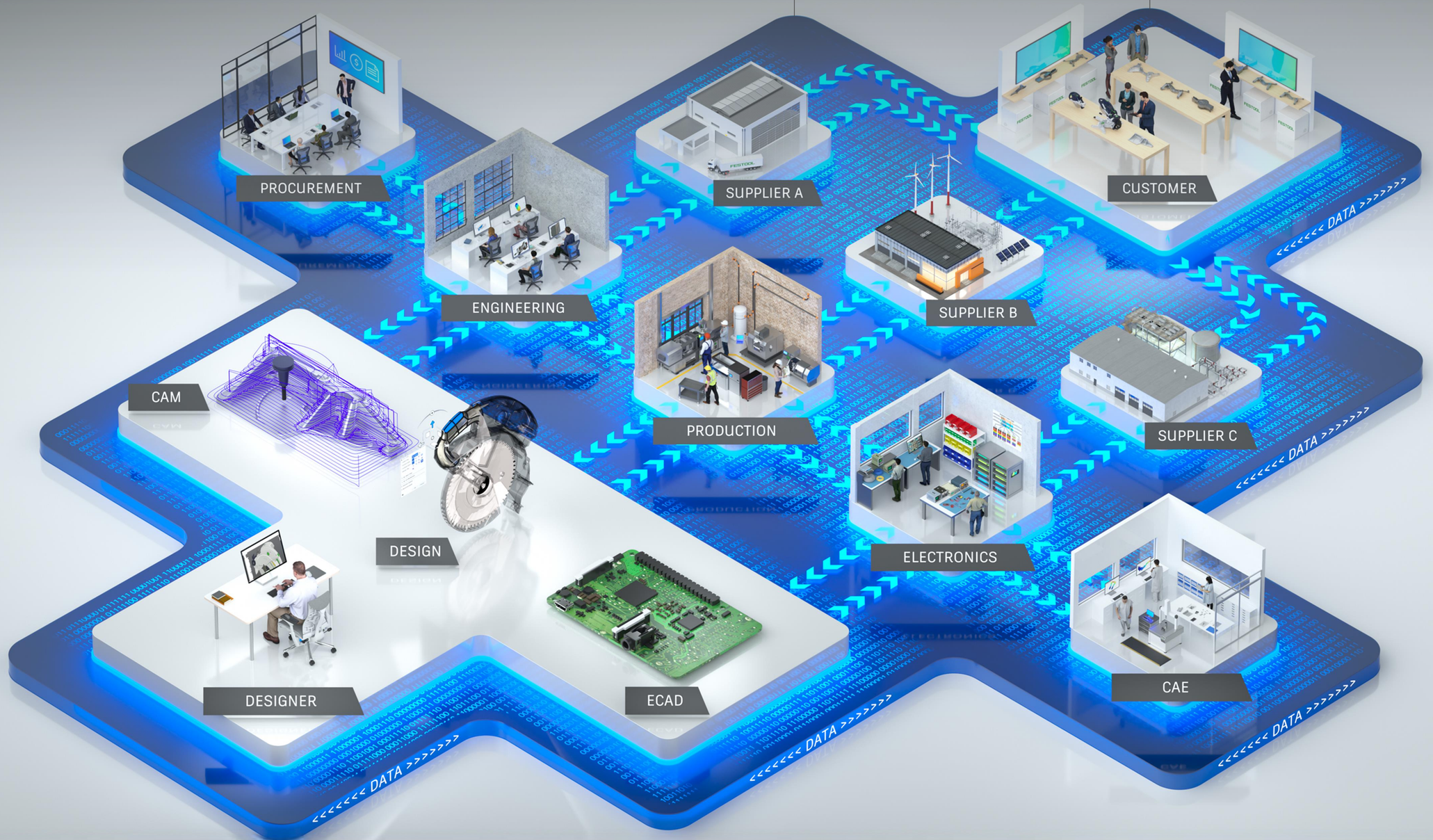


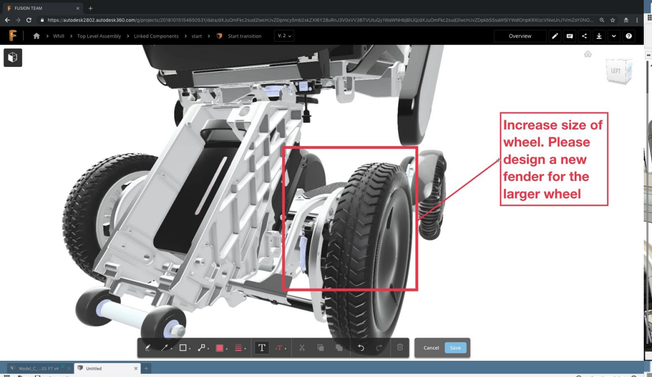

CONNECT | AUTOMATE | NETWORK
CONVERGENCE OF DESIGN & MANUFACTURING

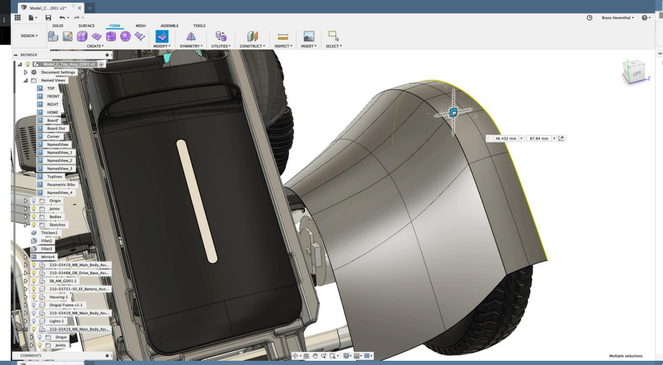
Fusion 360 moves your business & industry forward

