



# CP124007 - 3D Printing and Prototype Development with Fusion 360

Steven Schain - Post Production Supervisor / M & E Content Developer

Jerry Berns – Manufacturing Content Manager

4D Technologies ([www.cadlearning.com](http://www.cadlearning.com))

Join the conversation #AU2017

**WELCOME!**

# Class summary

3D printing has revolutionized the design and manufacturing production workflow, making the creation of design prototypes as easy as pushing a button. Fusion 360 software has become an indispensable tool in this revolution, letting designers and engineers create and iterate their designs faster than ever before. This course will step through the process of developing, printing, and iterating the design of a real product prototype—learning the different phases of the design used to create a 3D-printable final product. Fusion 360 and Print Studio are used every day for a variety of purposes, from the office, to the house, to production and marketing. This course will explore the creation of a unique spinner toy that you can assemble, personalize, and take home with you. This session will feature Fusion 360, Print Studio, and a live 3D printing demonstration.

# Key learning objectives

At the end of this class, you will be able to:

- Understand where Fusion 360 fits into the prototype development process
- See how 3D printing can accelerate the design review process
- Learn how to use Fusion 360 to continuously modify a model, saving time on redesigning a part
- Identify the differences between design for manufacture and design for 3D print

Please hold questions until the end of the class. Thank you.

# Enter to Win an M3D Micro 3D Printer

When You Activate Your FREE 30-Day Subscription to CADLearning!

## Entering is Easy!

Simply activate your FREE 30-Day subscription using your CADLearning poker chip **no later than 11/30/17**.

By activating your FREE trial, you'll automatically be entered into a drawing to win this M3D Micro 3D Printer!

[www.cadlearning.com/free30daytrial](http://www.cadlearning.com/free30daytrial)

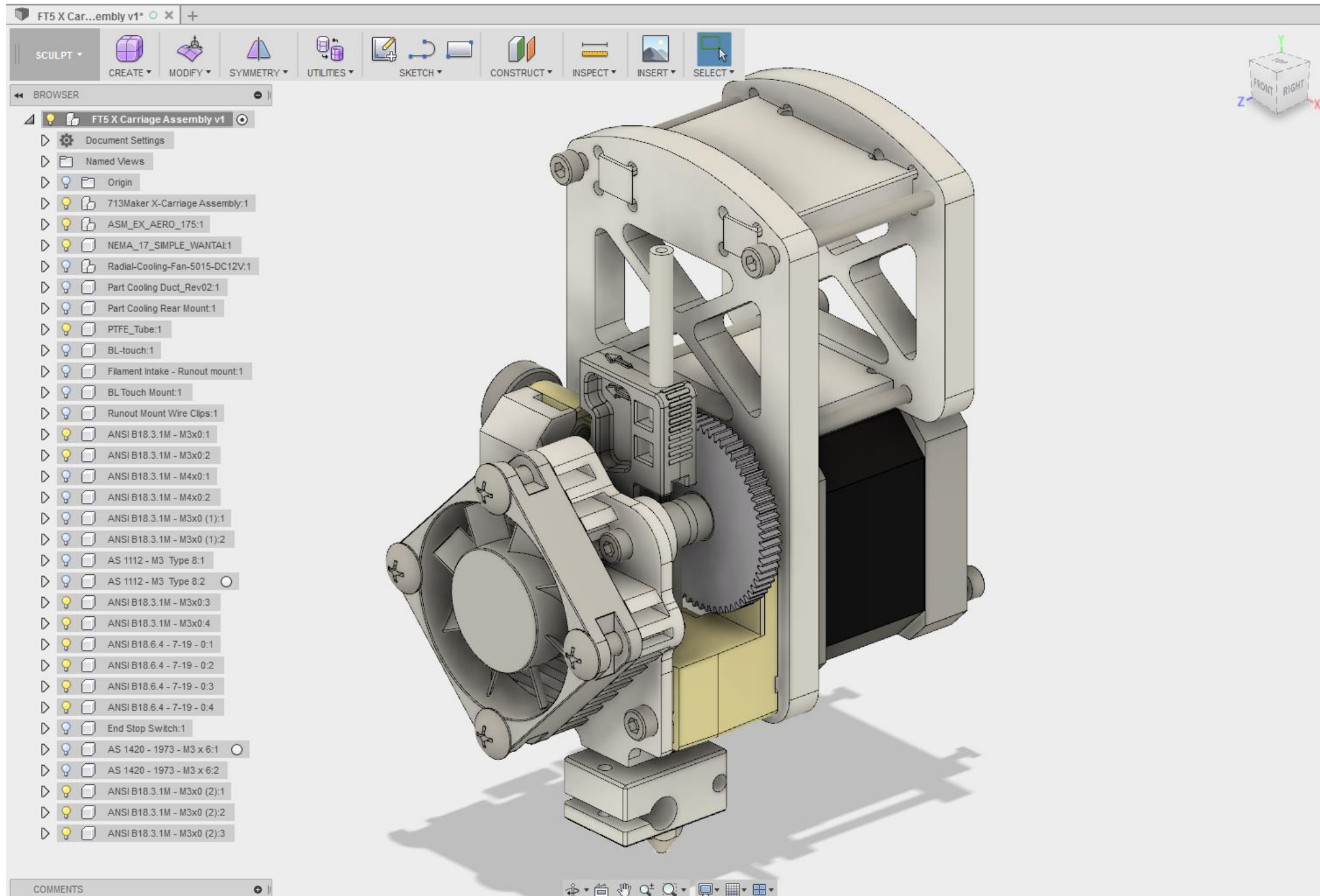


\*Poker chips are limited in availability.



Winner will be announced on December 1, 2017.