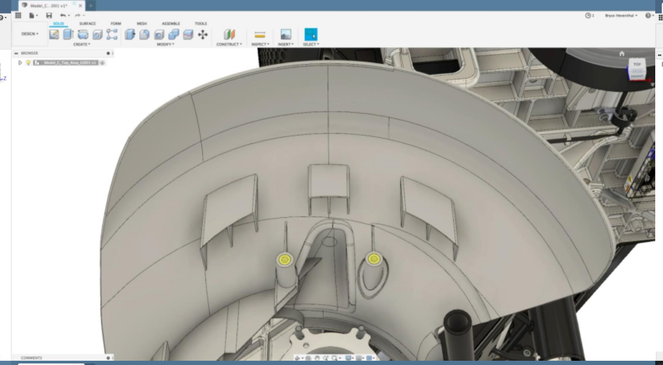
Catalyze innovation across disciplines

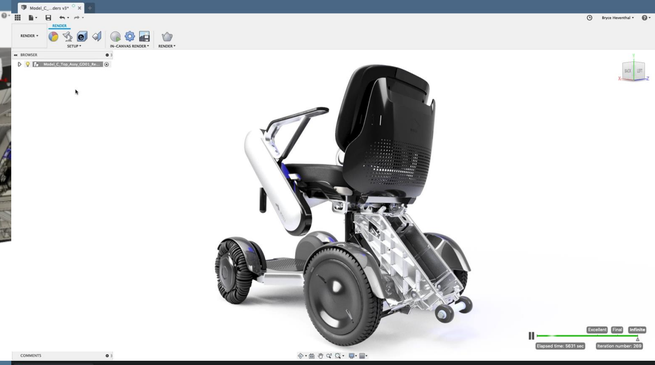
Realize previously impossible outcomes

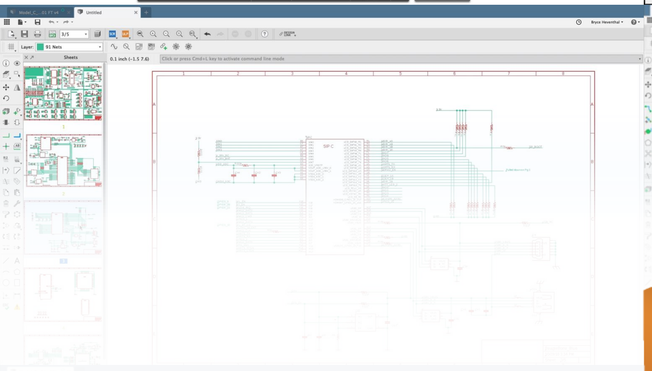


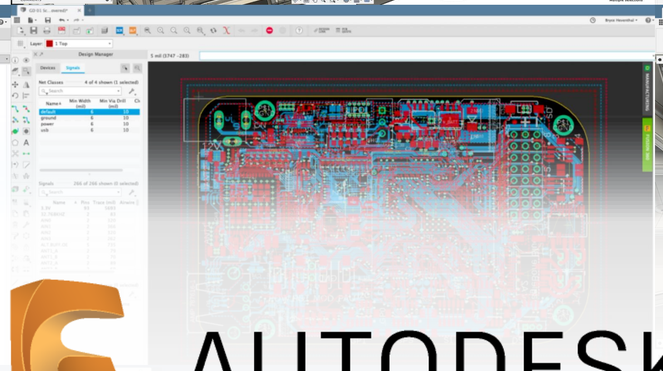


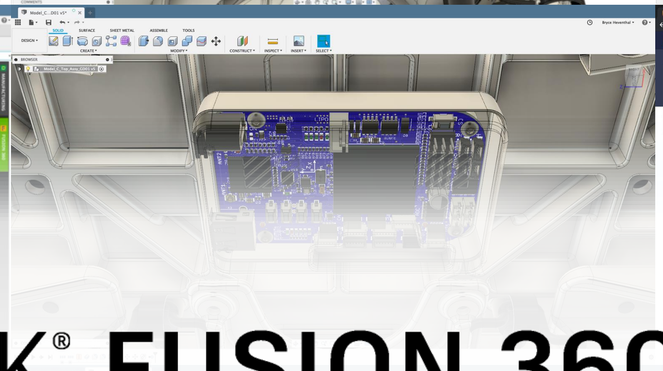


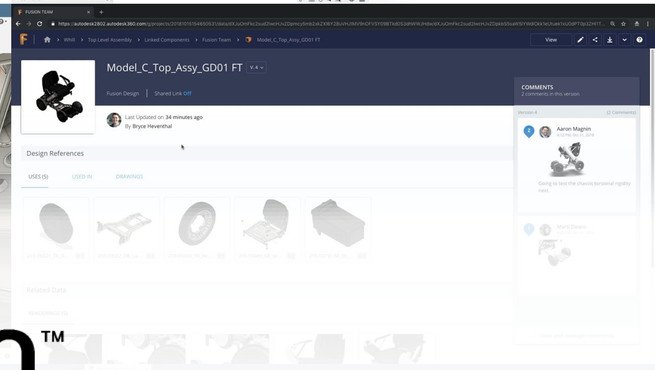




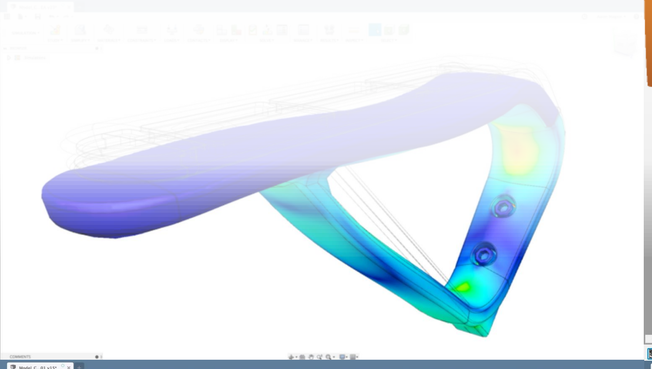


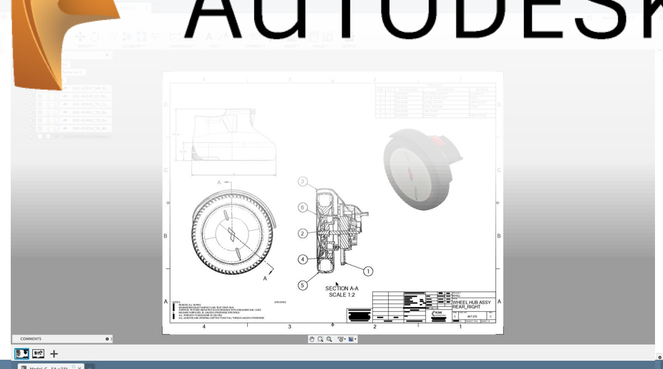


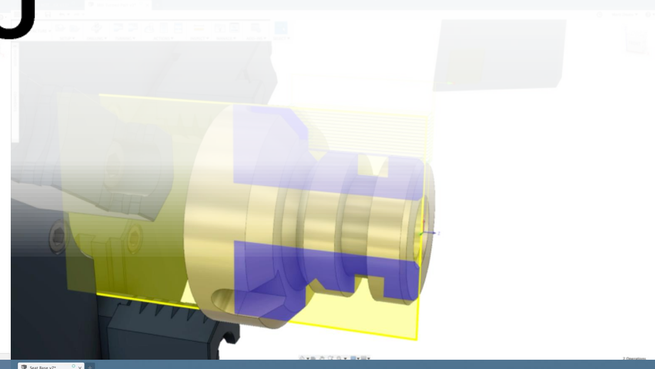


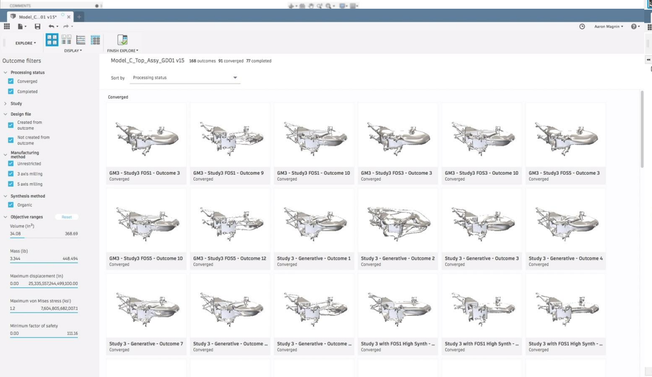


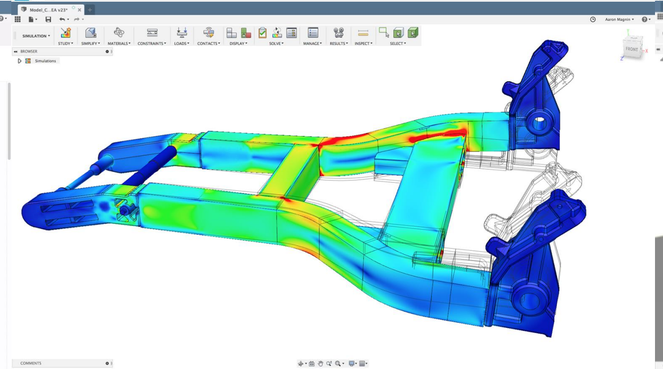
AUTODESK® FUSION 360™

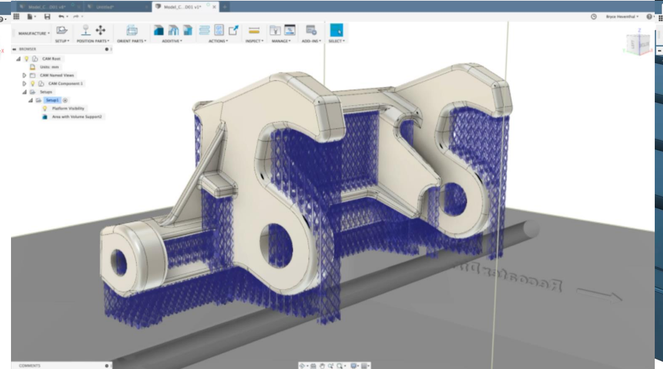


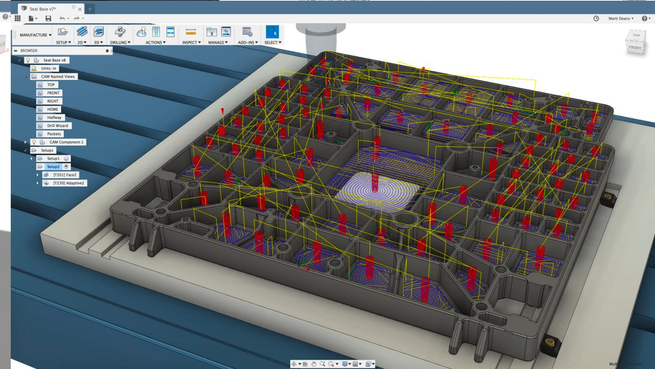




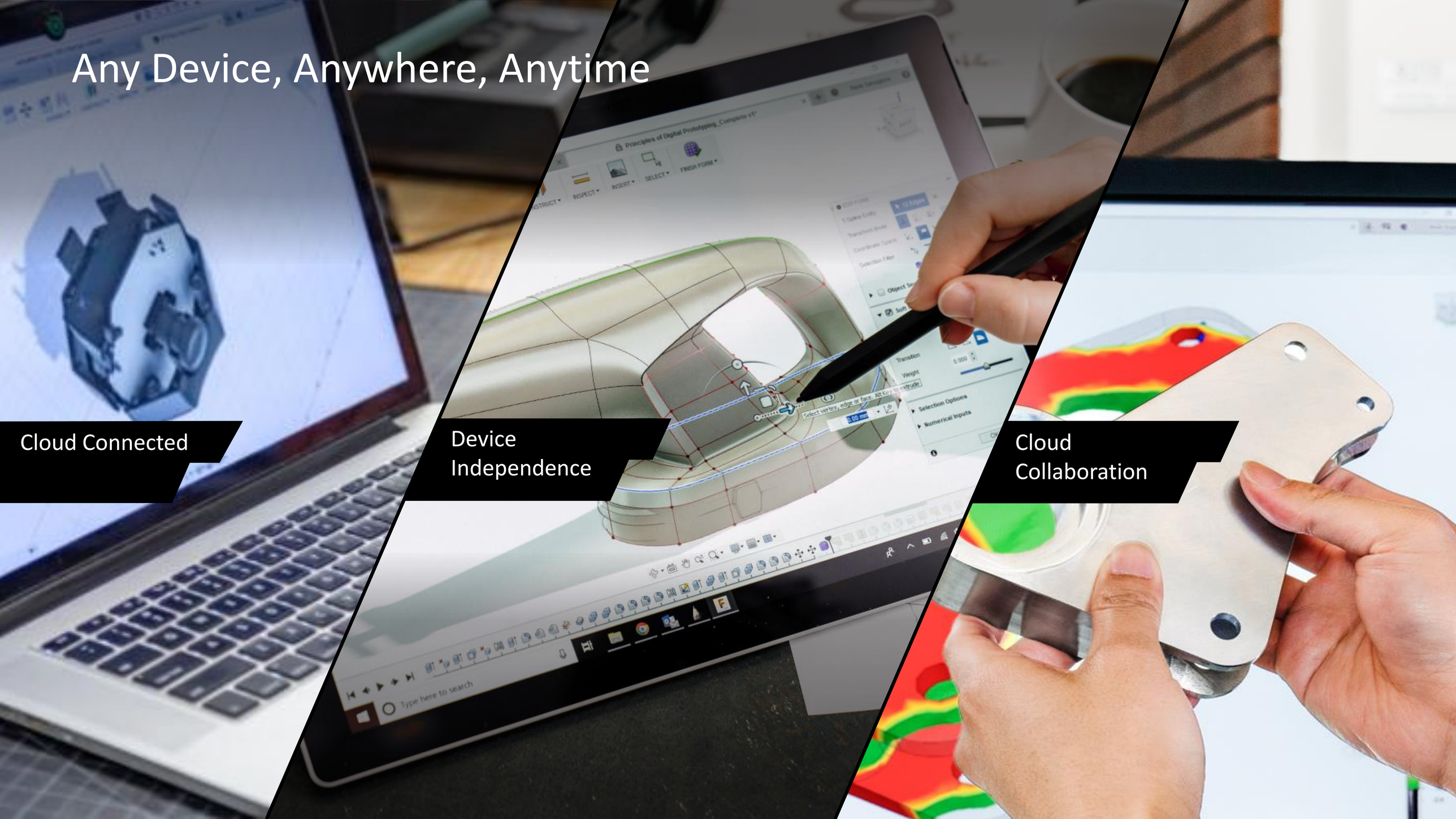




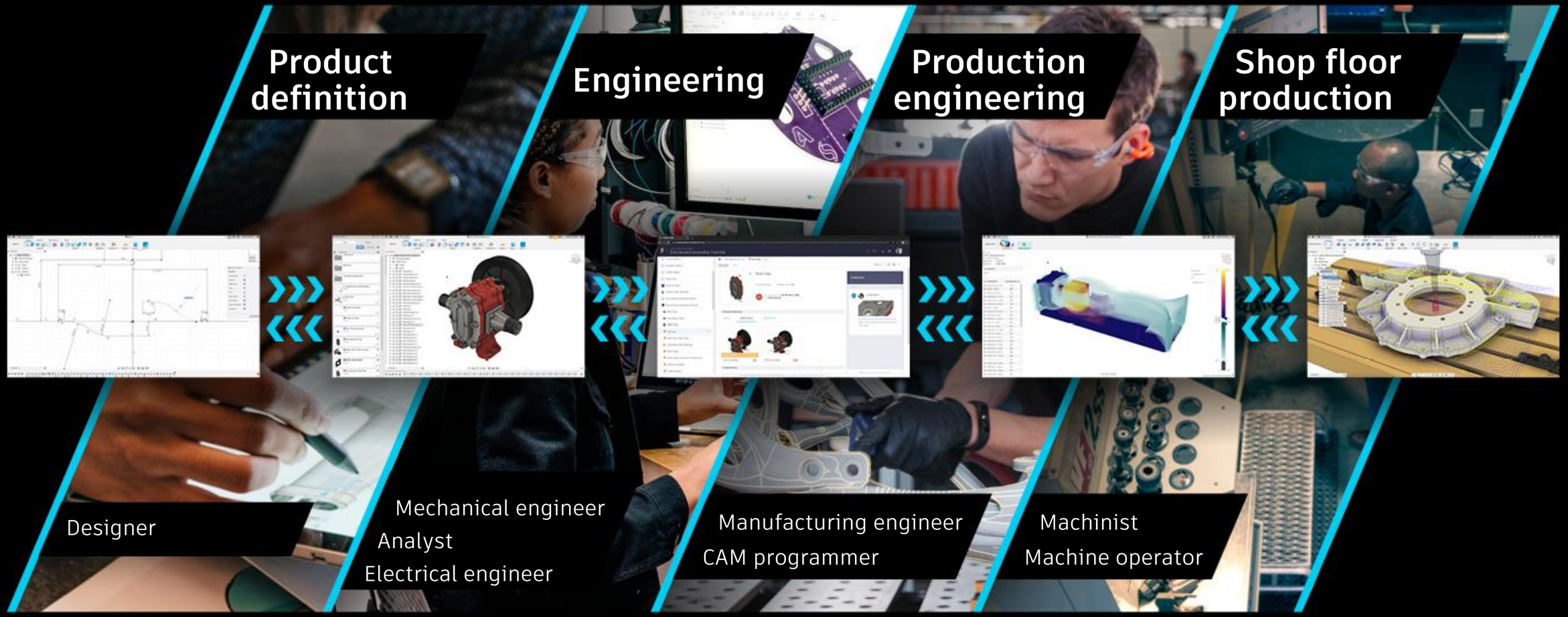


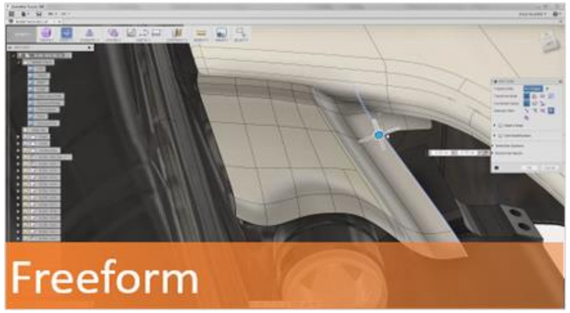


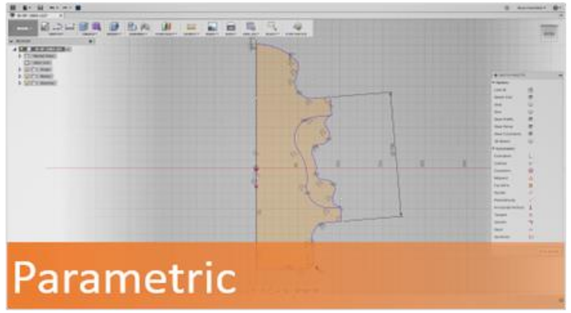
Any Device, Anywhere, Anytime

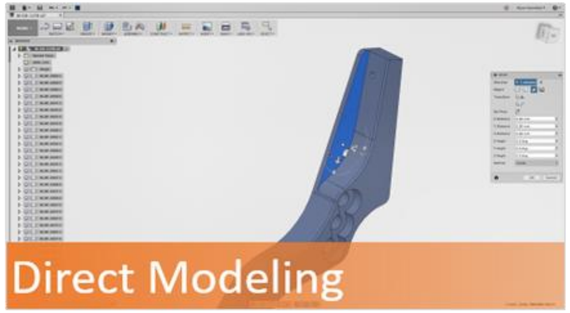


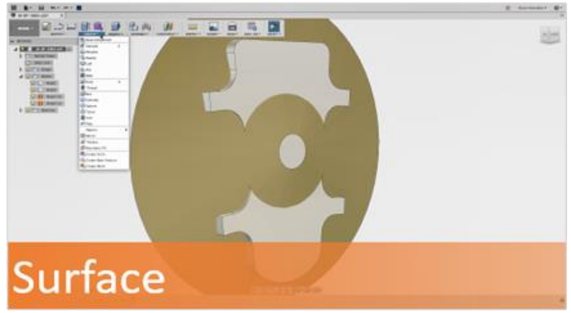
Solutions for complete product development process



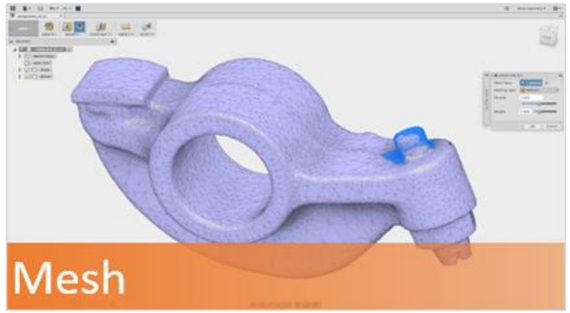

Freeform

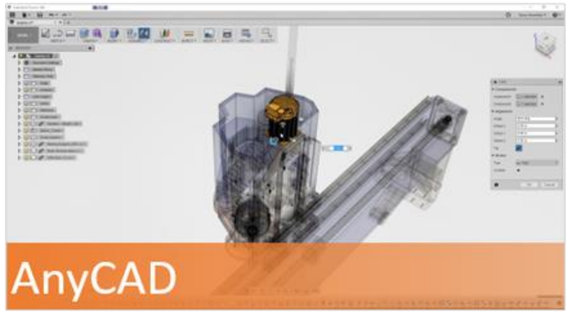

Parametric


Direct Modeling

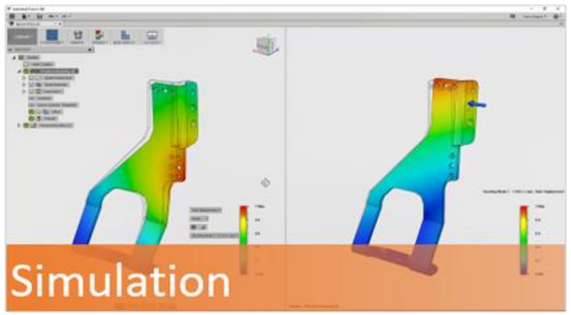

Surface

Sheet Metal


Mesh


AnyCAD

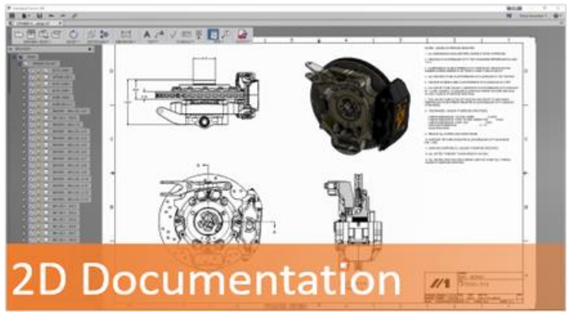

Assemble & Part Creation


Simulation

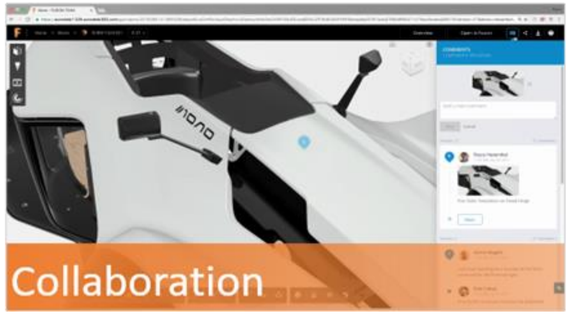

CAM


ECAD

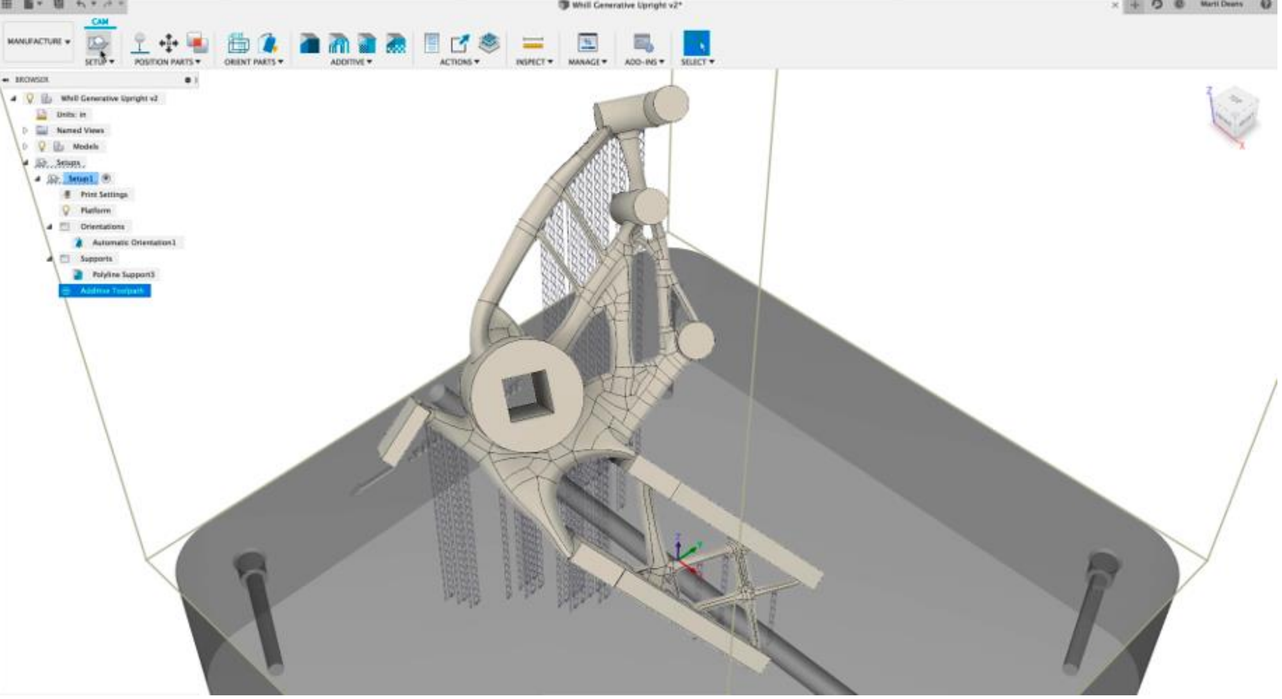
Generative Design

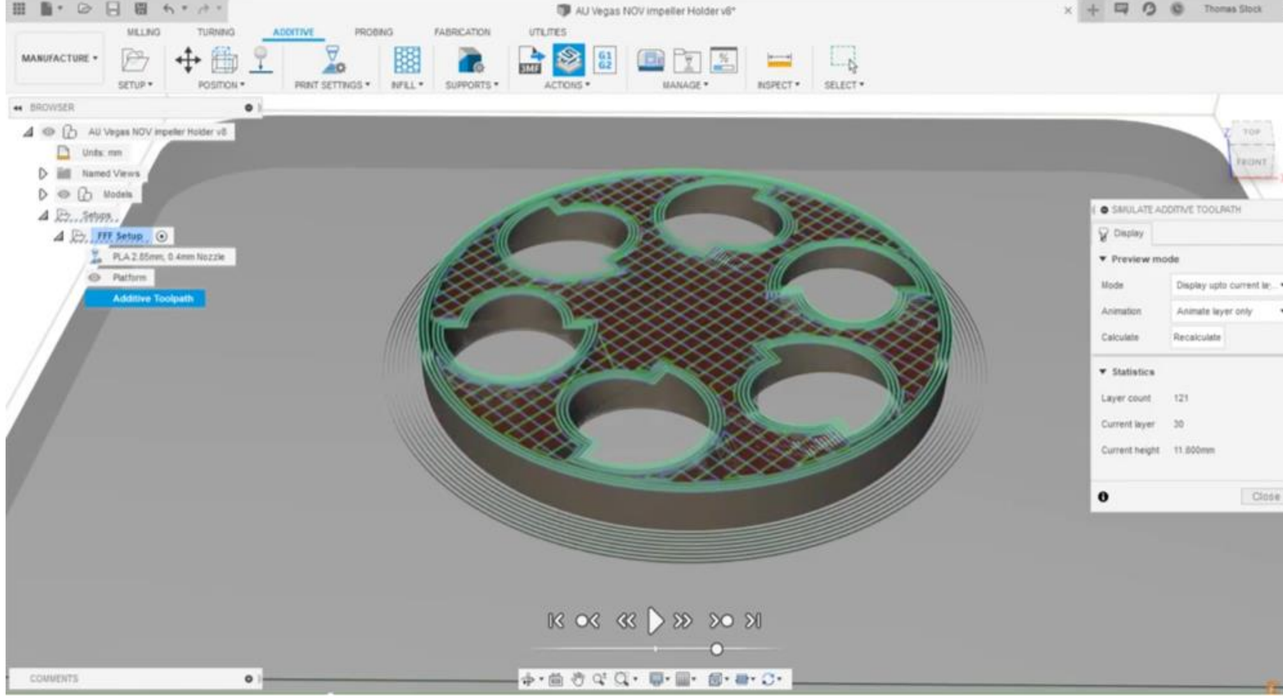

2D Documentation

Rendering


Collaboration

AUTODESK®
FUSION 360™



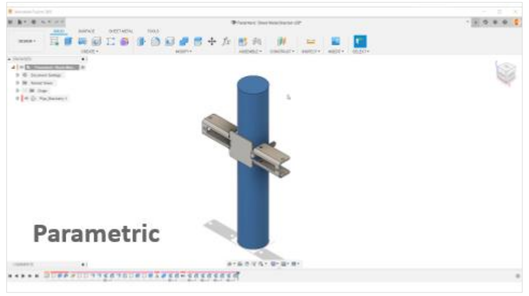


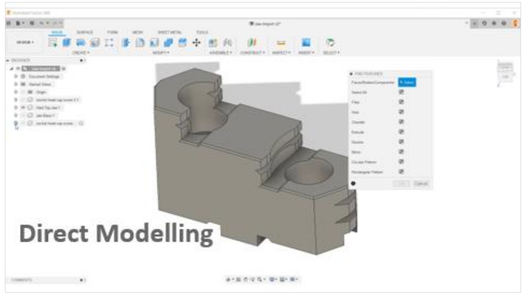
Benefits

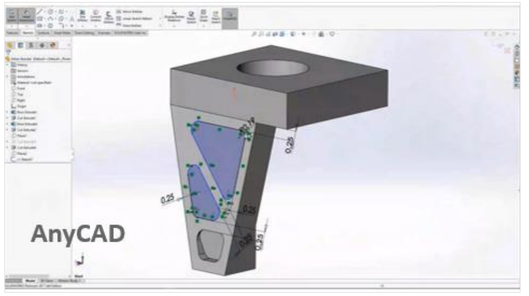
- Flexible to changes
- Easily create controlled surfaces and models
- Fast learning curve
- Adaptable to most designs

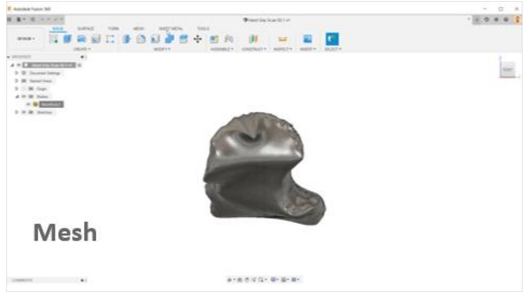
Capabilities

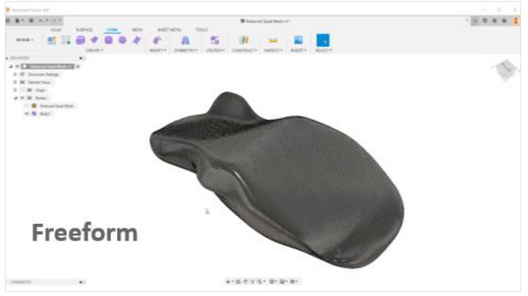
- Integrated Printing Workflow
- Automatic Part Orientation
- Printing Simulation
- Support for plastic and metal printing machines

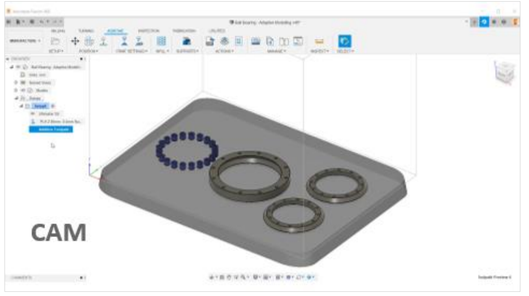


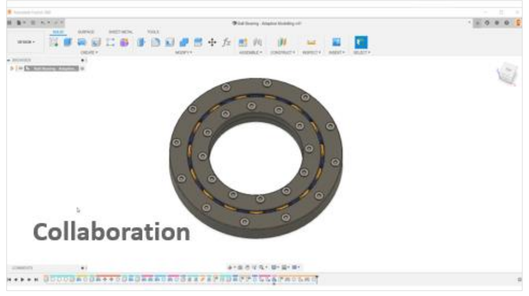












AUTODESK®
FUSION 360™

Autodesk Fusion 360

Paramteric Sheet Metal Bracket v28*

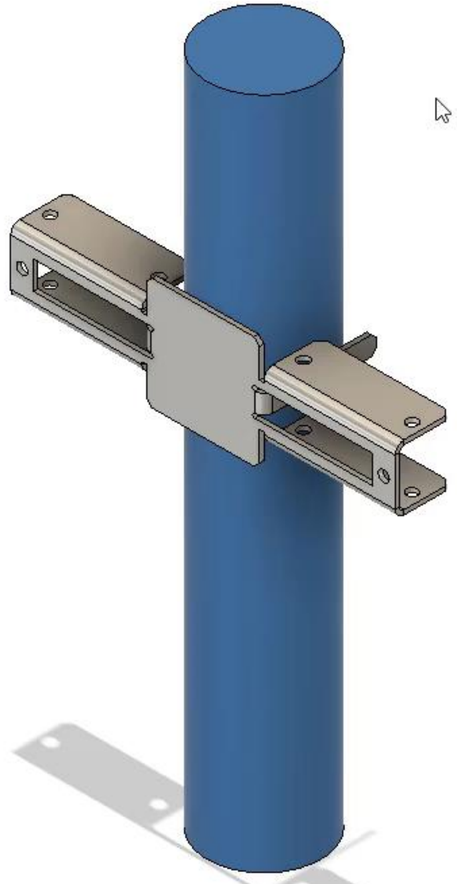
SOLID SURFACE SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

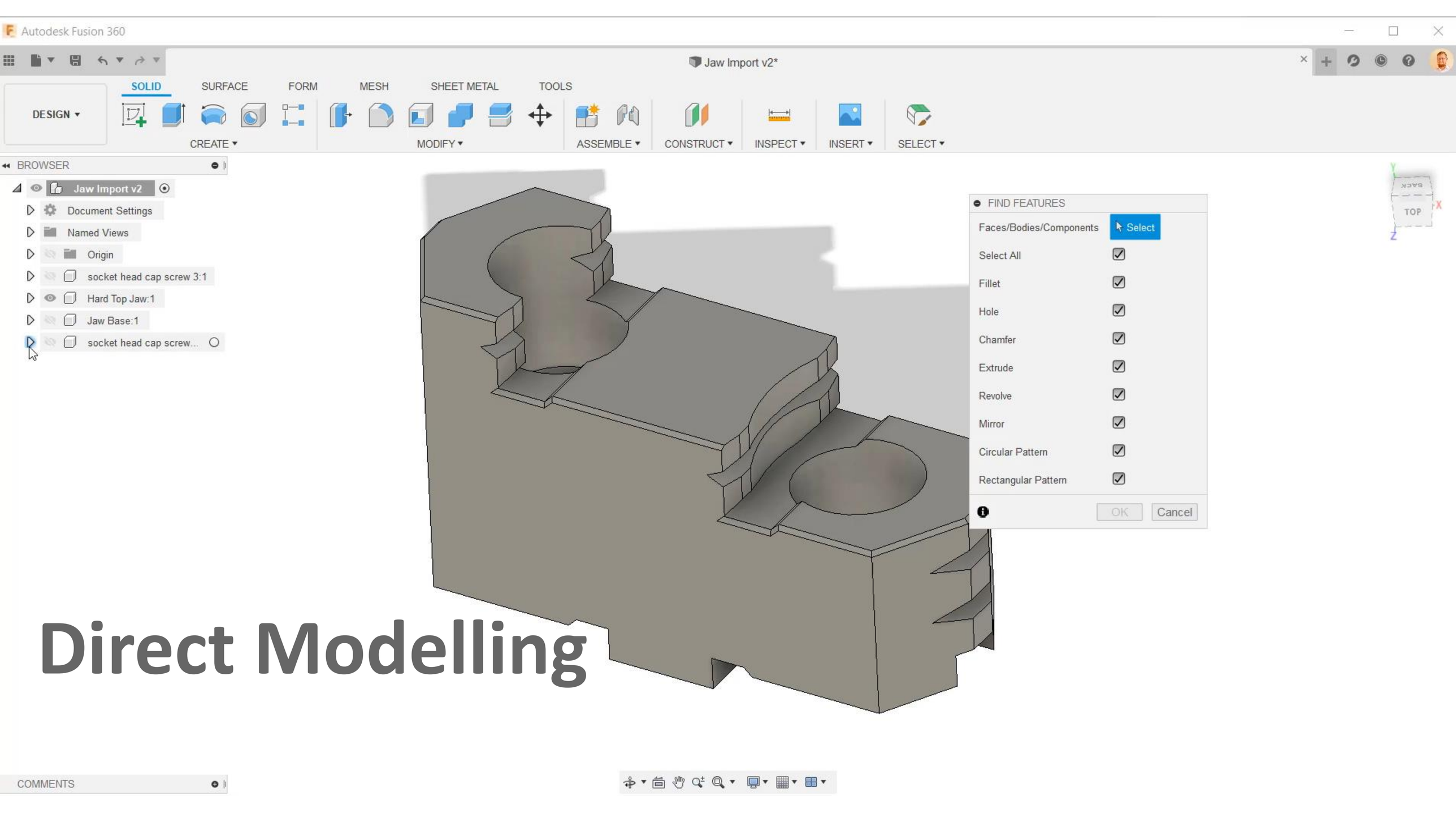
BROWSER

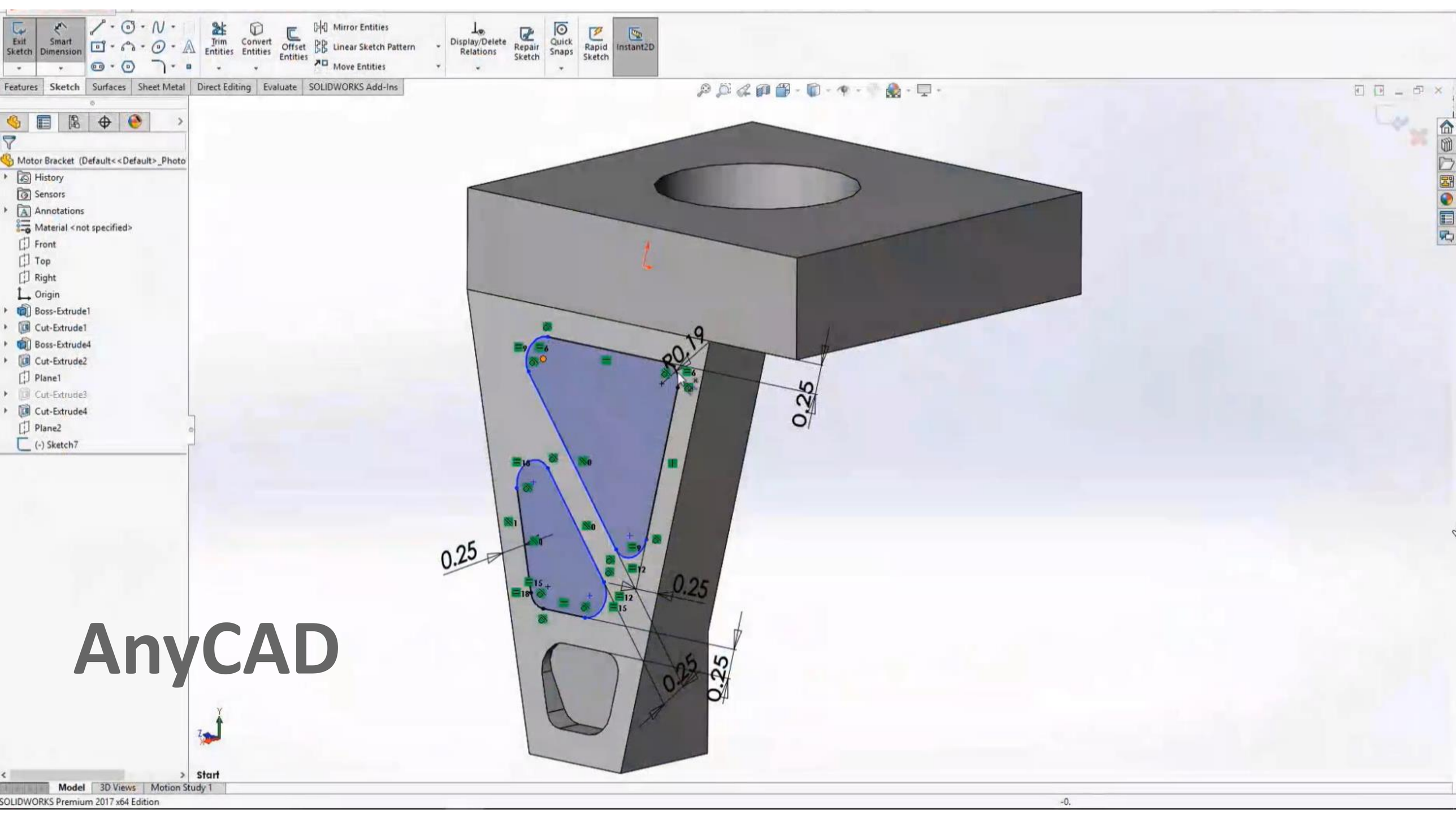
- Paramteric Sheet Met...
- Document Settings
- Named Views
- Origin
- Pipe_Bracketry:1



Parametric

COMMENTS


Autodesk Fusion 360
Jaw Import v2*
SOLID
SURFACE
FORM
MESH
SHEET METAL
TOOLS
DESIGN
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
BROWSER
Jaw Import v2
Document Settings
Named Views
Origin
socket head cap screw 3:1
Hard Top Jaw:1
Jaw Base:1
socket head cap screw...
FIND FEATURES
Faces/Bodies/Components
Select
Select All
Fillet
Hole
Chamfer
Extrude
Revolve
Mirror
Circular Pattern
Rectangular Pattern
OK
Cancel
TOP
COMMENTS
Direct Modelling


Exit Sketch
Smart Dimension
Trim Entities
Convert Entities
Offset Entities
Mirror Entities
Linear Sketch Pattern
Move Entities
Display/Delete Relations
Repair Sketch
Quick Snaps
Rapid Sketch
Instant2D
Features
Sketch
Surfaces
Sheet Metal
Direct Editing
Evaluate
SOLIDWORKS Add-Ins
Motor Bracket (Default<<Default>_Photo
History
Sensors
Annotations
Material <not specified>
Front
Top
Right
Origin
Boss-Extrude1
Cut-Extrude1
Boss-Extrude4
Cut-Extrude2
Plane1
Cut-Extrude3
Cut-Extrude4
Plane2
(-) Sketch7
R0.19
0.25
0.25
0.25
0.25
0.25
AnyCAD
Start
Model
3D Views
Motion Study 1
SOLIDWORKS Premium 2017 x64 Edition

Autodesk Fusion 360

Hand Grip Scan 02.1 v1

SOLID SURFACE FORM MESH SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Hand Grip Scan 02.1 v1
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - MeshBody1
  - Sketches

Mesh

COMMENTS

Autodesk Fusion 360

Reduced Quad Mesh v1*

SOLID SURFACE FORM MESH SHEET METAL TOOLS

DESIGN

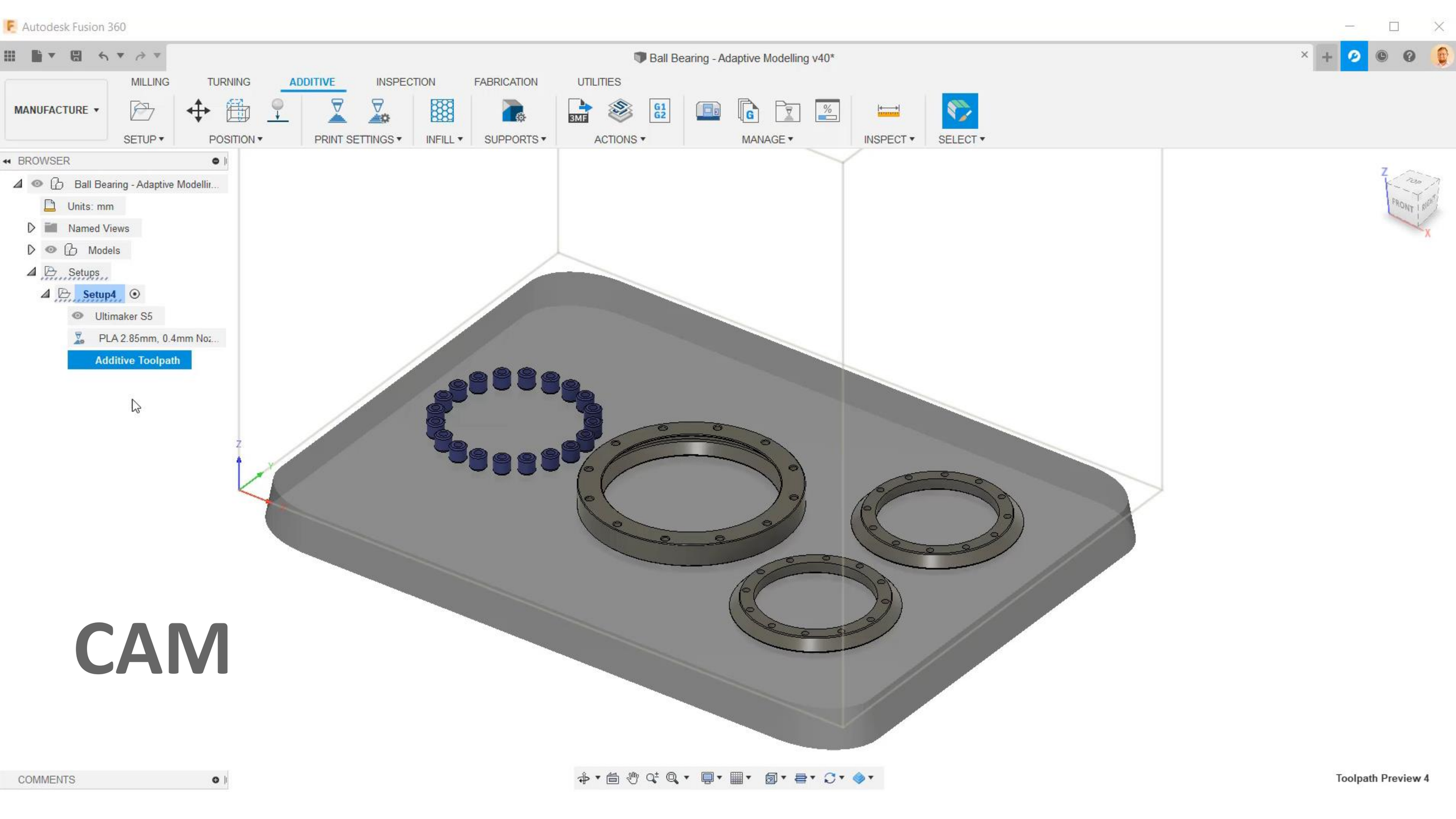
CREATE MODIFY SYMMETRY UTILITIES CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Reduced Quad Mesh v1
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Reduced Quad Mesh
    - Body1

Freeform

COMMENTS


Autodesk Fusion 360
Ball Bearing - Adaptive Modelling v40*
MILLING
TURNING
ADDITIVE
INSPECTION
FABRICATION
UTILITIES
MANUFACTURE
SETUP
POSITION
PRINT SETTINGS
INFILL
SUPPORTS
ACTIONS
MANAGE
INSPECT
SELECT
BROWSER
Ball Bearing - Adaptive Modellir...
Units: mm
Named Views
Models
Setups
Setup4
Ultimaker S5
PLA 2.85mm, 0.4mm No...
Additive Toolpath
CAM
COMMENTS
Toolpath Preview 4

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v41

SOLID SURFACE SHEET METAL TOOLS

DESIGN

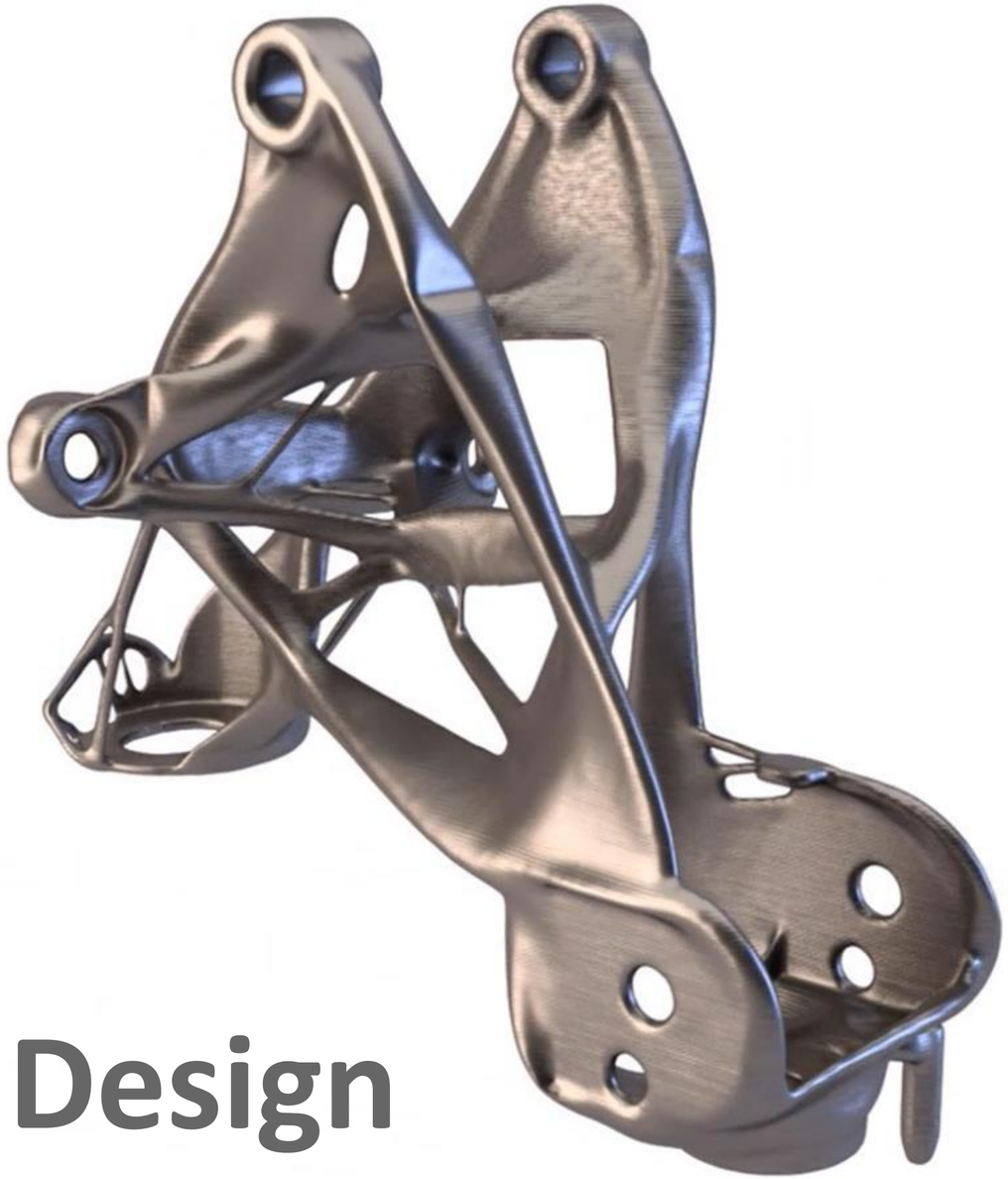
CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

Ball Bearing - Adaptive...

Collaboration

COMMENTS



Generative Design

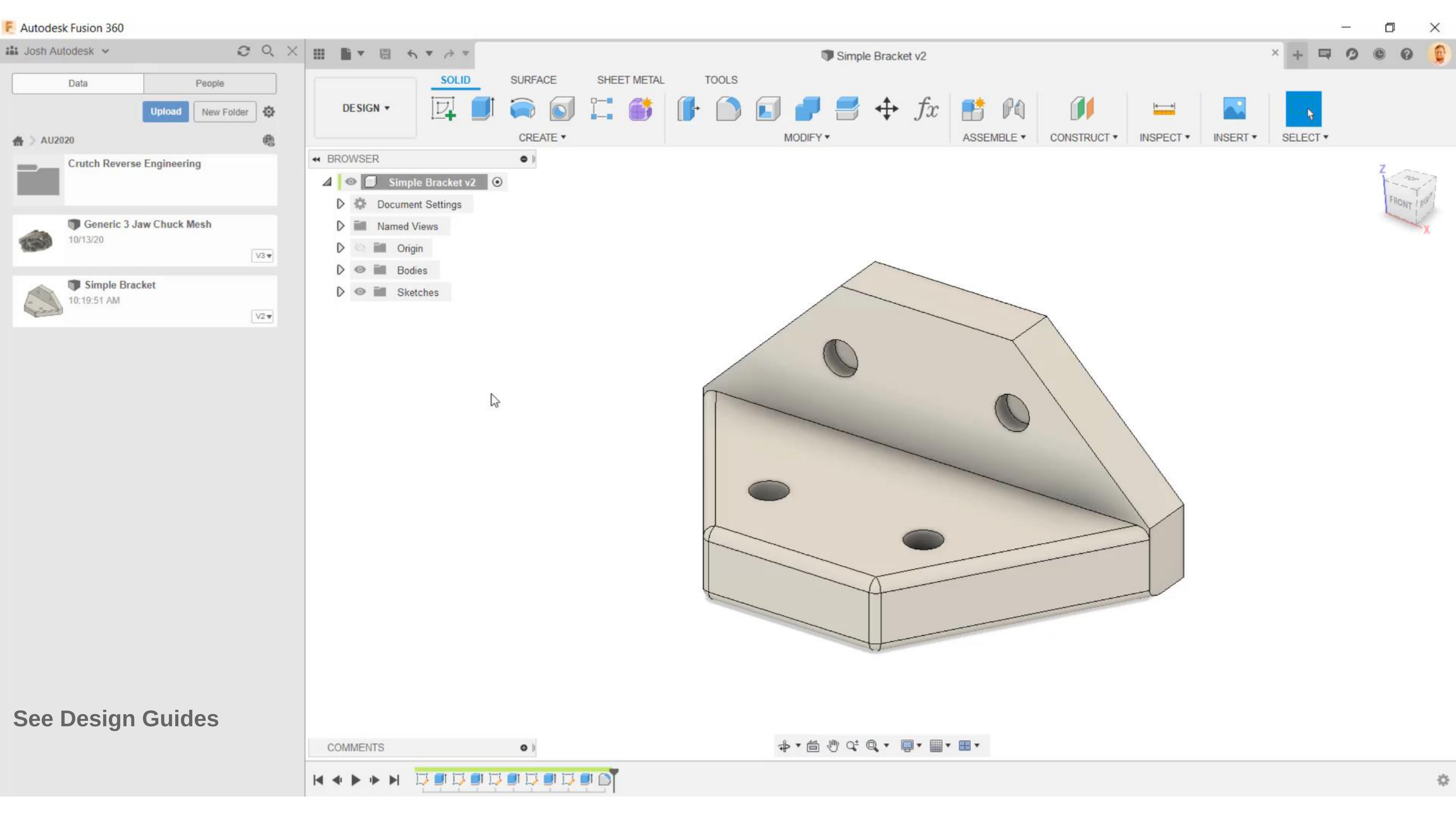
AUTODESK.