# Why Fusion 360?

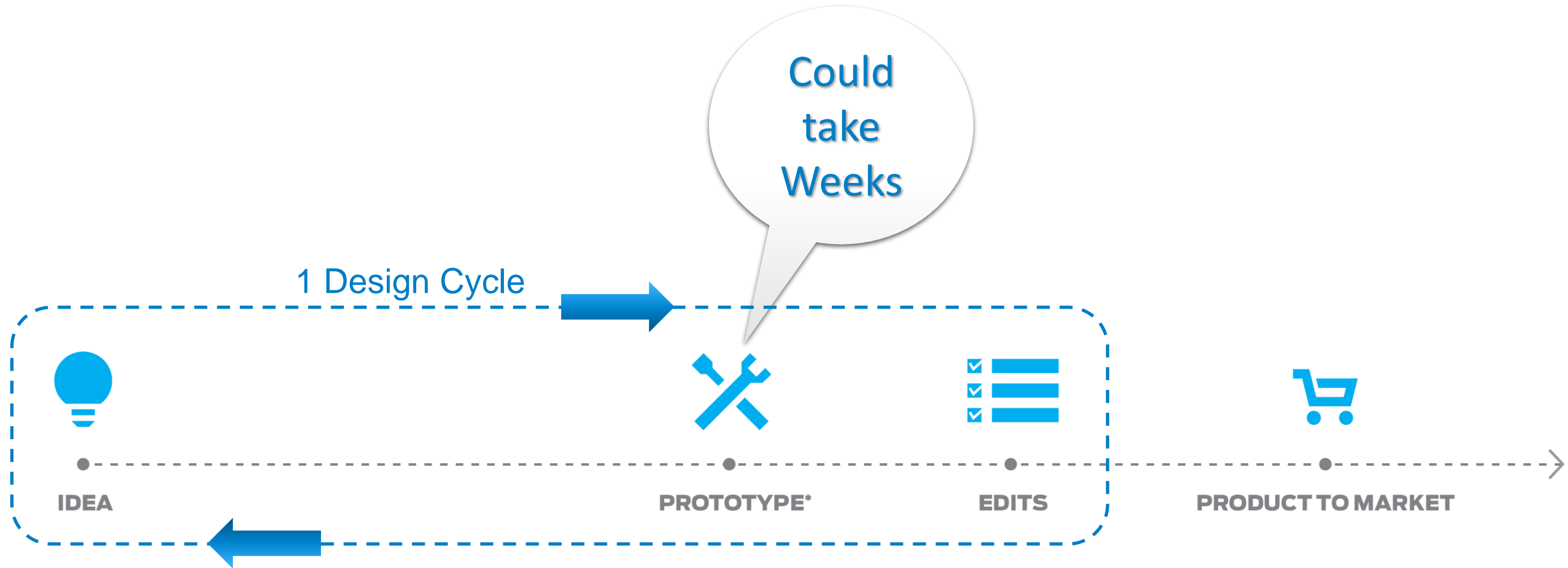


# Prototype Development



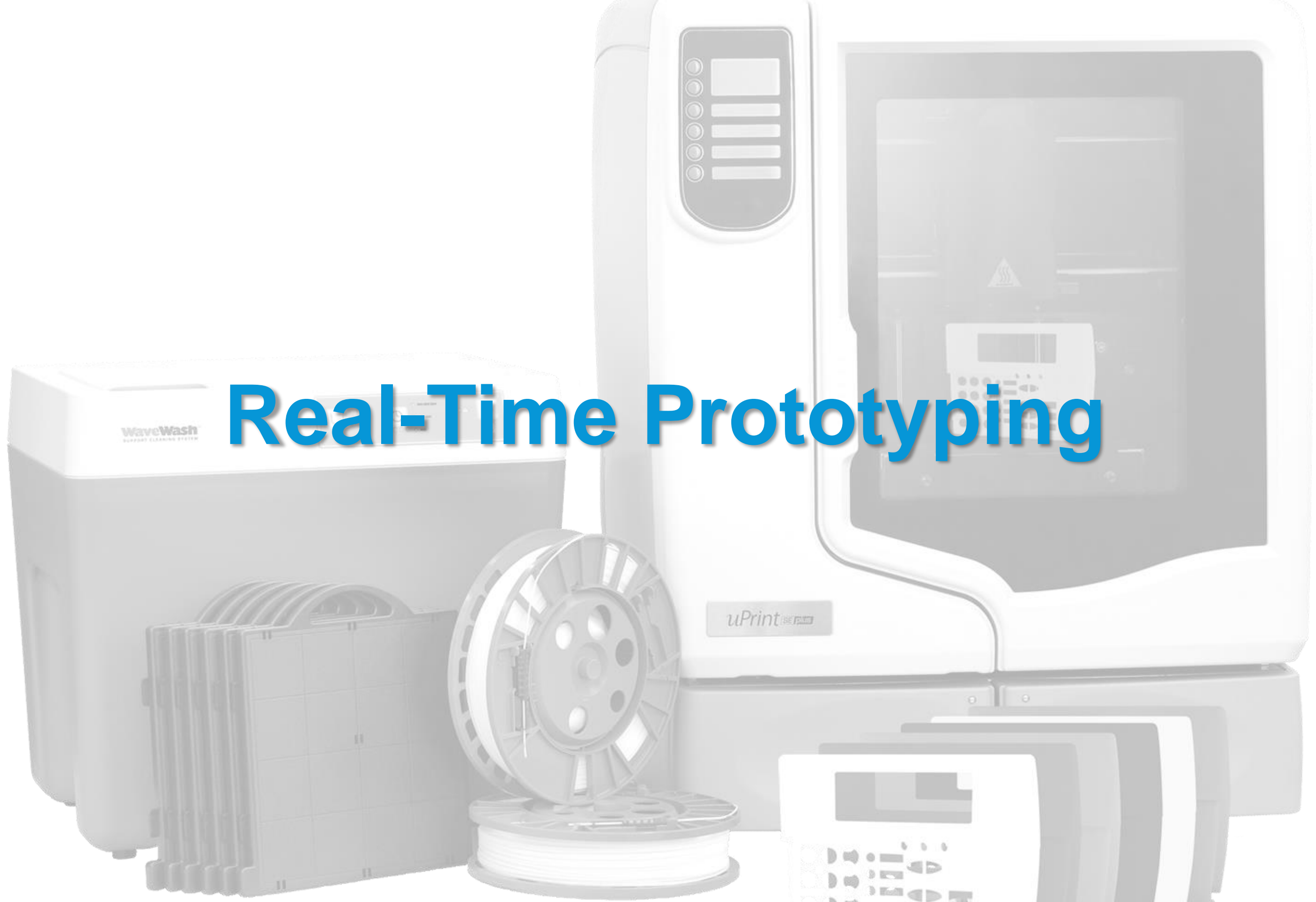
# **Traditional Prototyping**

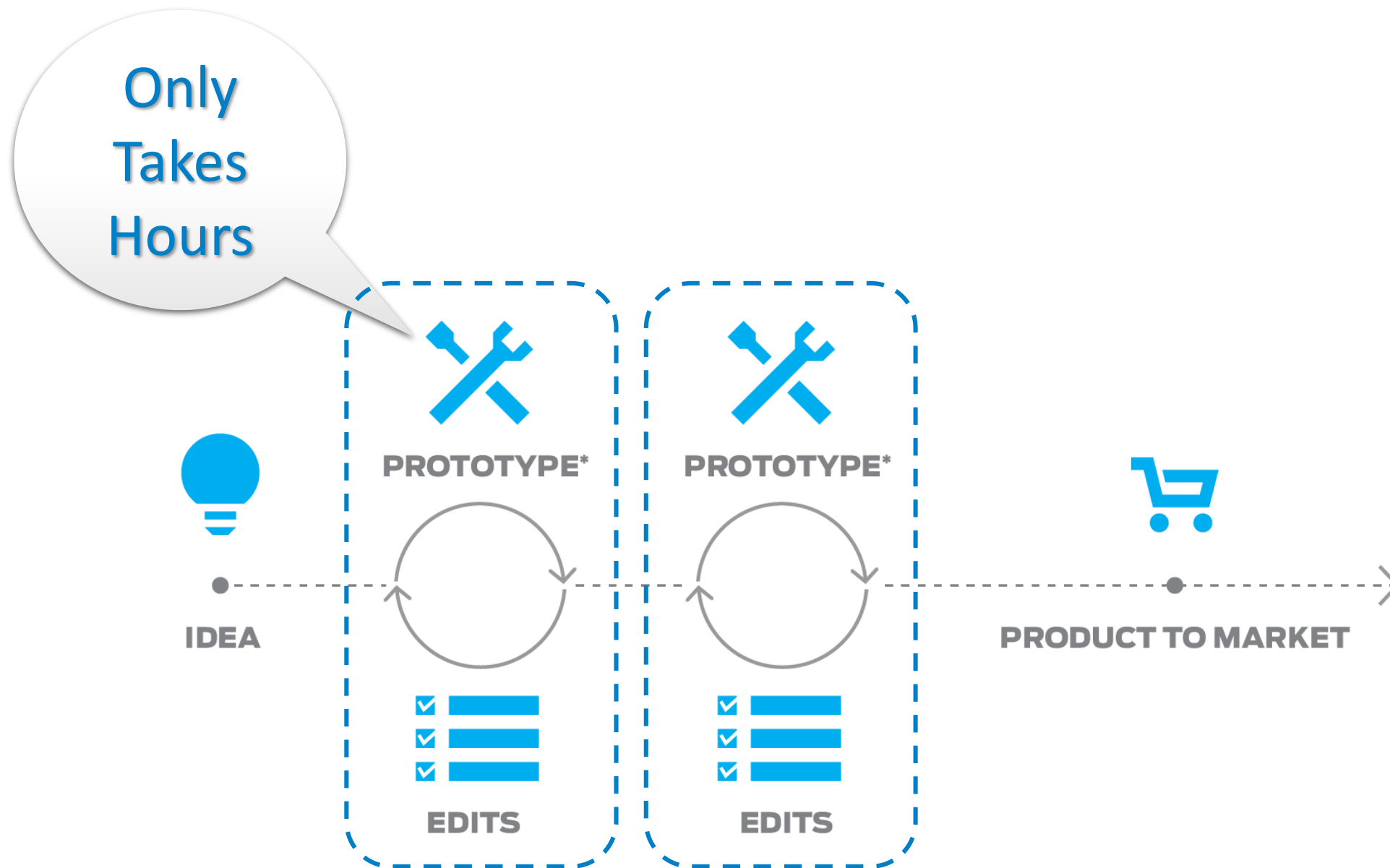




## Traditional Prototyping

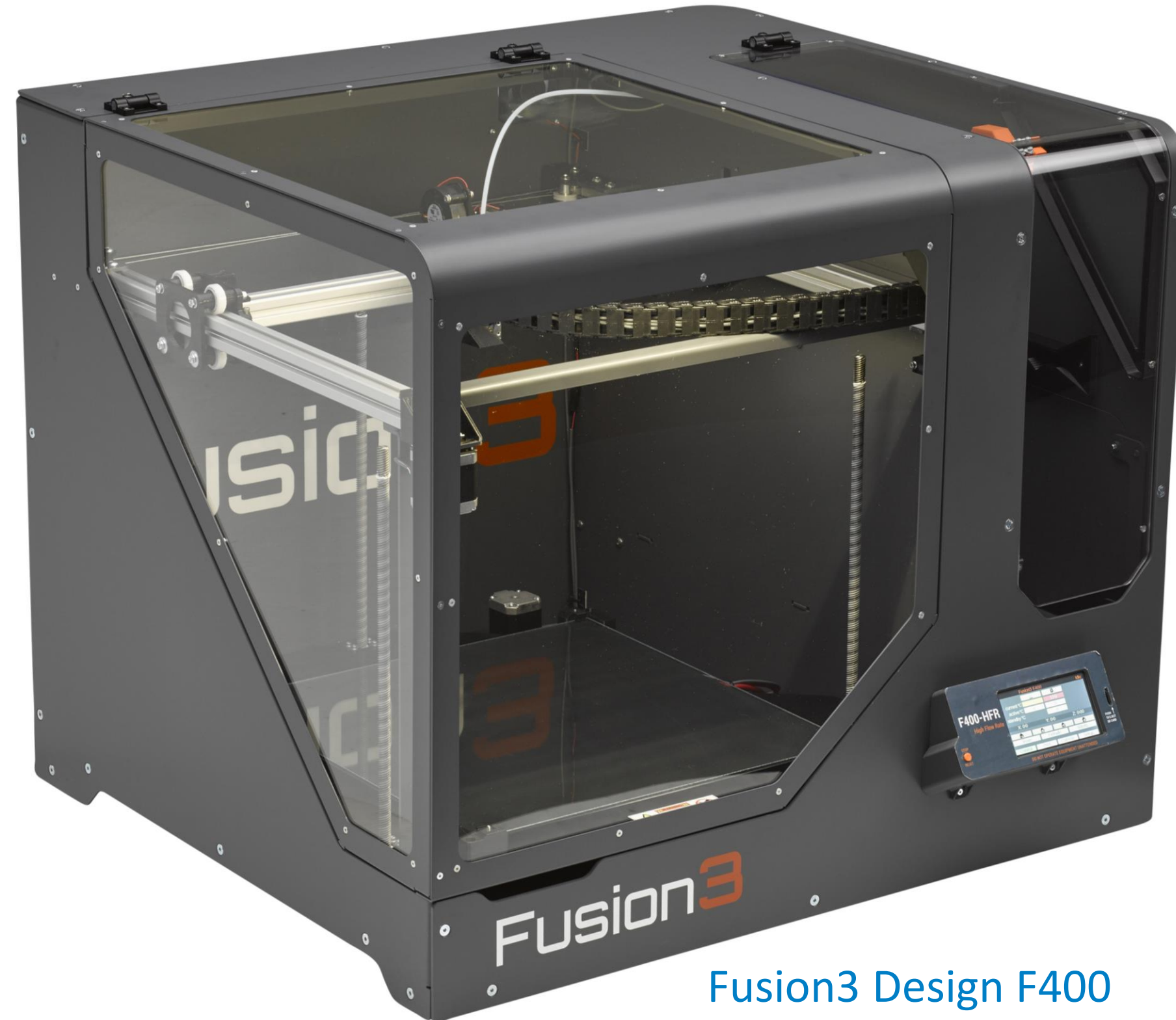
# Real-Time Prototyping





# Real-Time