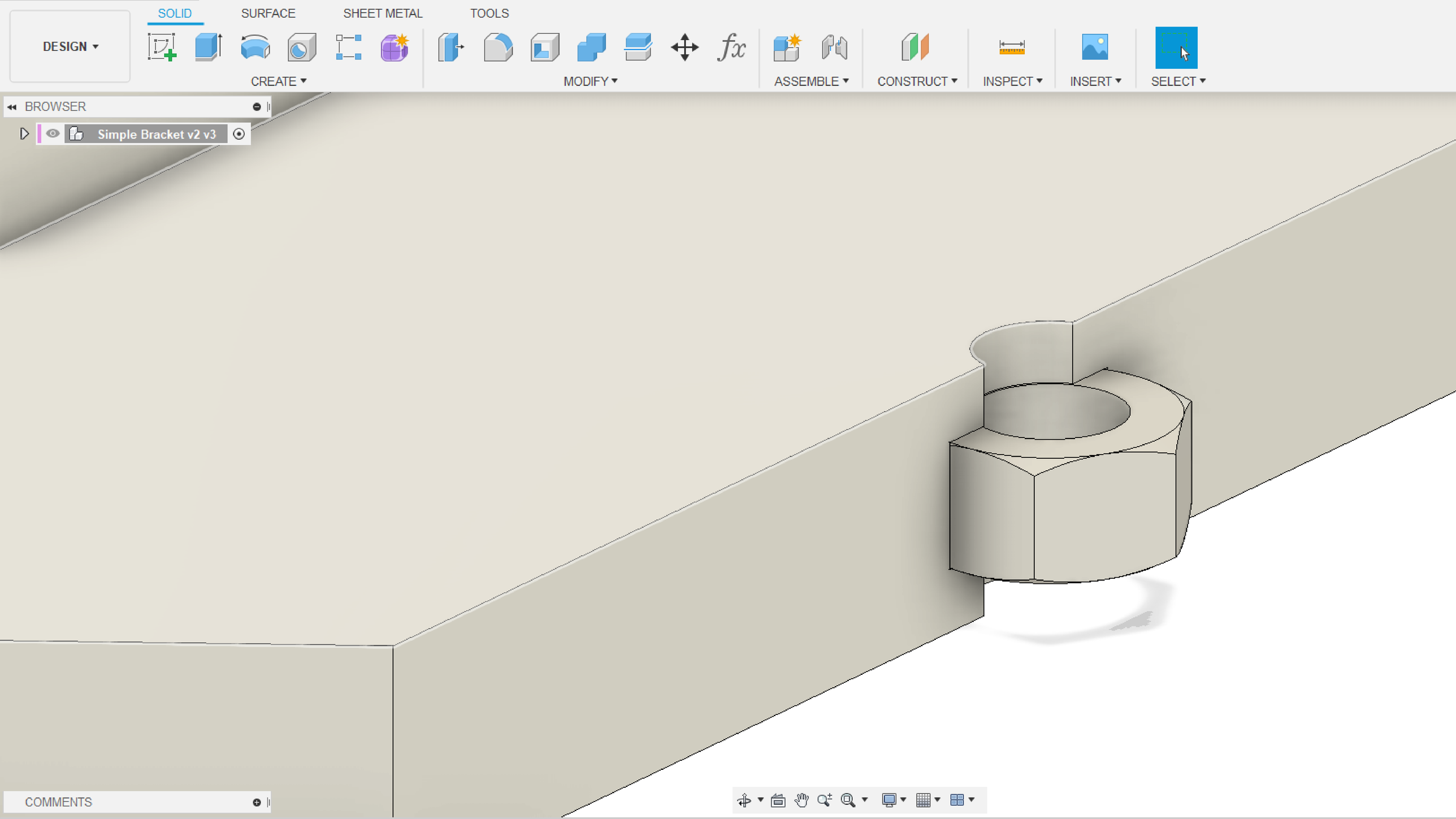
Optimize for Manufacturing

Optimize for Manufacturing (Material Extrusion)

DfAM

- **Building a 3D model via Computer Aided Design (CAD)**
- **Parametric sketching and modelling**


Autodesk Fusion 360
Josh Autodesk
Data
People
Upload
New Folder
AU2020
Crutch Reverse Engineering
Generic 3 Jaw Chuck Mesh
10/13/20
V3
Simple Bracket
10:19:51 AM
V2
Simple Bracket v2
SOLID
SURFACE
SHEET METAL
TOOLS
DESIGN
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
BROWSER
Simple Bracket v2
Document Settings
Named Views
Origin
Bodies
Sketches
FRONT
COMMENTS
See Design Guides


DESIGN
SOLID
SURFACE
SHEET METAL
TOOLS
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
BROWSER
Simple Bracket v2 v3
COMMENTS

Autodesk Fusion 360

Simple Bracket v2 v1*

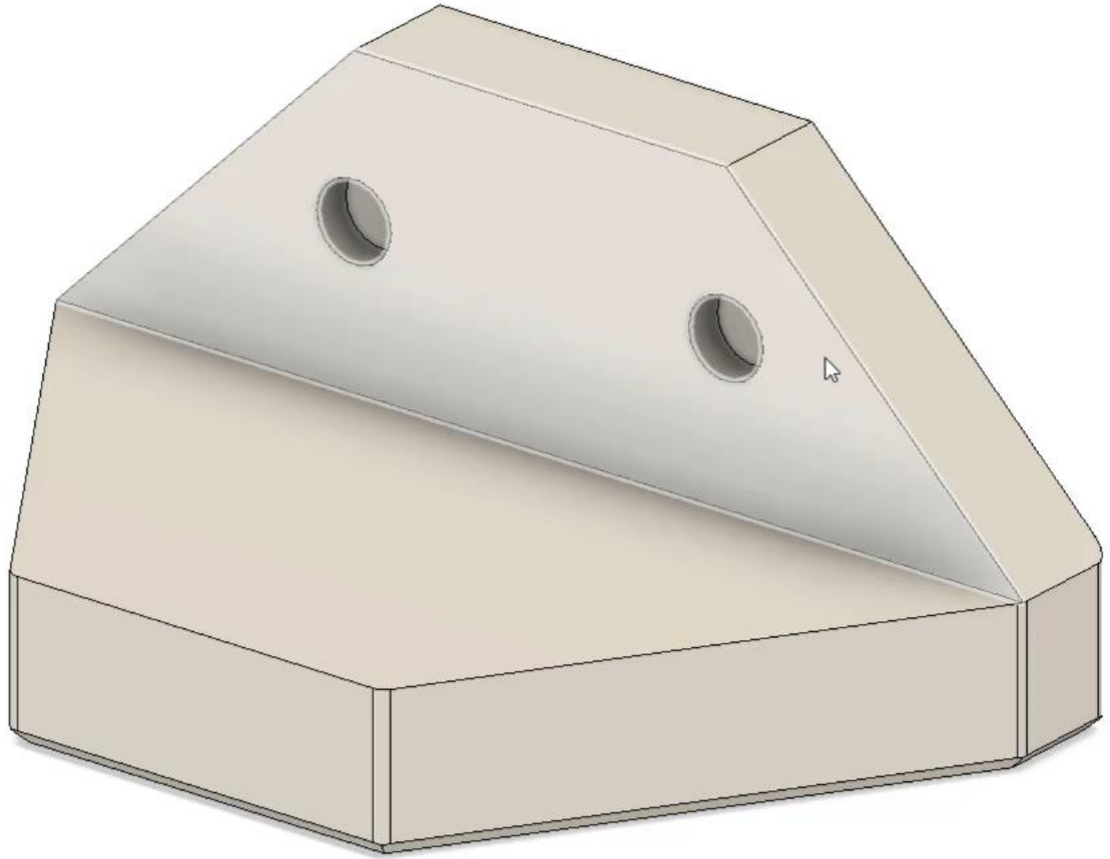
SOLID SURFACE SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Simple Bracket v2 v1
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Body1



See Design Guides

COMMENTS

Autodesk Fusion 360

Simple Bracket v2 v1*

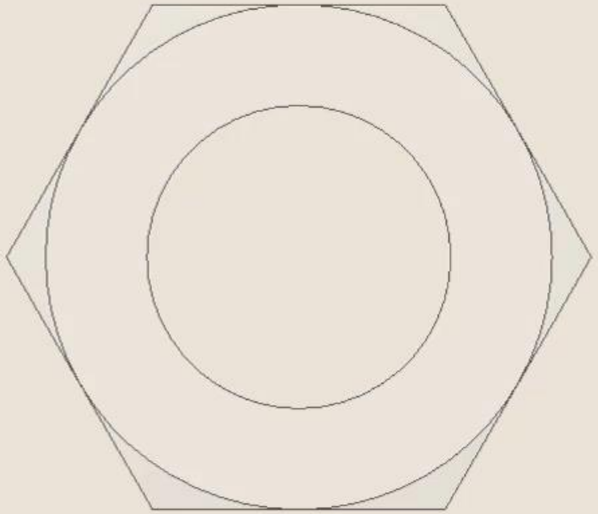
DESIGN

SOLID SURFACE SHEET METAL TOOLS

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT POSITION

BROWSER

- Simple Bracket v2 v1
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Body1
  - 90592A016_NO THREADS...



See Design Guides

COMMENTS

Autodesk Fusion 360

Simple Bracket v2 v2*

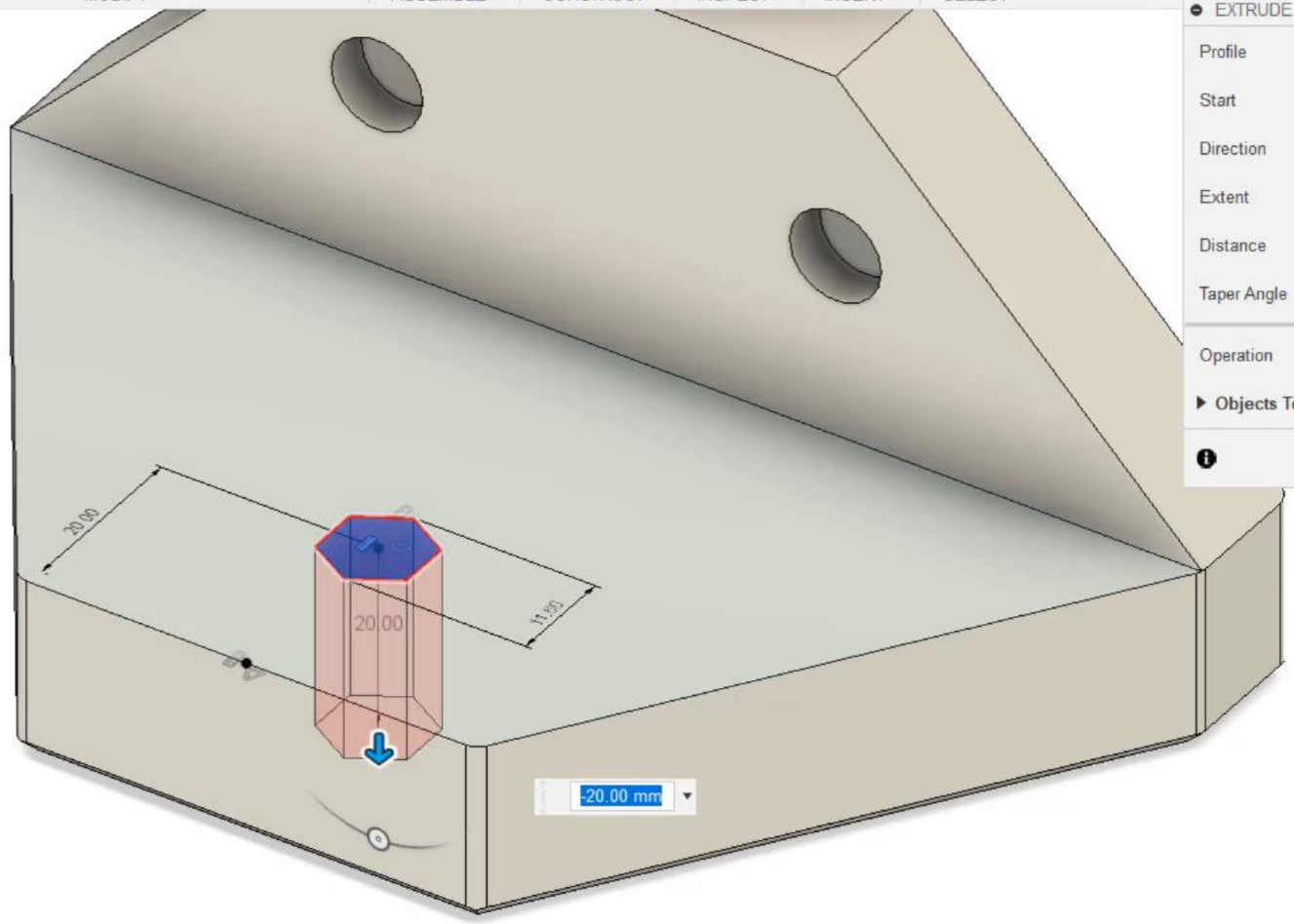
SOLID SURFACE SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Simple Bracket v2 v2
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Body1
  - Sketches
  - 90592A016_NO THREADS...



EXTRUDE

Profile	1 selected
Start	Profile Plane
Direction	One Side
Extent	Distance
Distance	-20.00 mm
Taper Angle	0.0 deg
Operation	Cut

Objects To Cut

OK Cancel

See Design Guides

COMMENTS

1 Profile | Area : 87.399 mm^2

Autodesk Fusion 360

Simple Bracket v2 v2*

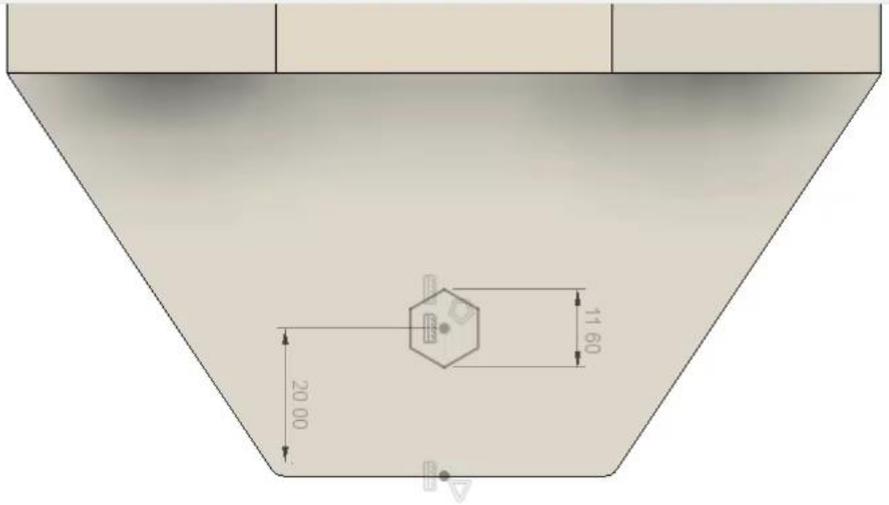
DESIGN

SOLID SURFACE SHEET METAL TOOLS

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Simple Bracket v2 v2
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Body1
  - Sketches
    - Sketch1
  - 90592A016_NO THREADS...



TOP

See Design Guides

COMMENTS

Adaptive Modelling for Extrusion Printing

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v43*

SOLID SURFACE SHEET METAL TOOLS

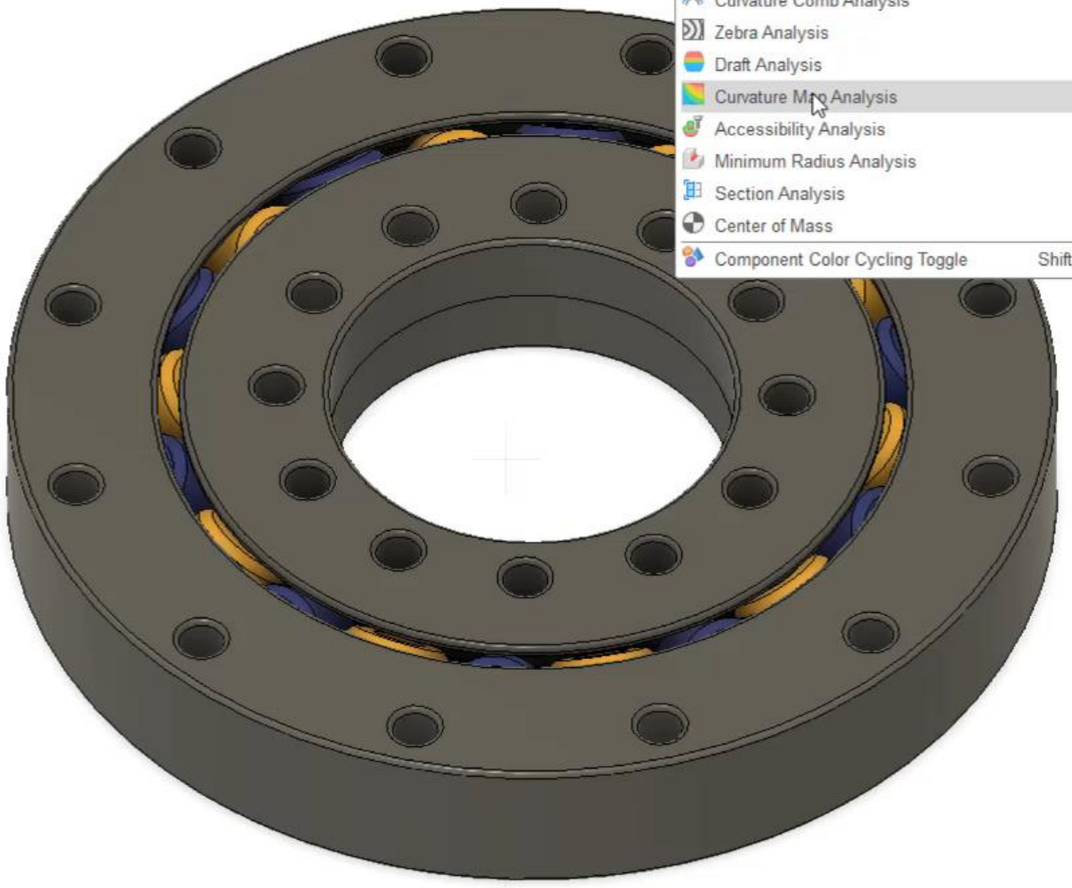
DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

- Measure I
- Interference
- Curvature Comb Analysis
- Zebra Analysis
- Draft Analysis
- Curvature Map Analysis
- Accessibility Analysis
- Minimum Radius Analysis
- Section Analysis
- Center of Mass
- Component Color Cycling Toggle Shift+N

BROWSER

- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Joints
  - Ball Bearing:1
  - 91223A415:1
    - Origin
    - Bodies



COMMENTS

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v43*

SOLID SURFACE SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Ball Bearing:1

FRONT

COMMENTS

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v43*

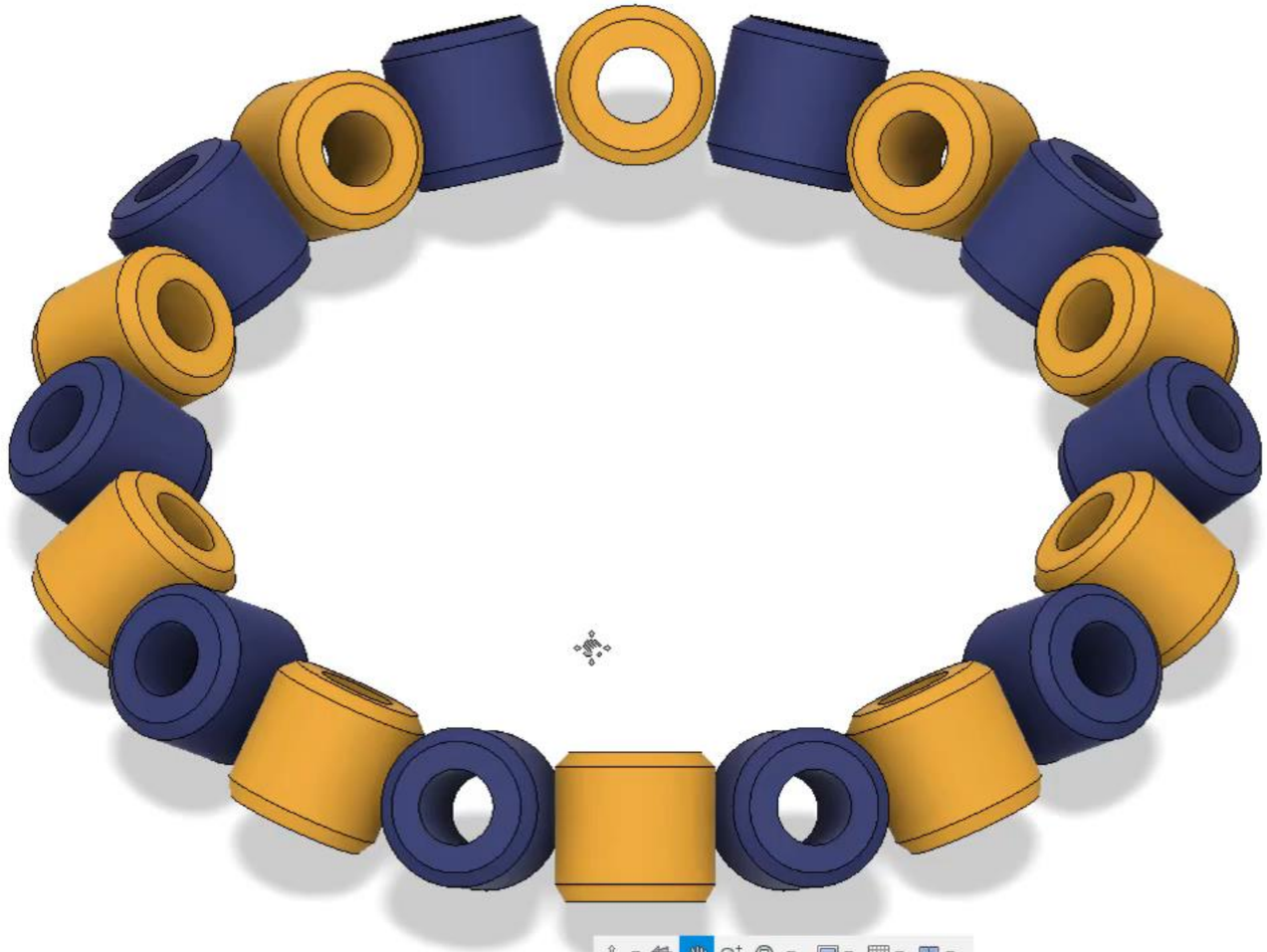
DESIGN

SOLID | SURFACE | SHEET METAL | TOOLS

CREATE | MODIFY | ASSEMBLE | CONSTRUCT | INSPECT | INSERT | SELECT

BROWSER

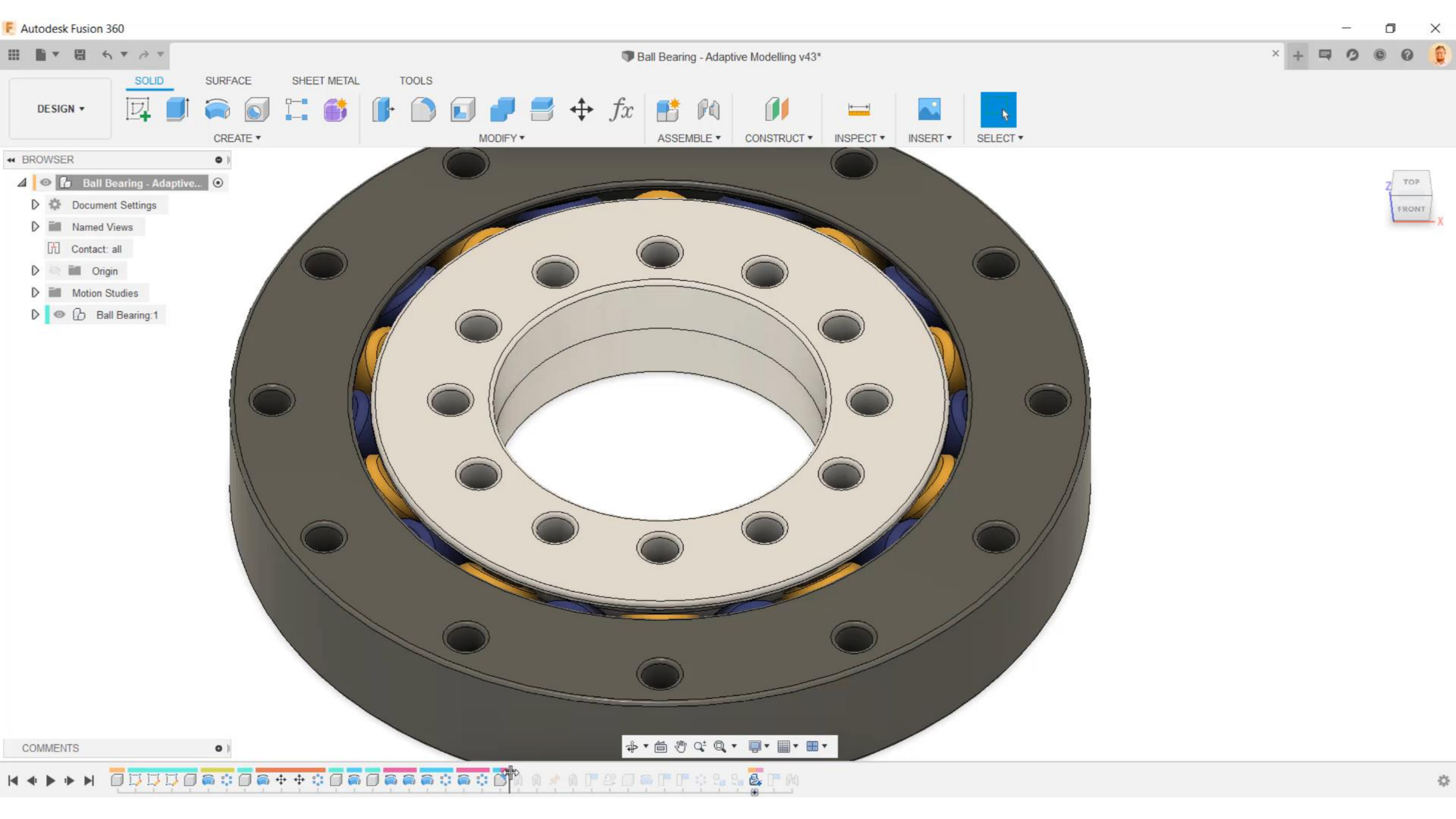
- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Ball Bearing:1



TOP

FRONT

COMMENTS


Autodesk Fusion 360
Ball Bearing - Adaptive Modelling v43*
DESIGN
SOLID
SURFACE
SHEET METAL
TOOLS
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
BROWSER
Ball Bearing - Adaptive...
Document Settings
Named Views
Contact: all
Origin
Motion Studies
Ball Bearing:1
TOP
FRONT
COMMENTS

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v43*

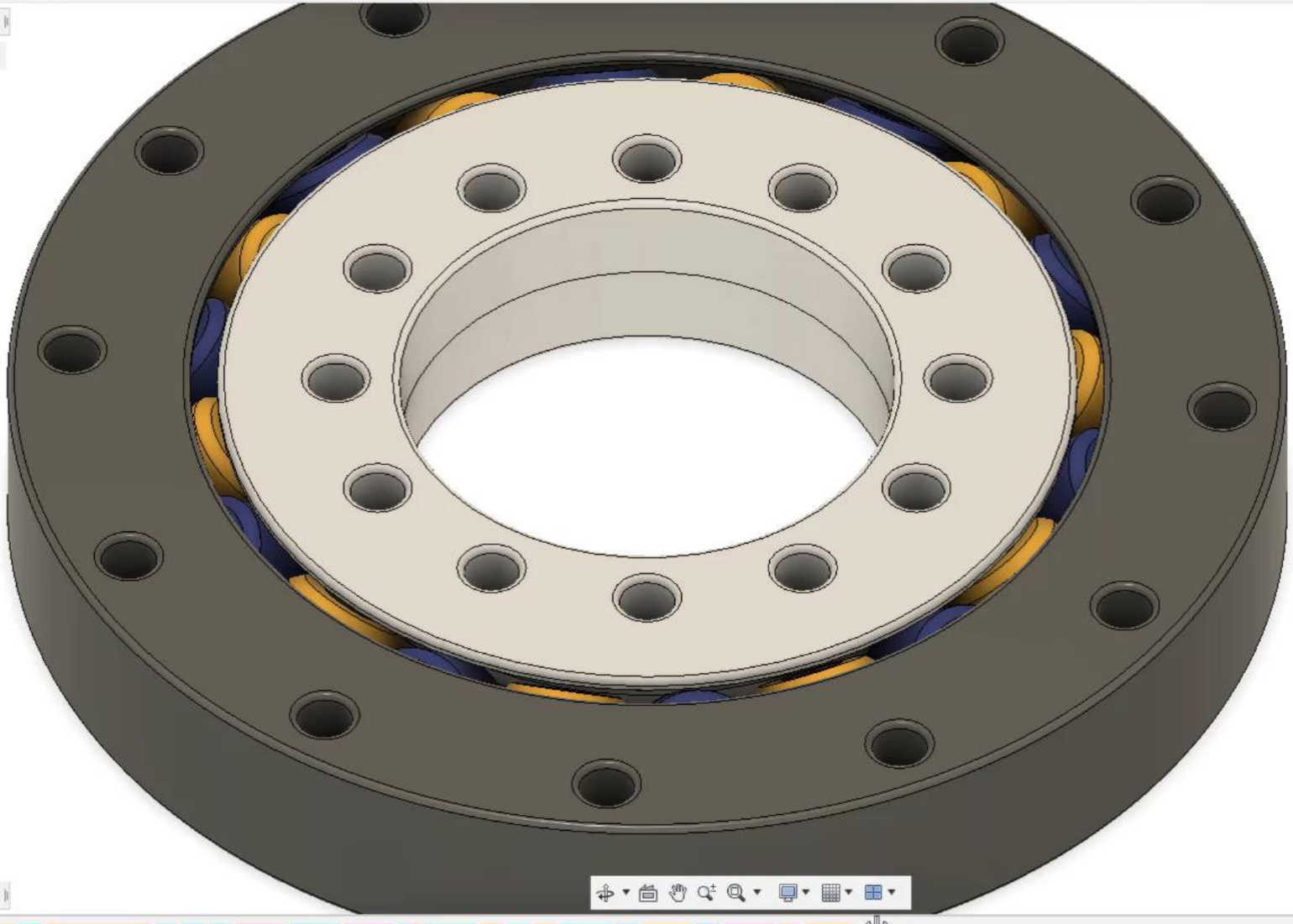
DESIGN

SOLID | SURFACE | SHEET METAL | TOOLS

CREATE | MODIFY | ASSEMBLE | CONSTRUCT | INSPECT | INSERT | SELECT

BROWSER

- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Ball Bearing:1



TOP

FRONT

COMMENTS

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v44*

DESIGN

SOLID | SURFACE | SHEET METAL | TOOLS

CREATE | MODIFY | ASSEMBLE | CONSTRUCT | INSPECT | INSERT | SELECT | POSITION

BROWSER

- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Joints
  - Ball Bearing:1
  - 91223A415:1

TOP

FRONT

COMMENTS

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v44*

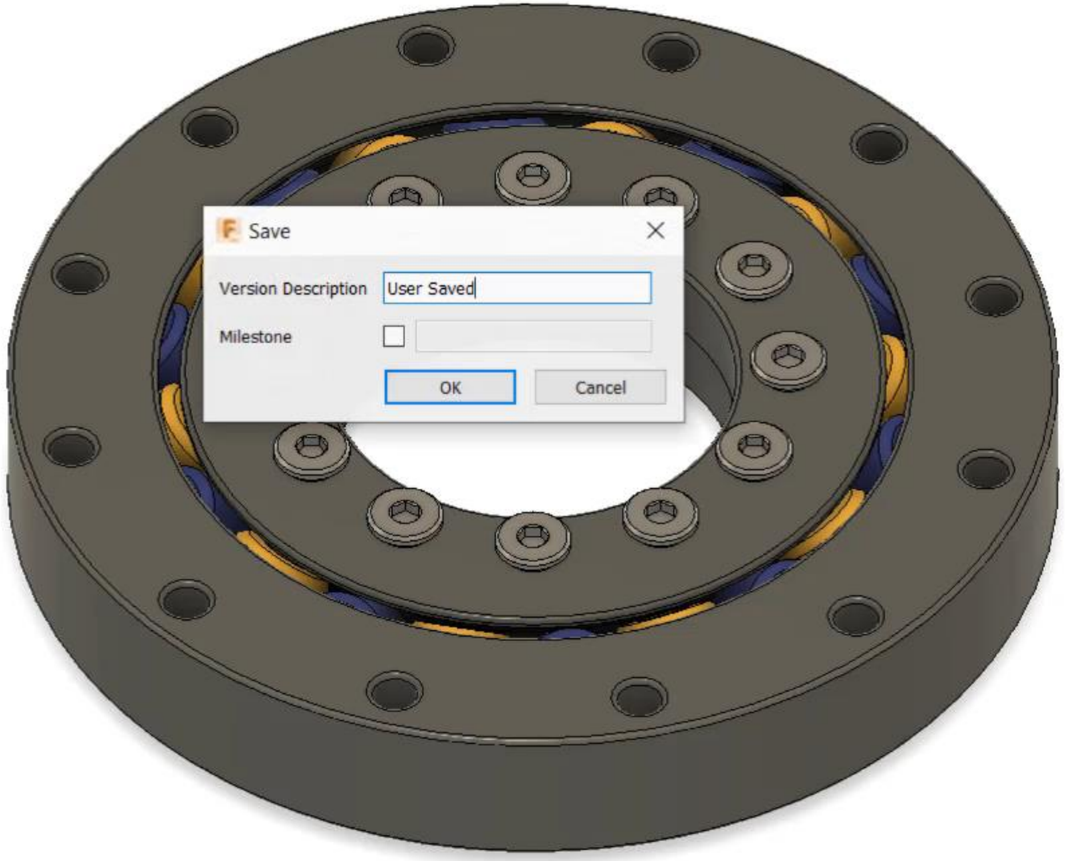
SOLID SURFACE SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Joints
  - Ball Bearing:1
  - 91223A415:1
  - 91223A415:2
  - 91223A415:3
  - 91223A415:4
  - 91223A415:5
  - 91223A415:6
  - 91223A415:7
  - 91223A415:8
  - 91223A415:9
  - 91223A415:10
  - 91223A415:11
  - 91223A415:12



TOP FRONT

COMMENTS

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v45*

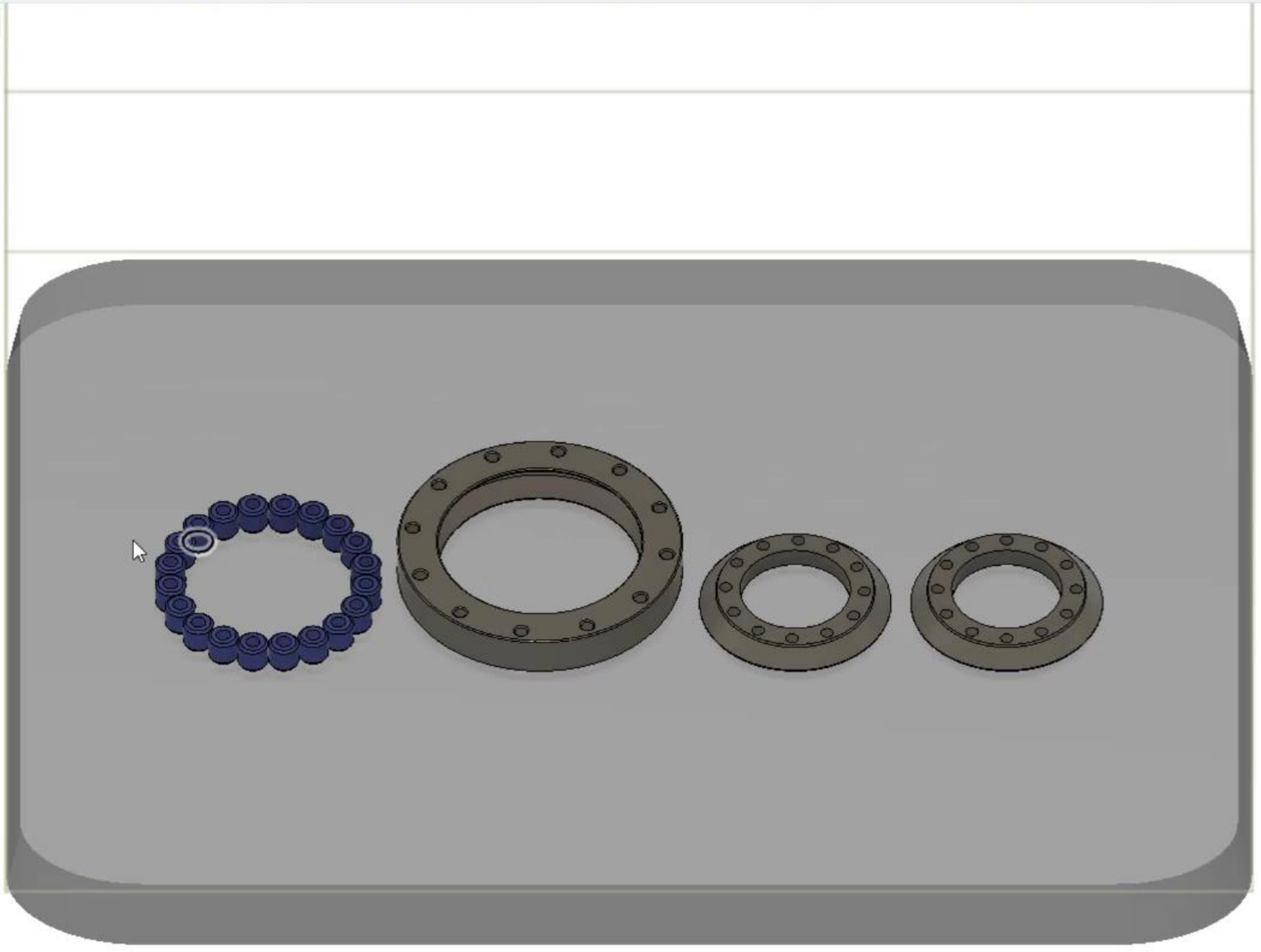
MILLING TURNING ADDITIVE INSPECTION FABRICATION UTILITIES

MANUFACTURE

SETUP POSITION PRINT SETTINGS INFILL SUPPORTS ACTIONS MANAGE INSPECT SELECT

BROWSER

- Ball Bearing - Adaptive Modellir...
  - Units: mm
  - Named Views
  - Models
    - Ball Bearing - Adaptive M...
      - Named Views
      - Origin
      - Joints
      - Motion Studies
      - Ball Bearing:1
      - 91223A415:1
  - Setups
    - Setup3



TOP FRONT

COMMENTS

Setup3

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v45*

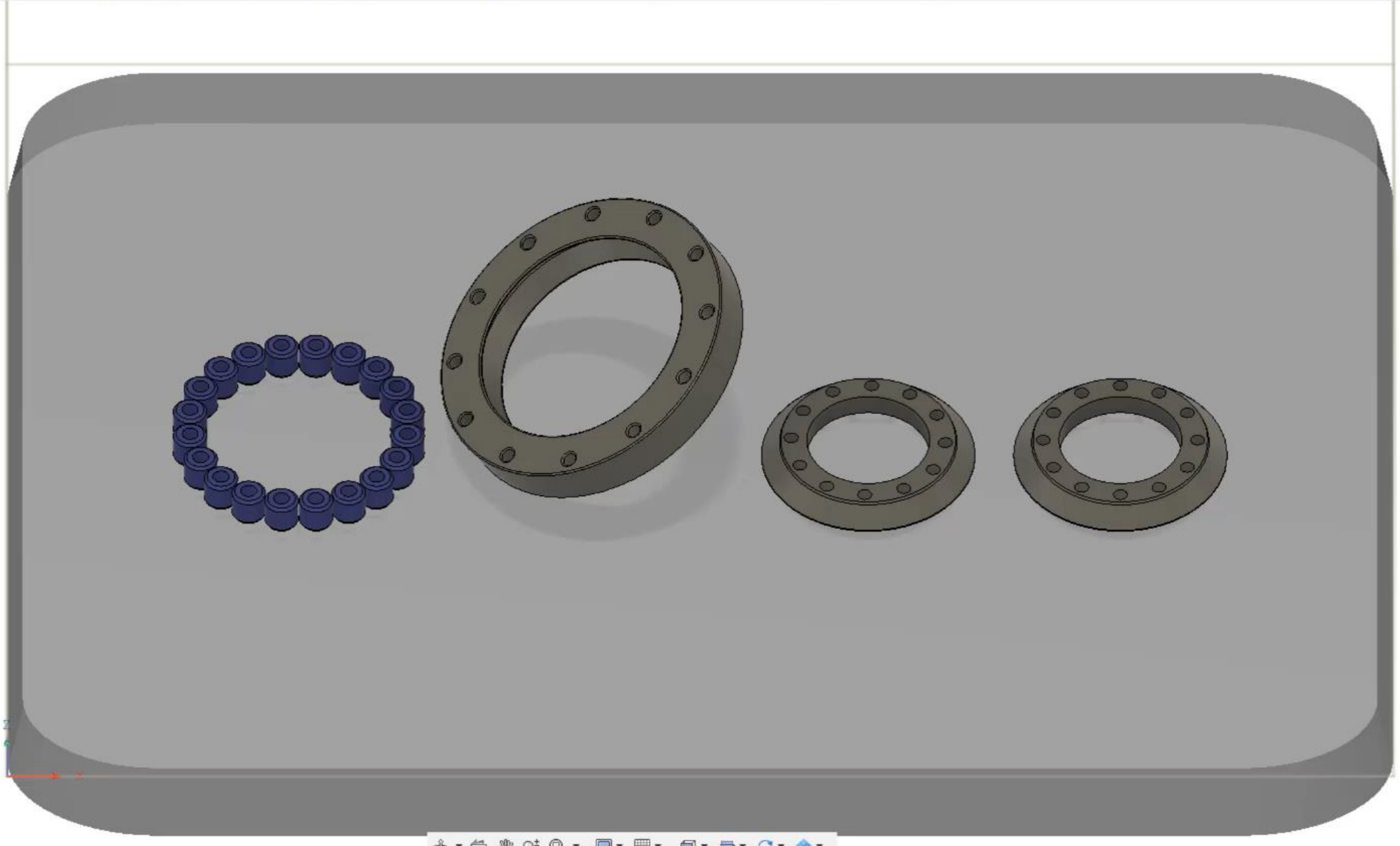
MILLING TURNING ADDITIVE INSPECTION FABRICATION UTILITIES

MANUFACTURE

SETUP POSITION PRINT SETTINGS INFILL SUPPORTS ACTIONS MANAGE INSPECT SELECT

BROWSER Move

- Ball Bearing - Adaptive Modellir...
  - Units: mm
  - Named Views
  - Models
    - Ball Bearing - Adaptive M...
      - Named Views
      - Origin
      - Joints
      - Motion Studies
      - Ball Bearing:1
      - 91223A415:1
  - Setups
    - Setup3
      - Ultimaker S5
      - PLA 2.85mm, 0.4mm No...
      - Additive Toolpath