Prototyping

# What about 3D printing?



Fusion3 Design F400



# Manufacturing vs. 3D Printing

# Manufacturing

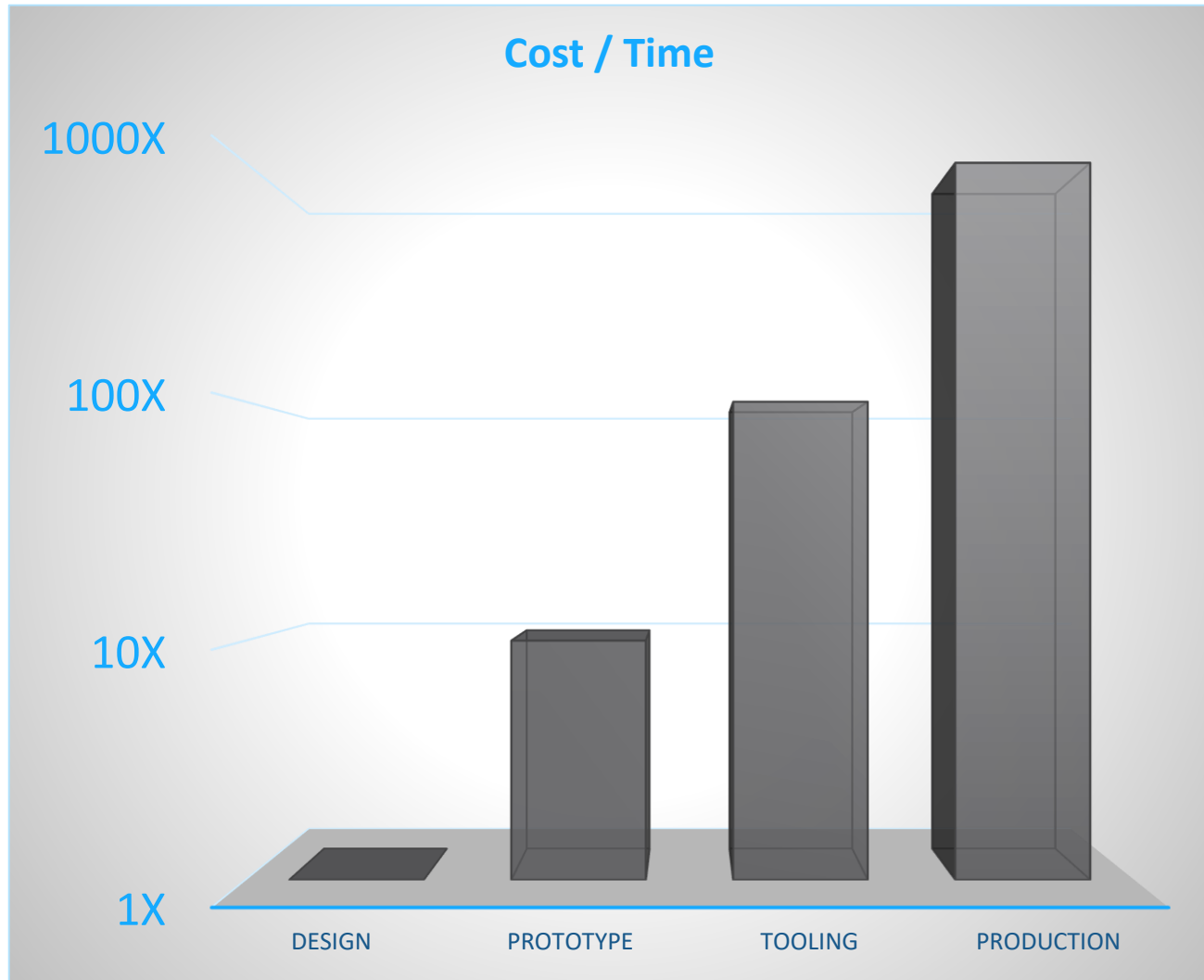
vs.