COMMENTS

Setup3

UMS5_Bearing Print Test - Ultimaker Cura

File Edit View Settings Extensions Preferences Help

Ultimaker Cura

PREPARE PREVIEW MONITOR

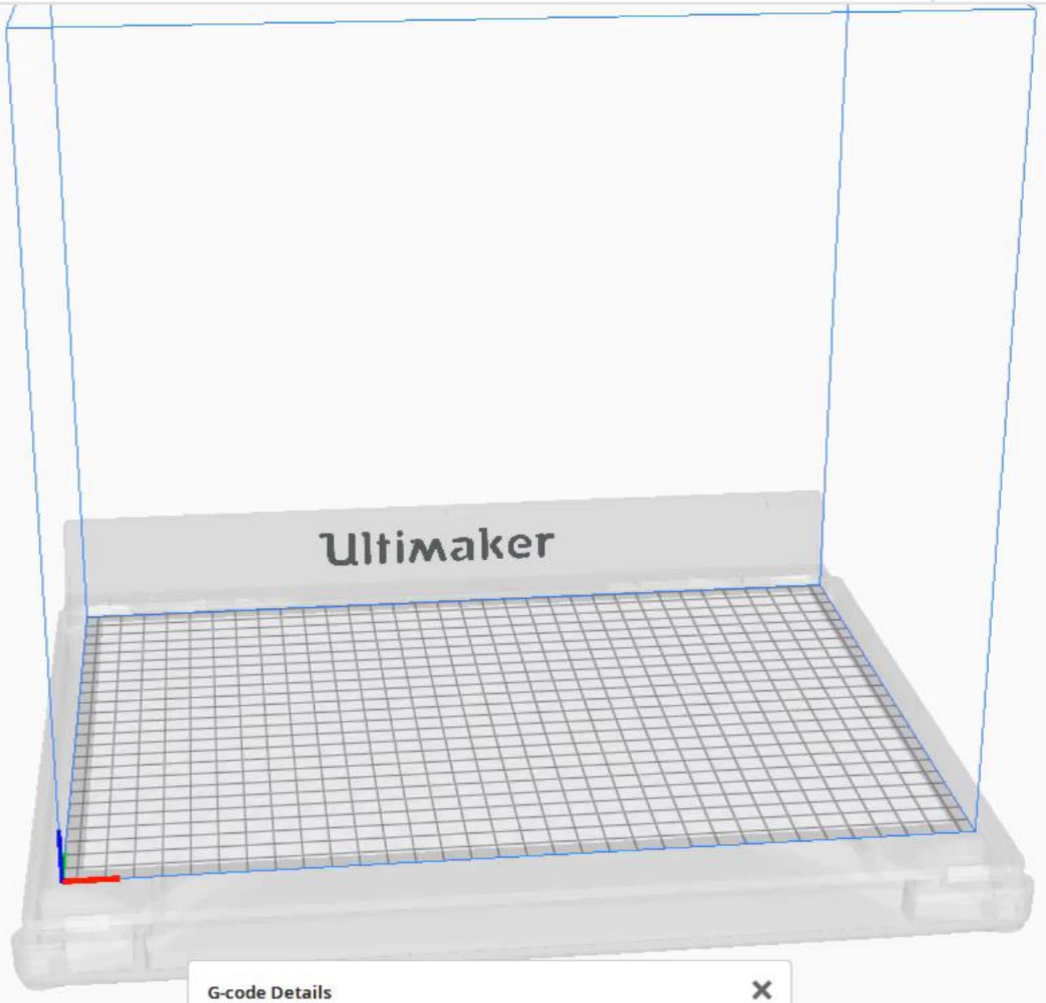
Marketplace Sign in

Ultimaker S5

Generic PLA
AA 0.4

Generic PLA
AA 0.4

Fine - 0.1mm 20% Off On



G-code Details

Make sure the g-code is suitable for your printer and printer configuration before sending the file to it. The g-code representation may not be accurate.

Autodesk Fusion 360

Ball Bearing - Adaptive Modelling v45*

SOLID SURFACE SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Ball Bearing - Adaptiv...
  - Document Settings
  - Named Views
  - Contact: all
  - Origin
  - Motion Studies
  - Joints
  - Ball Bearing:1
  - 91223A415:1

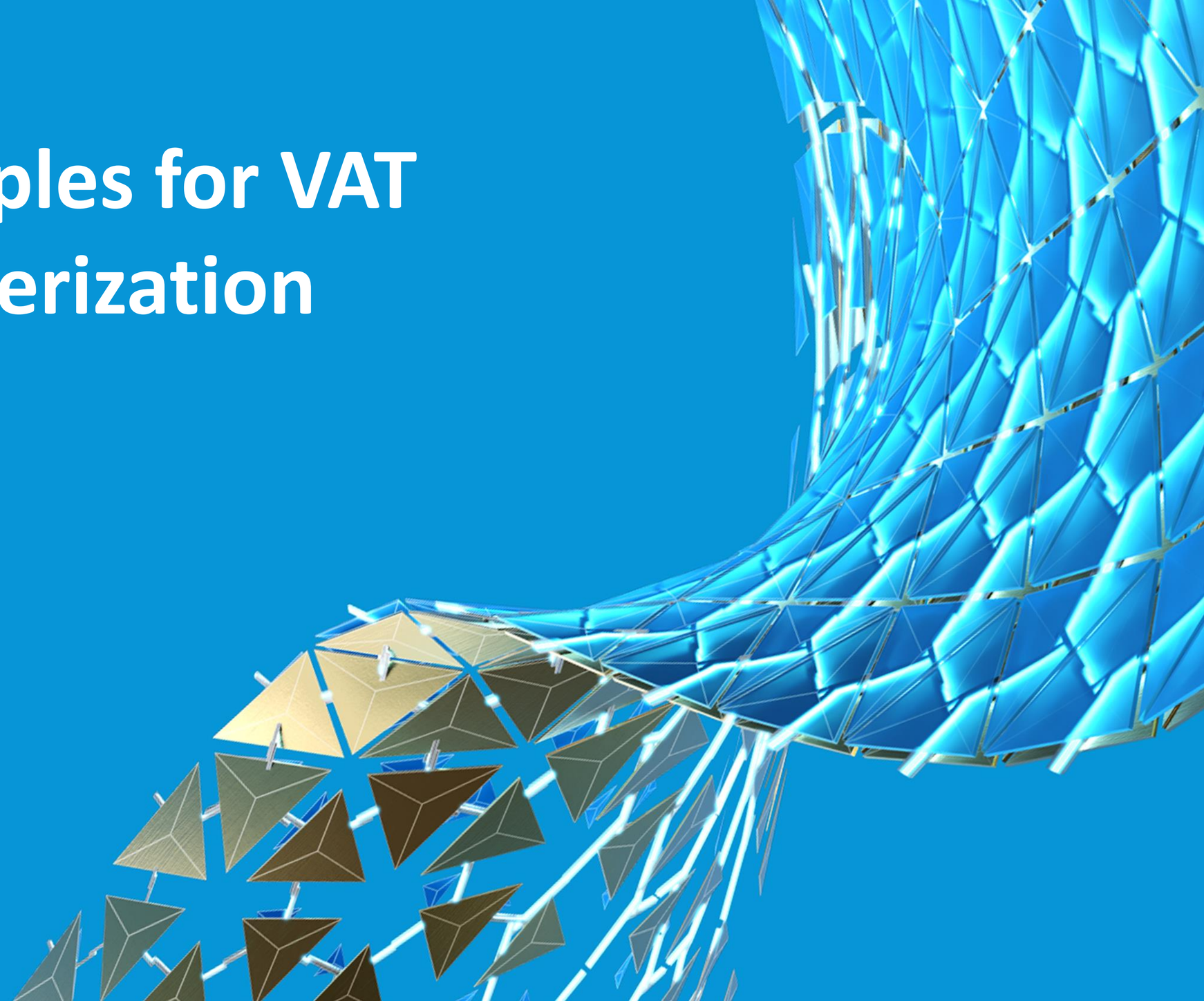
TOP FRONT

COMMENTS

Fresh off the printer…

Printable on extrusion printers as with the likes of Markforged & Ultimaker for example.

DfAM Principles for VAT Photopolymerization

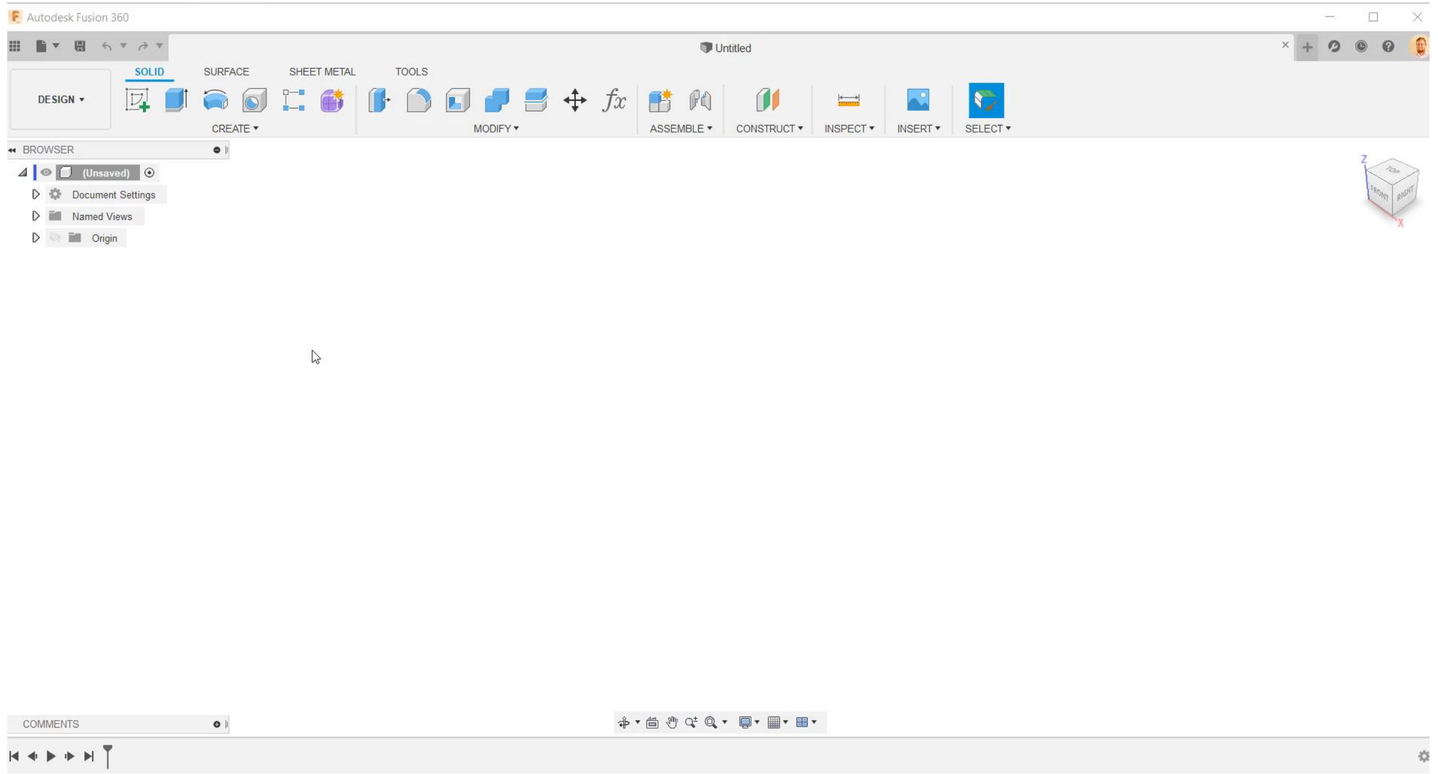


Optimize for Manufacturing (VAT Photopolymerization)

DfAM

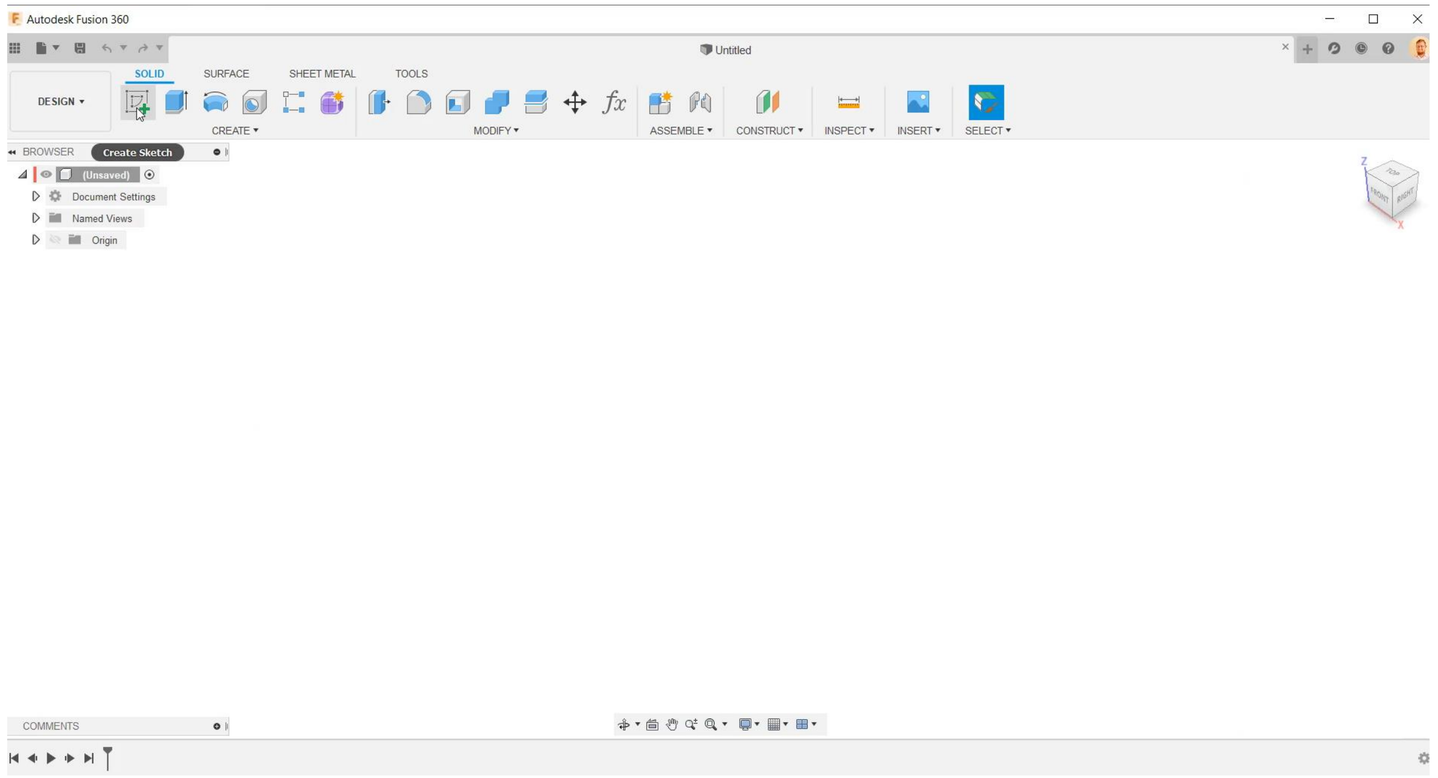
- **Building a 3D model via Computer Aided Design (CAD)**
- **Parametric sketching and modelling**

DfAM – Supported Wall Thickness



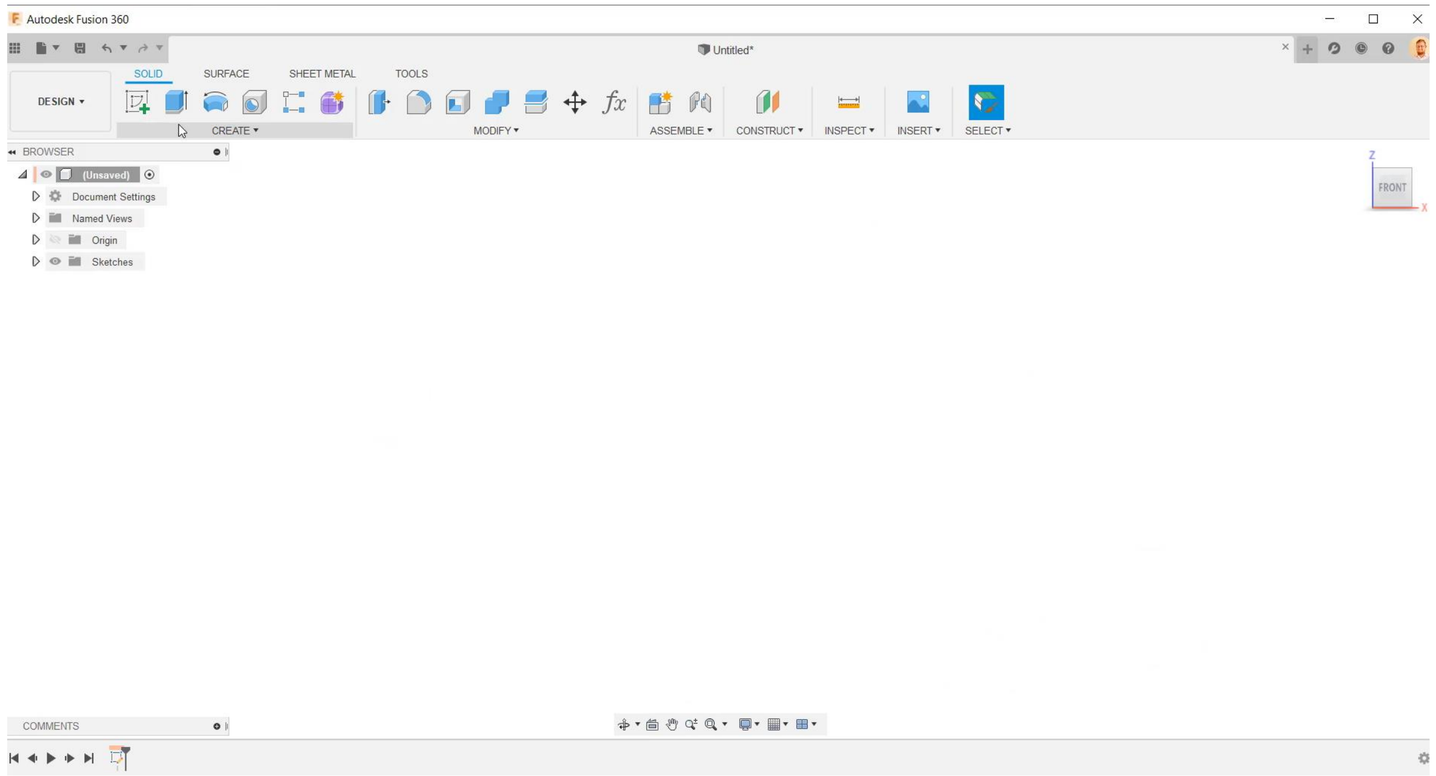
See Design Guides in Resources

DfAM – Unsupported Wall Thickness



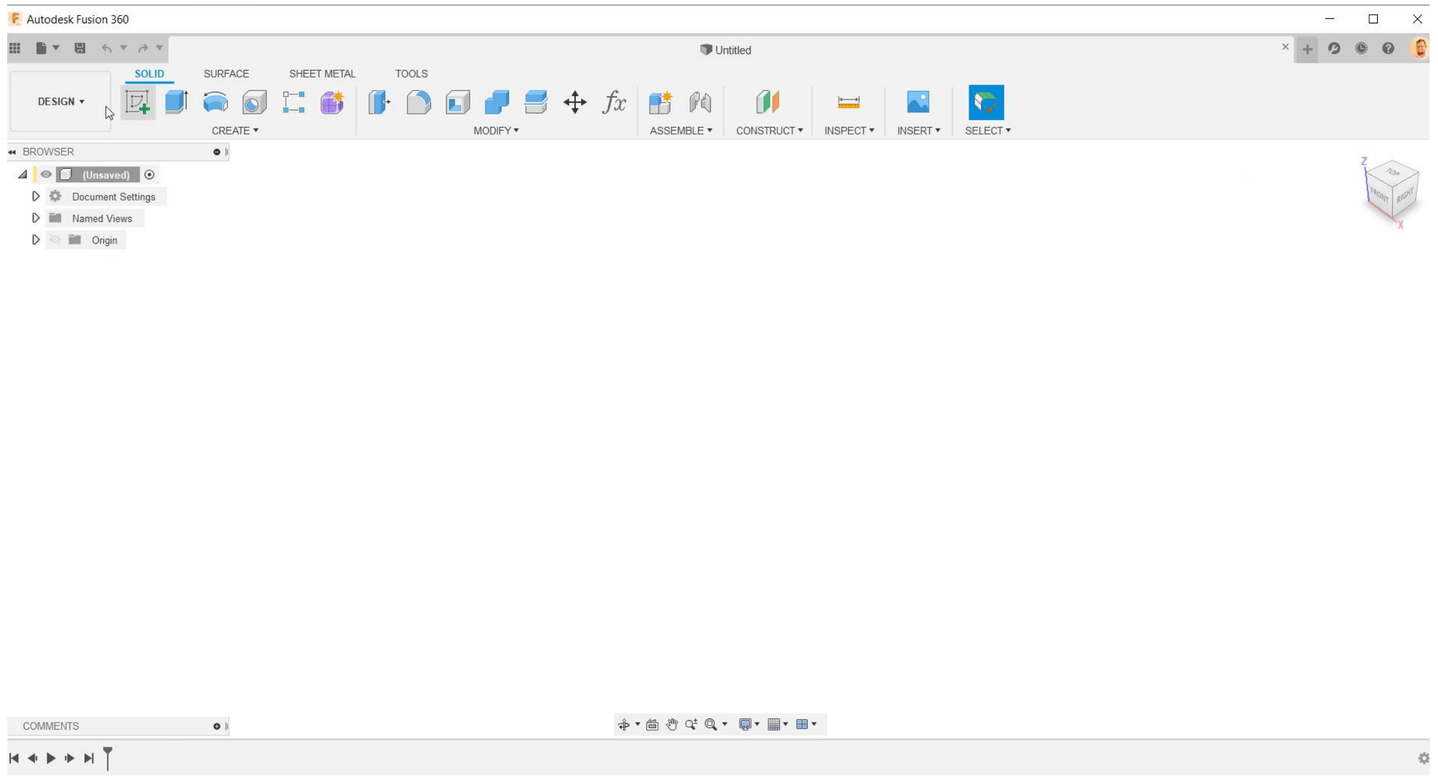
See Design Guides in Resources

DfAM – Unsupported Horizontal Overhang Length



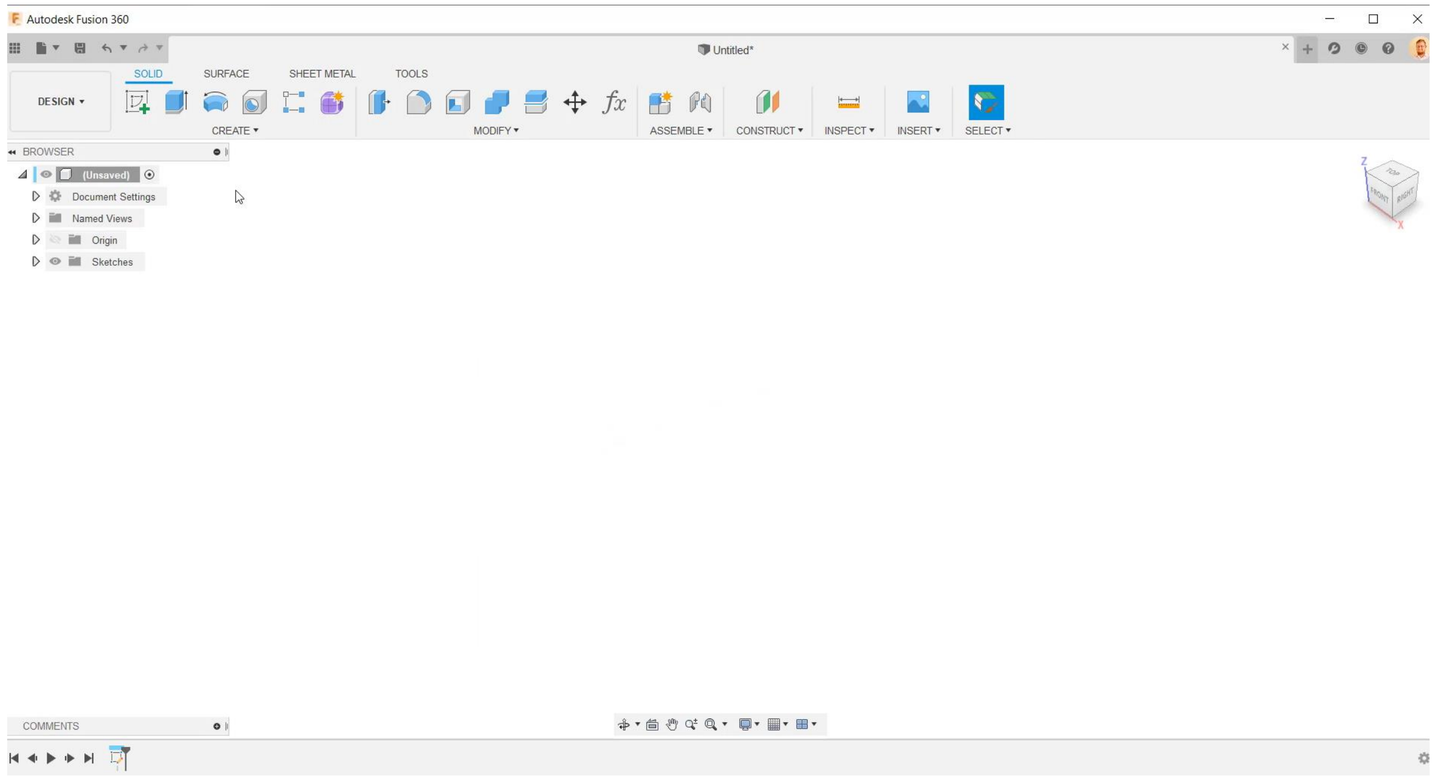
See Design Guides in Resources

DfAM – Unsupported Overhang Angles



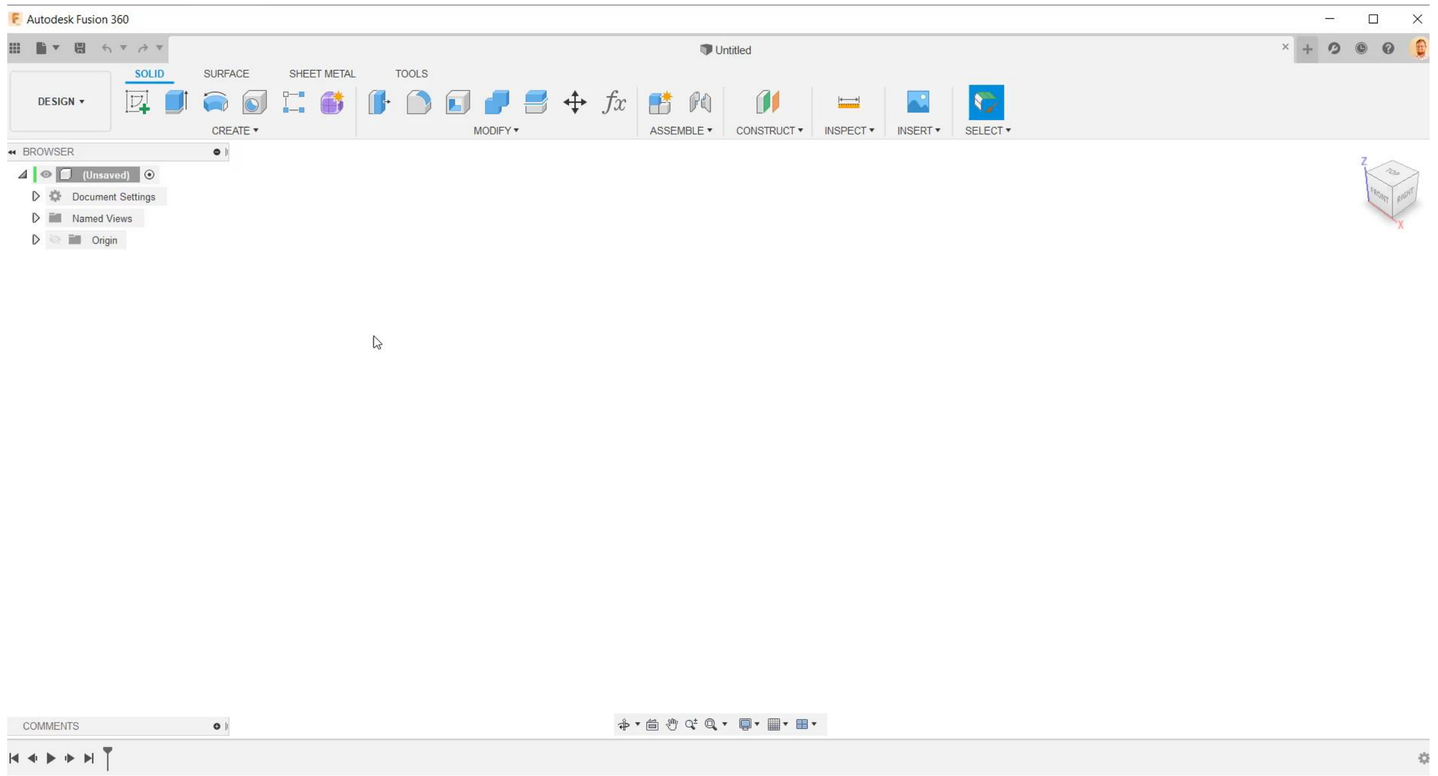
See Design Guides in Resources

DfAM – Horizontal Support Span



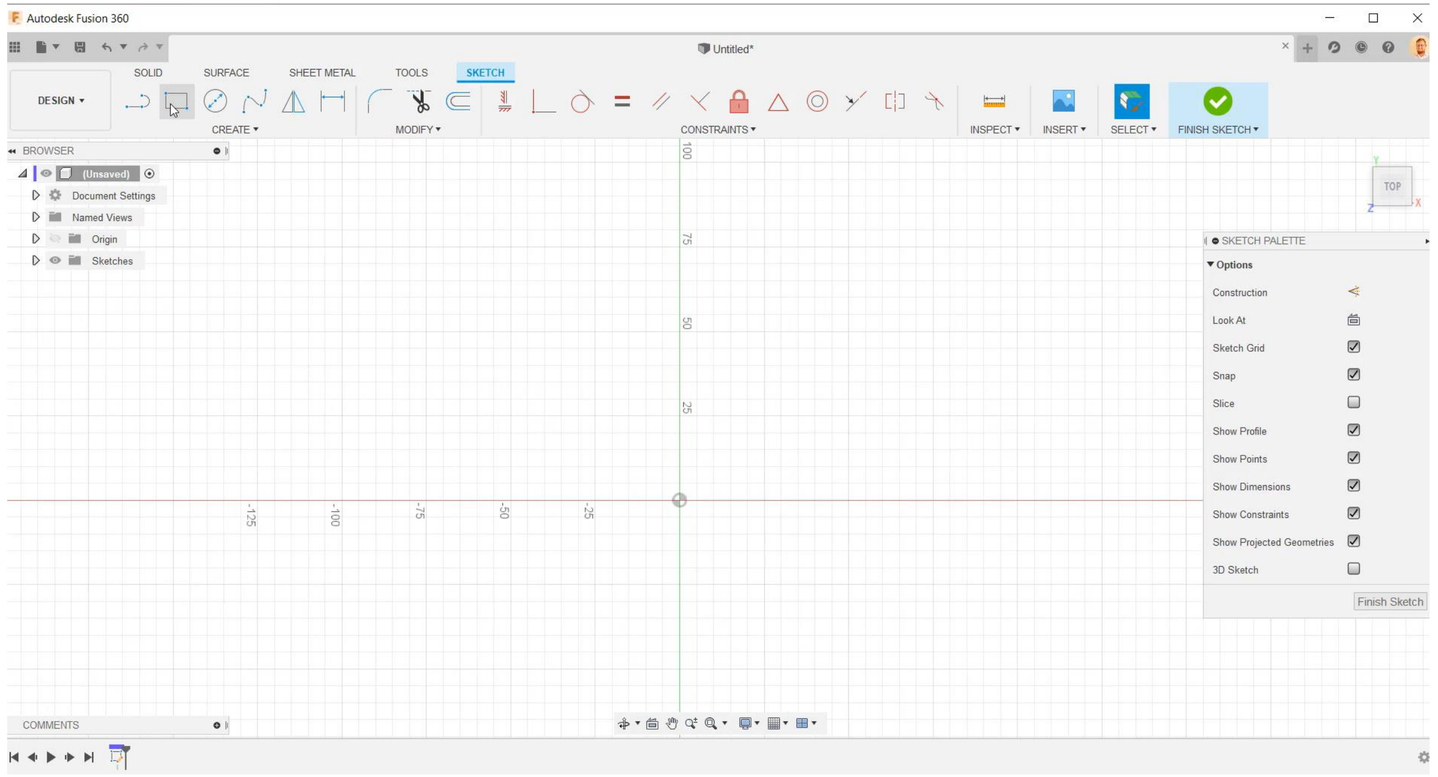
See Design Guides in Resources

DfAM – Vertical Pillar Diameters



See Design Guides in Resources

DfAM – Embossed/Engraved Detail



See Design Guides in Resources

Working with Scan Data

Workflow

3D SCANNING

DATA COLLECTION

Point Cloud Data

- Laser Scanning (hardware)
- Photogrammetry (image based)

MESH REPAIR & MANIPULATION

WORKING WITH MESH DATA

- Withing Computer Aided Design Software (Fusion 360)
- Netfabb / Recap Pro
- Within Scanning Software

CONVERSION TO MANIFOLD GEOMETRY

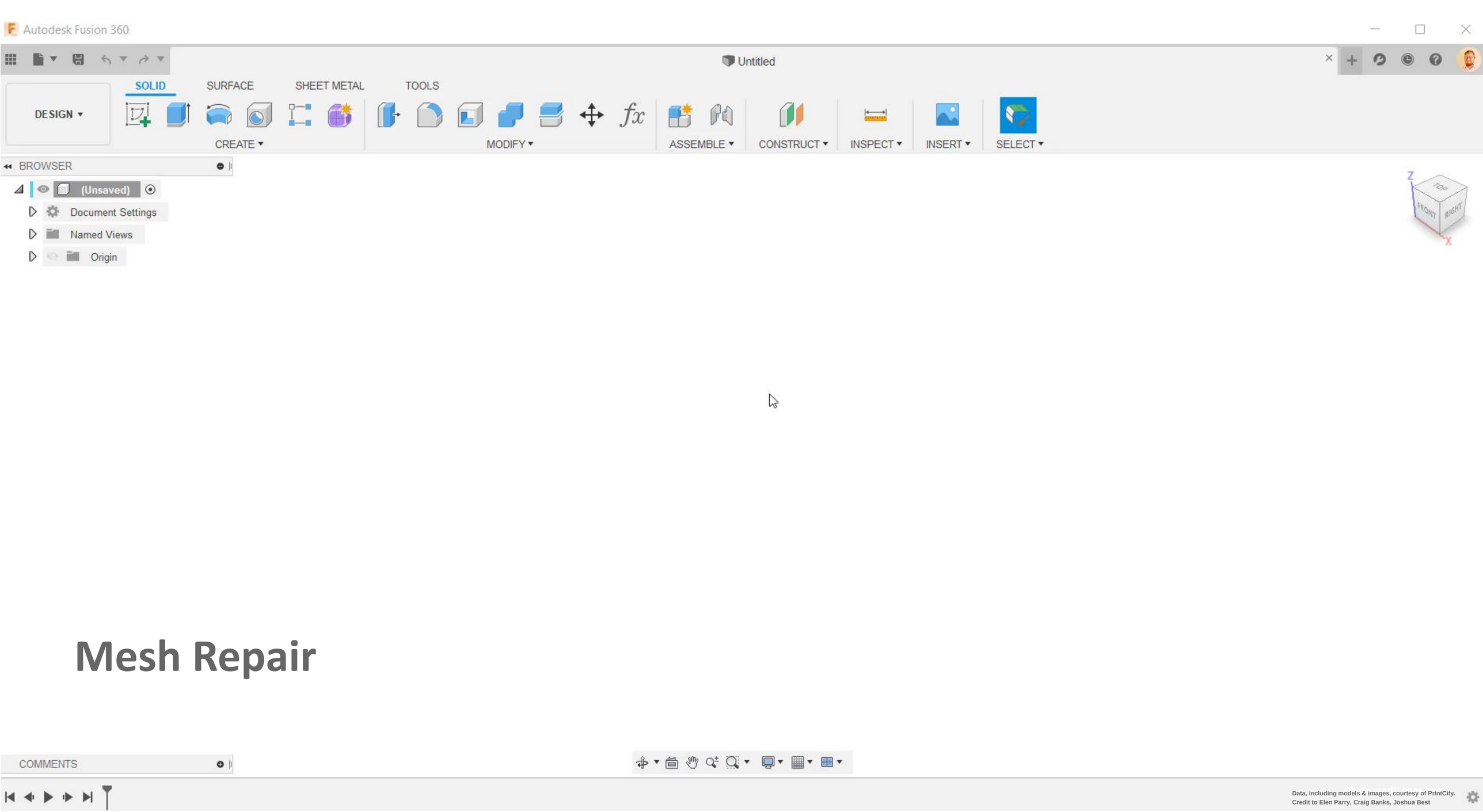
FOR ADDITIONAL MODIFICATION

- Mesh to BRep
- Tri Mesh – Quad Mesh – T-Spline - BRep

3D PRINT

SLICE AND EXPORT GCODE

- Within Computer Aided Design Software (Fusion 360 / Netfabb)
- Or Push to Printer Slicing Software


Autodesk Fusion 360
Untitled
DESIGN
SOLID
SURFACE
SHEET METAL
TOOLS
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
BROWSER
(Unsaved)
Document Settings
Named Views
Origin
TOP
FRONT
RIGHT
Z
X
COMMENTS
Data, including models & images, courtesy of PrintCity.
Credit to Elen Parry, Craig Banks, Joshua Best

Mesh Repair

Autodesk Fusion 360

Untitled*

MESH

DESIGN

CREATE

MODIFY

CONSTRUCT

INSPECT

SELECT

FINISH MESH

BROWSER

(Unsaved)

Document Settings

Named Views

Origin

Bodies

Mesh Repair

COMMENTS

Autodesk Fusion 360

Untitled*

MESH

DESIGN

CREATE

MODIFY

CONSTRUCT

INSPECT

SELECT

FINISH MESH

BROWSER

(Unsaved)

Document Settings

Named Views

Origin

Bodies

Mesh Repair

COMMENTS

Data, including models & images, courtesy of PrintCity.
Credit to Elen Parry, Craig Banks, Joshua Best