# 3D Printing

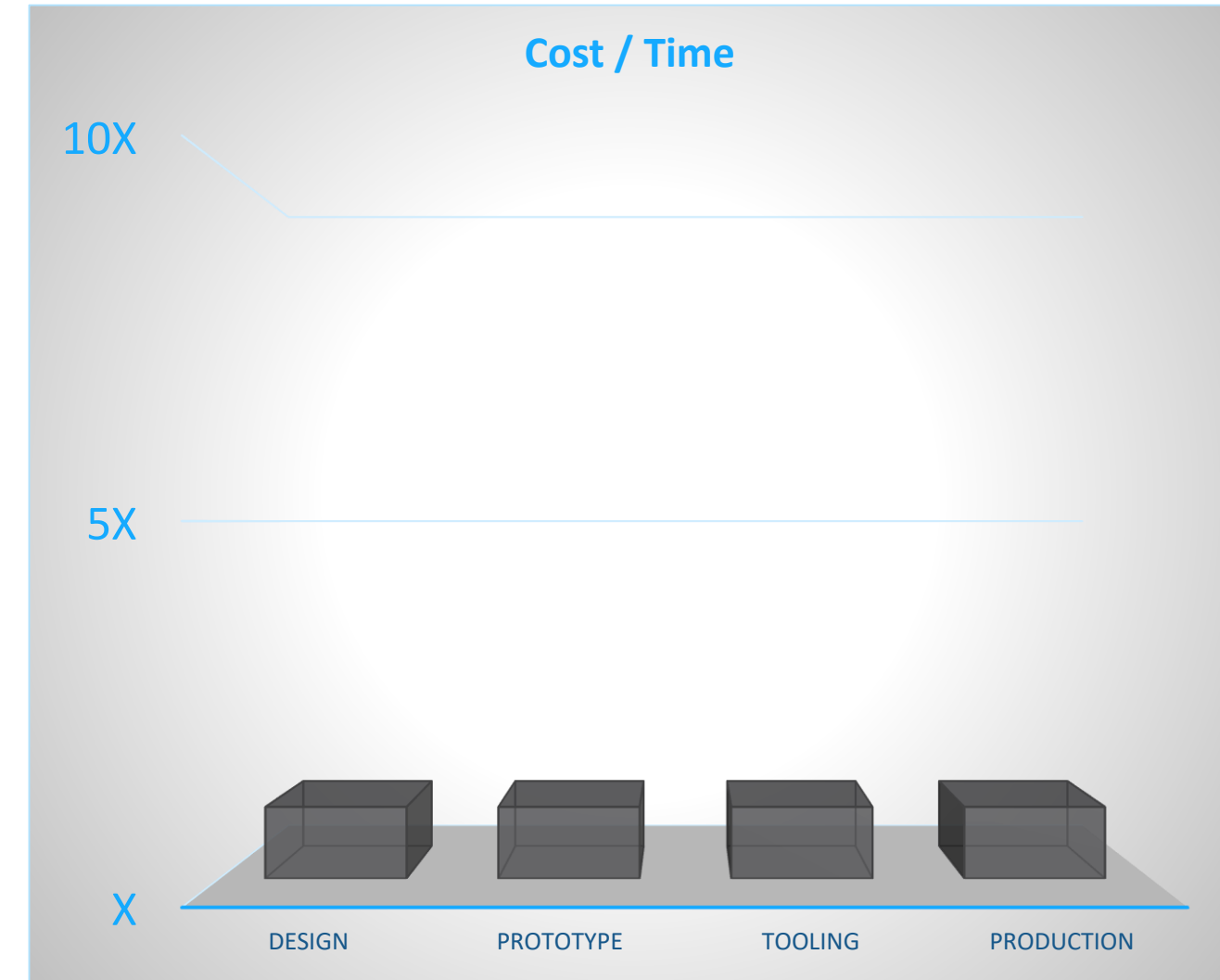
- Mass production
- Material variety
- Diminishing cost per part
- Costly tooling
- Changes = \$\$\$\$\$

- Low run
- Still limited materials
- Fixed cost per part
- No tooling
- Changes = \$

# Relative Cost Comparison



*TIME VS. COST FOR TRADITIONAL MANUFACTURING CHANGES*



*TIME VS. COST FOR 3D PRINTING CHANGES*

# Design for 3D Printing

- Print impossible parts

*He looked again and cried,  
“At last – Success is mine, it  
can’t even be cast!”*

Excerpt from “The Successful Designer”  
Author unknown

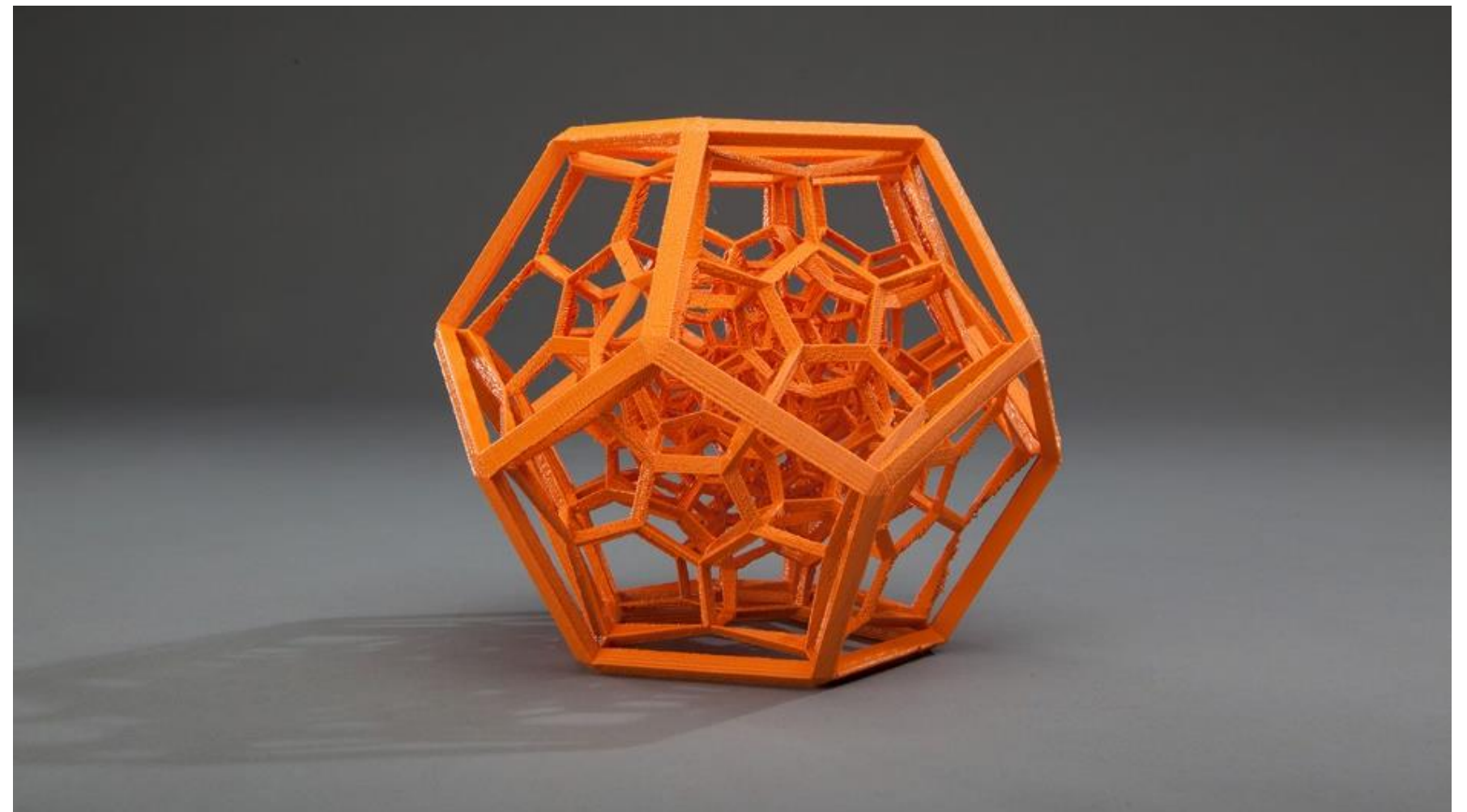


Image courtesy of MakerBot



# The Project

# Folgertech FT-5



**TITAN AERO**  
High Performance Extrusion  
for your 3D printer.

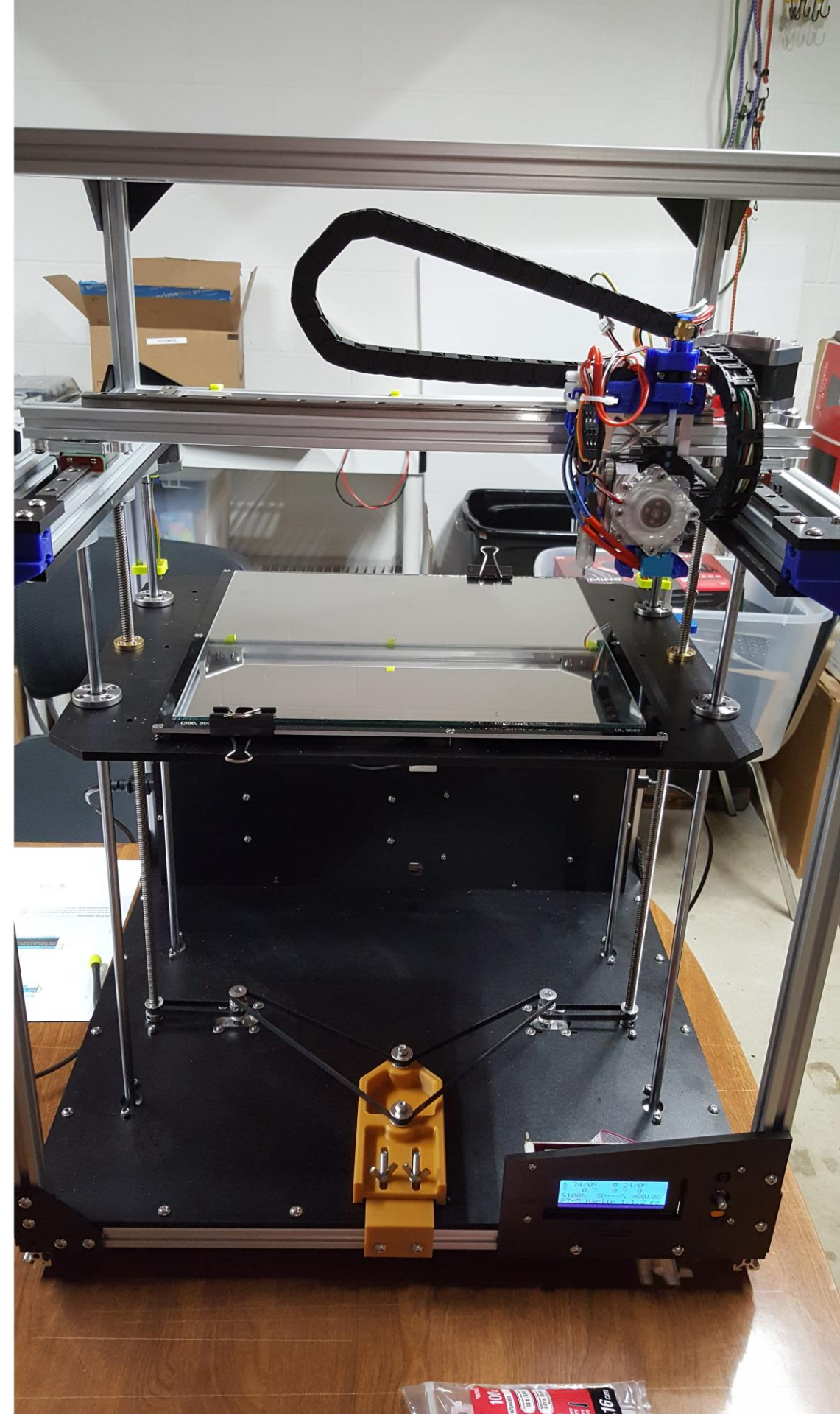
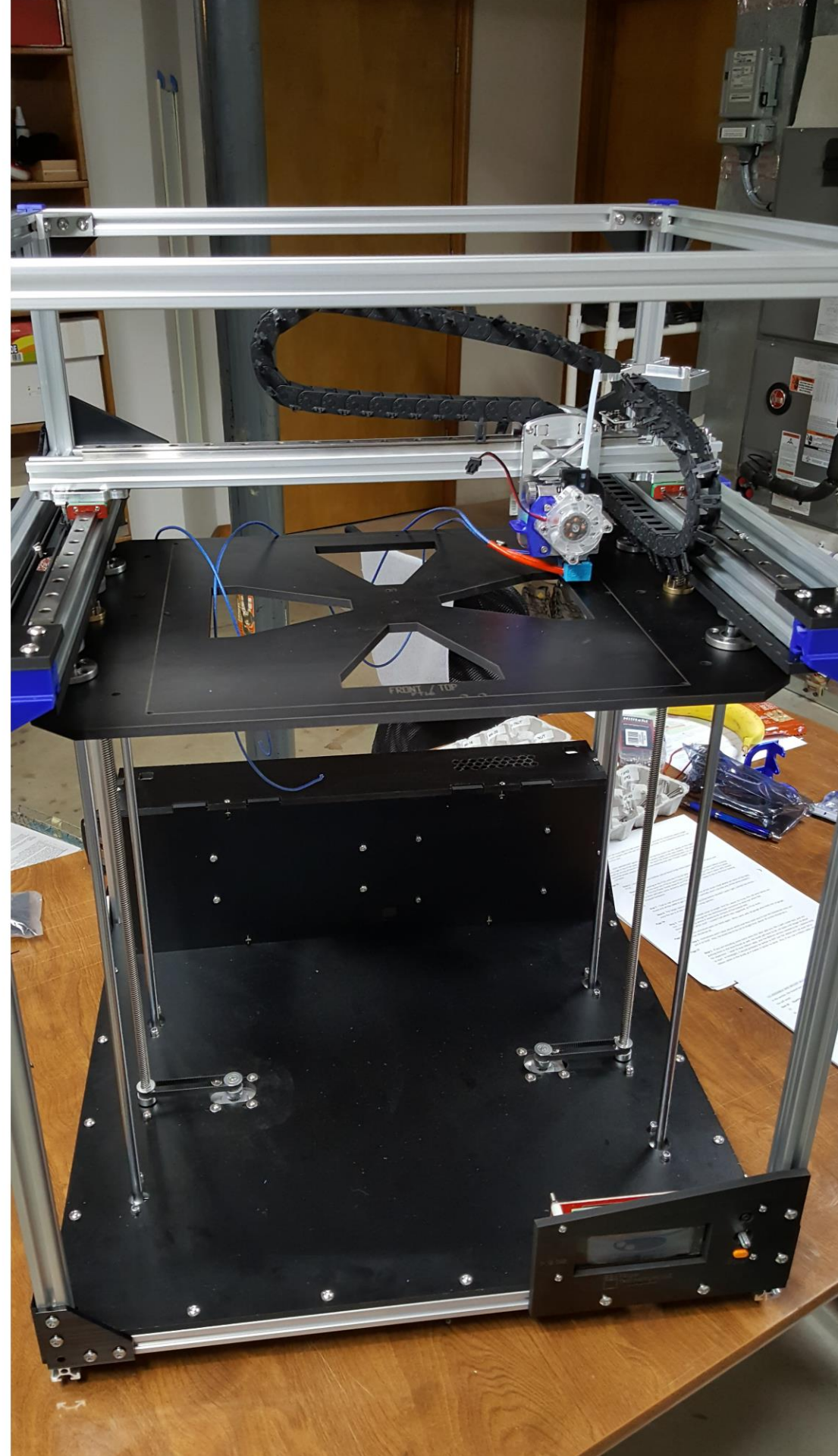