Autodesk Fusion 360

Hand Grip Scan 02.1 v2

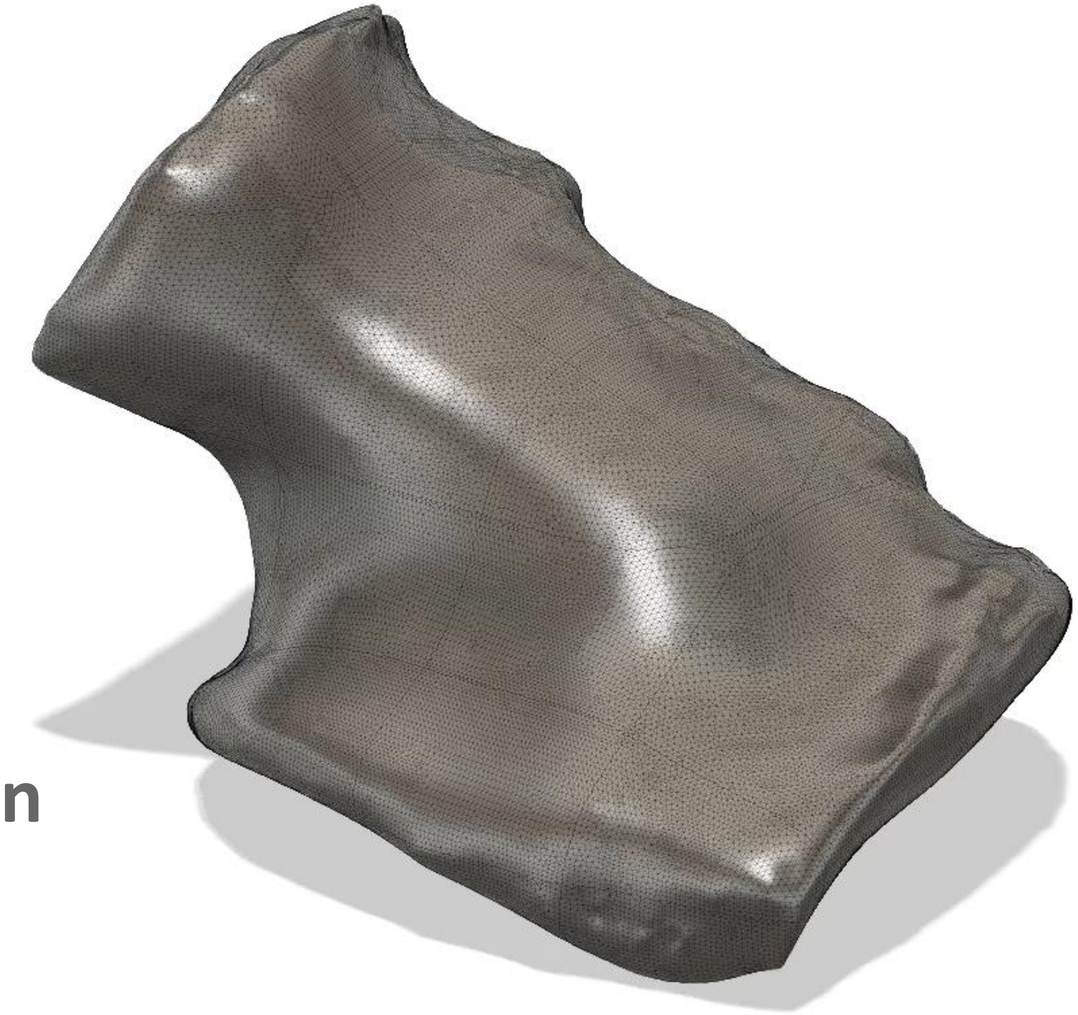
SOLID SURFACE FORM MESH SHEET METAL TOOLS

DESIGN

CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT SELECT

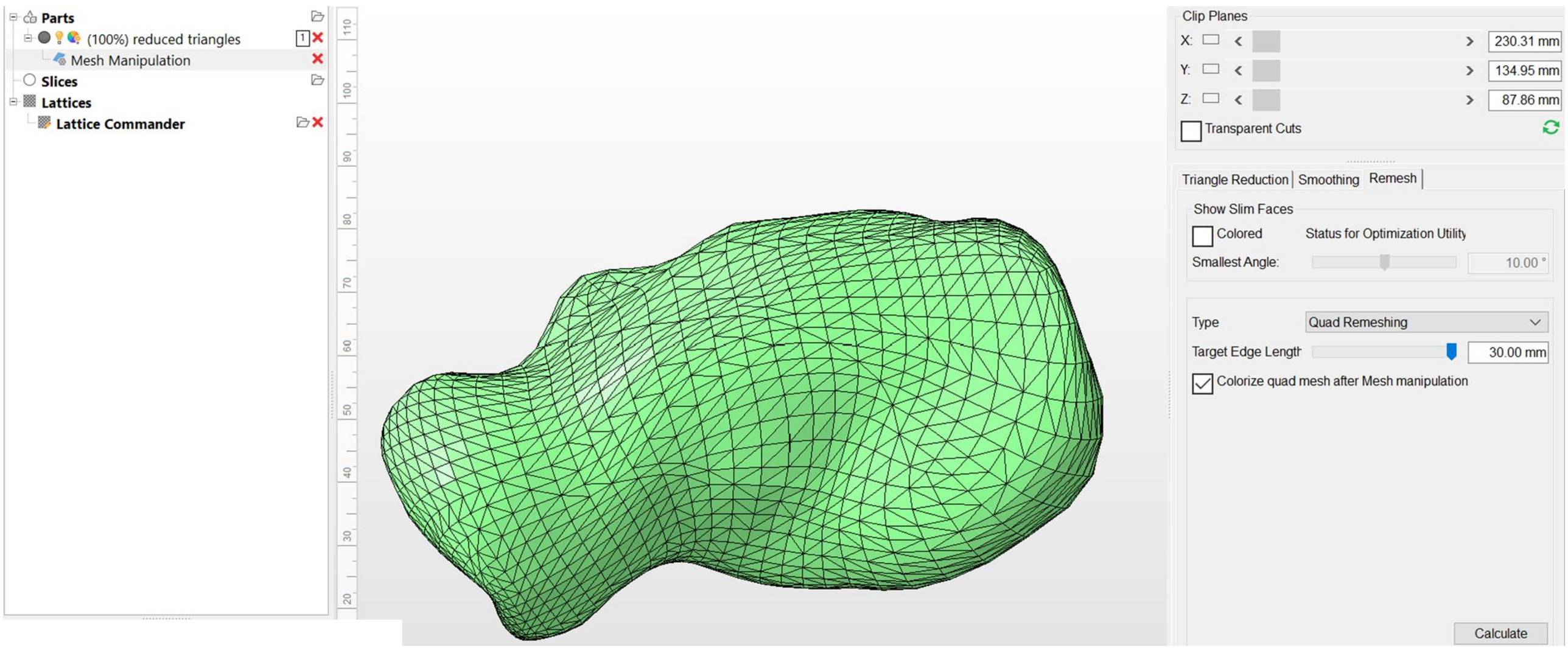
BROWSER

- Hand Grip Scan 02.1 v2
  - Document Settings
  - Named Views
  - Origin
  - Bodies
  - Sketches



Mesh Manipulation

COMMENTS



Conversion (Tri-Mesh to Quad Mesh)

Image shows workflow within Autodesk Netfabb

- **Mesh manipulation in Netfabb also enables allows for re-meshing, including conversion**
- **Increase or decrease triangle count and quality of Mesh, and convert to Quad-Mesh if T-Spline modification is desired**

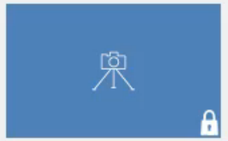
Dashboard Editor

ReCap Photo

Unsubscribed joshbest.autodesk

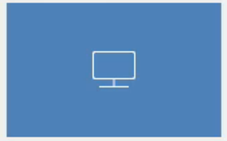
Create 3D

Aerial



Object

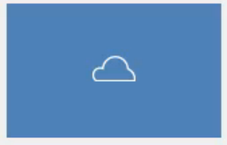
My Computer



Load a model

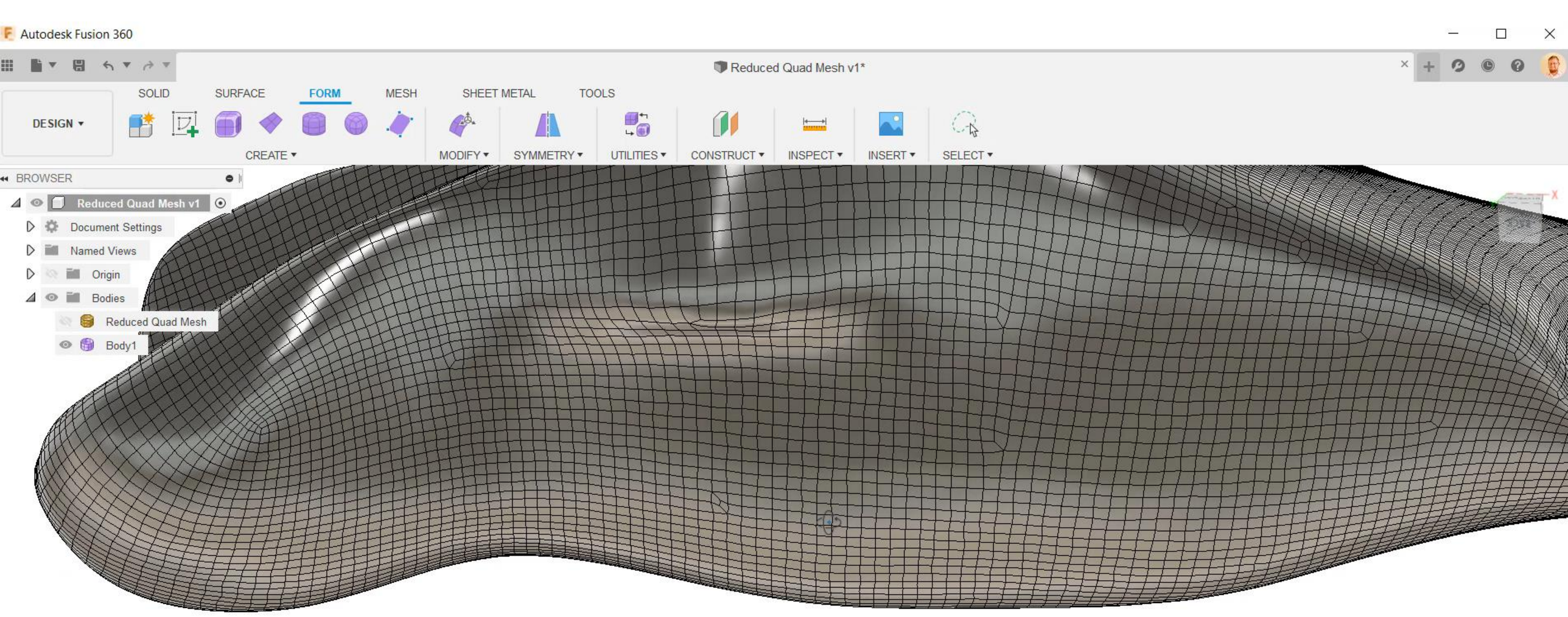
My Cloud Drive

Date Descending

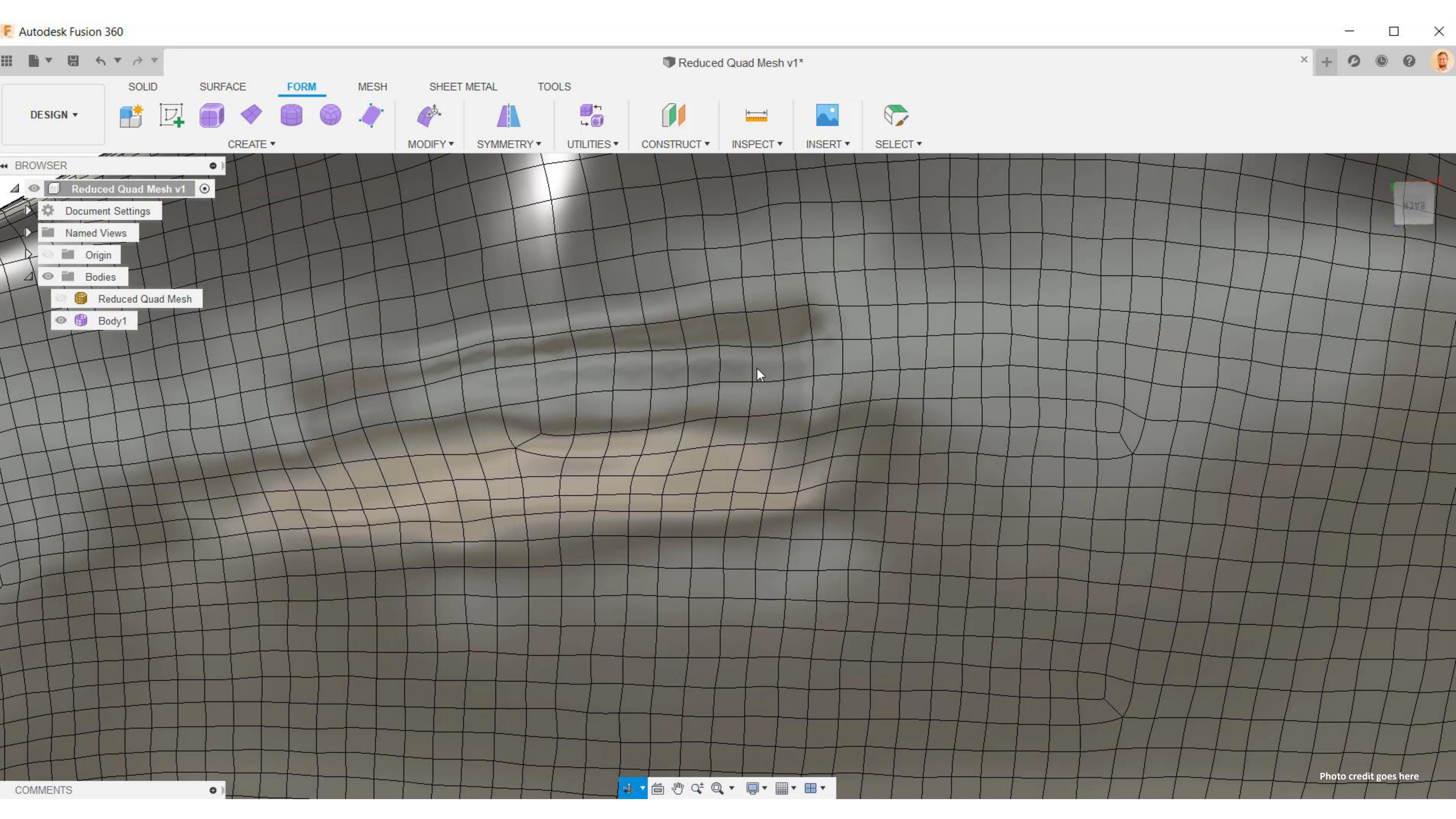


Browse 360.autodesk.com

Available storage: 500.0GB / 500.0GB



T-Spline Modification


Autodesk Fusion 360
Reduced Quad Mesh v1*
SOLID
SURFACE
FORM
MESH
SHEET METAL
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DESIGN
CREATE
MODIFY
SYMMETRY
UTILITIES
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INSPECT
INSERT
SELECT
BROWSER
Reduced Quad Mesh v1
Document Settings
Named Views
Origin
Bodies
Reduced Quad Mesh
Body1
COMMENTS
Photo credit goes here

Autodesk Fusion 360

Reduced Quad Mesh v1*

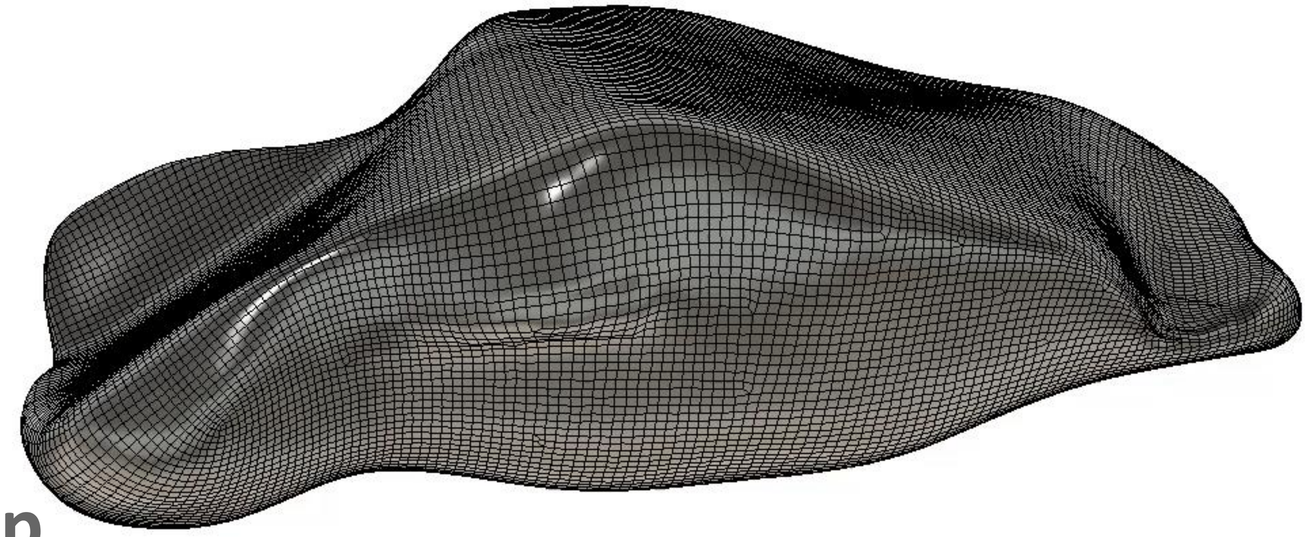
SOLID SURFACE FORM MESH SHEET METAL TOOLS

DESIGN

CREATE MODIFY SYMMETRY UTILITIES CONSTRUCT INSPECT INSERT SELECT

BROWSER

- Reduced Quad Mesh v1
  - Document Settings
  - Named Views
  - Origin
  - Bodies
    - Reduced Quad Mesh
    - Body1



Convert to BRep

COMMENTS

Results

10m

3D Scanning

Minimal labour intensity, semi automated data collection, minimal skill level

10m

Mesh Repair/Manipulation

Medium skill level, semi-automated data processing

10h

Additive Manufacturing

Low skill level, automated production on an Ultimaker 3D printer with Varioshore material. Some manual post processing

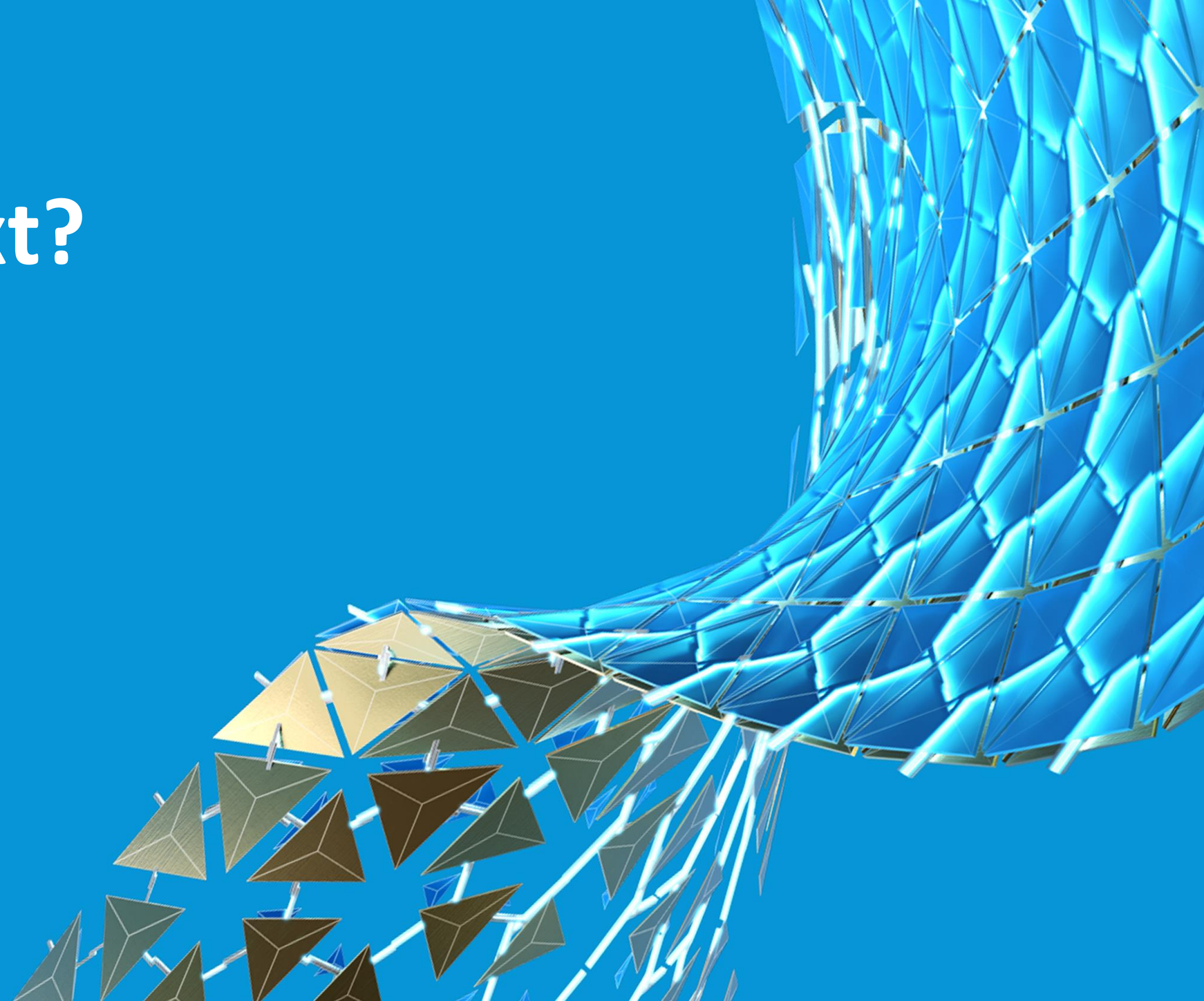
£4.92

Material Cost

Per part material cost / comparatively low against existing standardized products

Data, including models & images, courtesy of PrintCity.
Credit to Elen Parry, Craig Banks, Joshua Best

What’s Next?



Resource links

Consult your class hand out for additional links and possible next steps in getting started