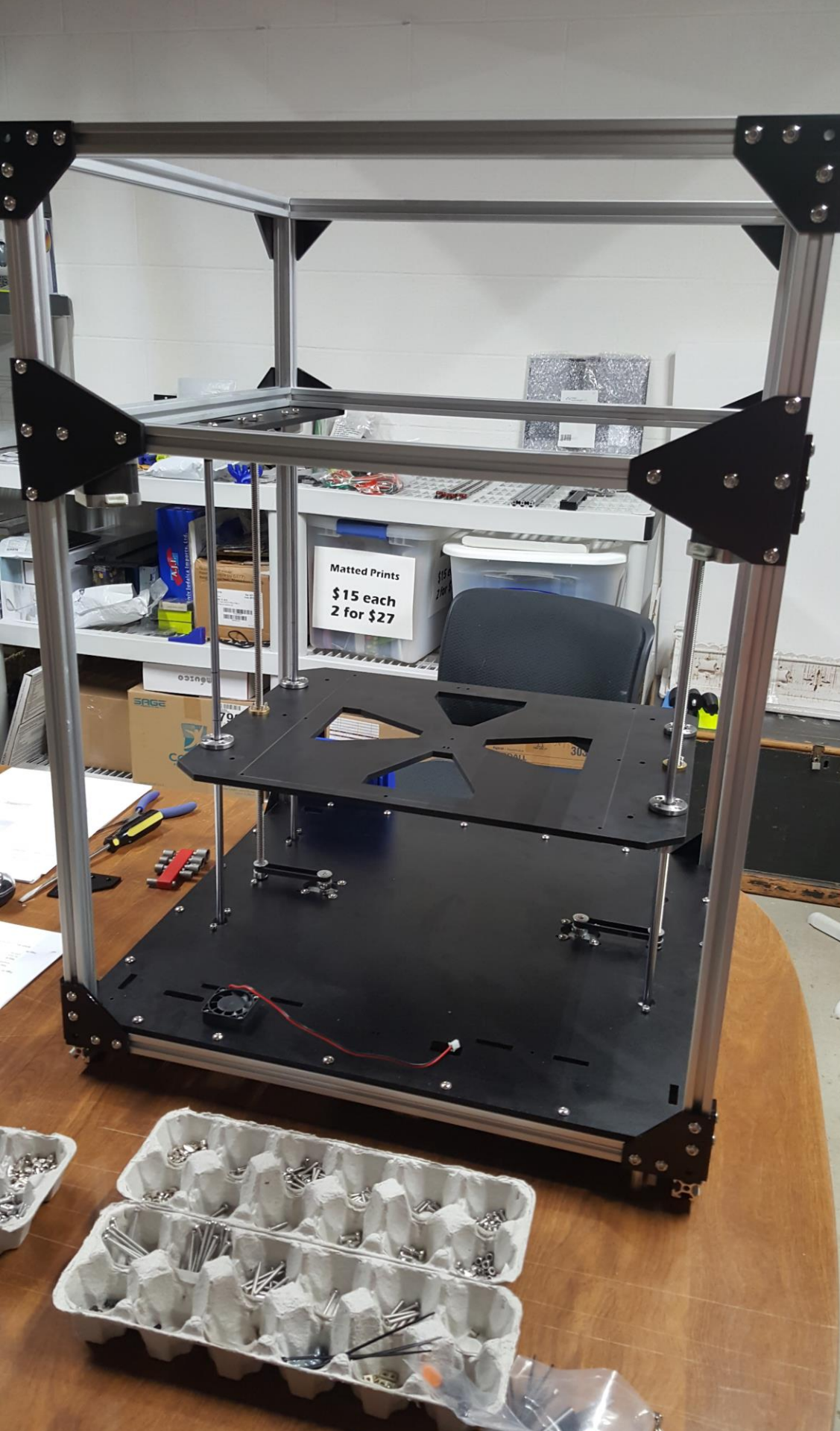
Folger Technologies LLC  
**MISCELLANEOUS**  
1X USB PORT  
1X POWER CORD  
1X USB CABLE CHAIN  
2X PHONE CABLE CHAIN ENDS  
2X BALE CABLE CHAIN ENDS  
1X USB CABLE A-A  
1X LED EXTENSION CABLE  
1X USB ADAPTER  
1X FORWARD ALUMINUM  
1X FORWARD PVC BRUSH BELT  
1X FORWARD MS THREADED PIN

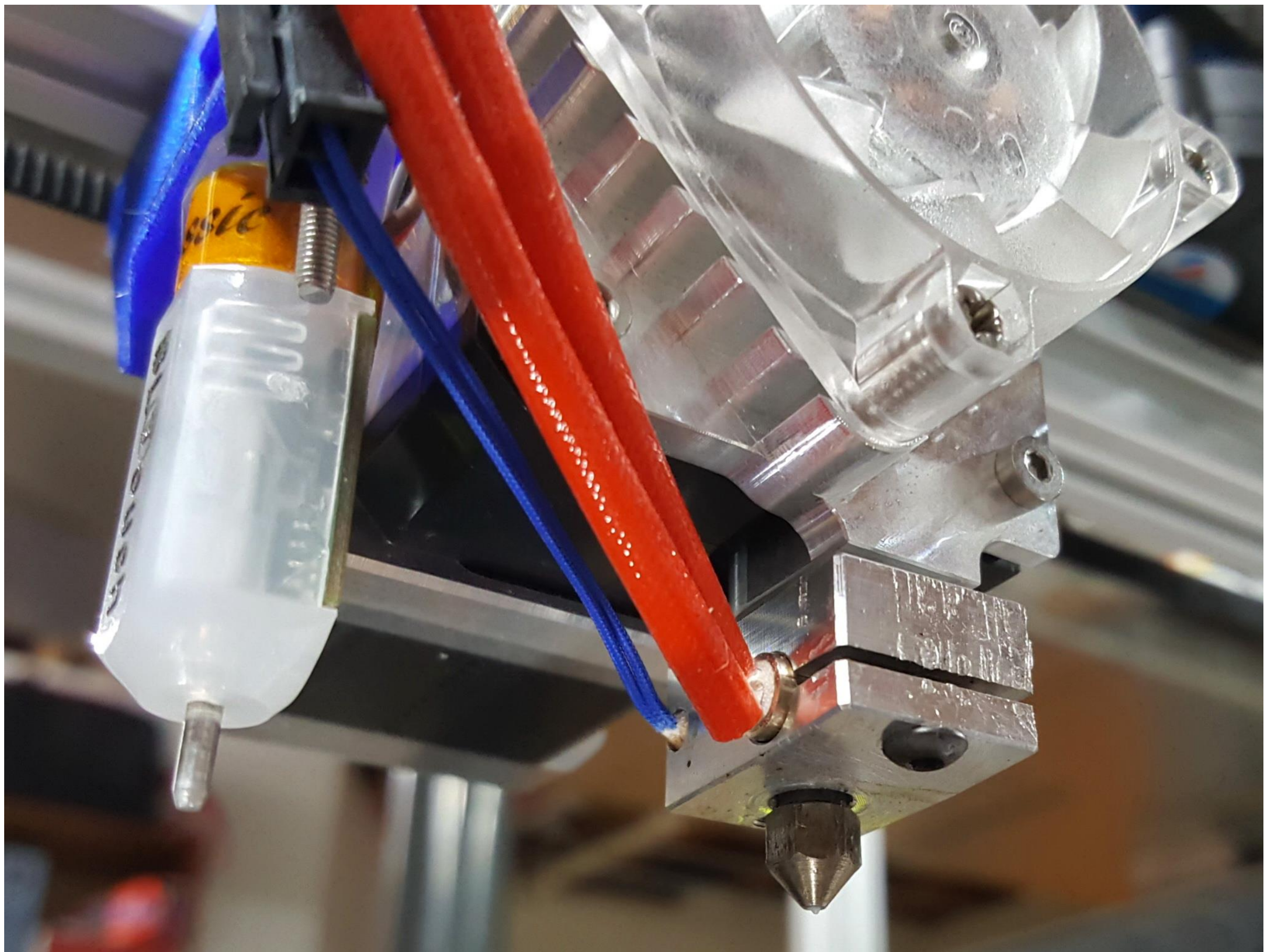
WE SMALL WIRE  
1X 10M 24 AWG 20 STR  
1X 10M 24 AWG 20 STR  
1X 10M 24 AWG 20 STR

Folger Technologies LLC  
www.folgertech.com  
**ELECTRONICS**  
1X MKS BOARD  
W/ 5X A4988 STEPPER DRIVERS  
5X HEATSINKS  
3X ENDSTOP  
1X BED THERMISTOR

Folger Technologies LLC  
www.folgertech.com  
**BED**  
MMX300MM HEATBED

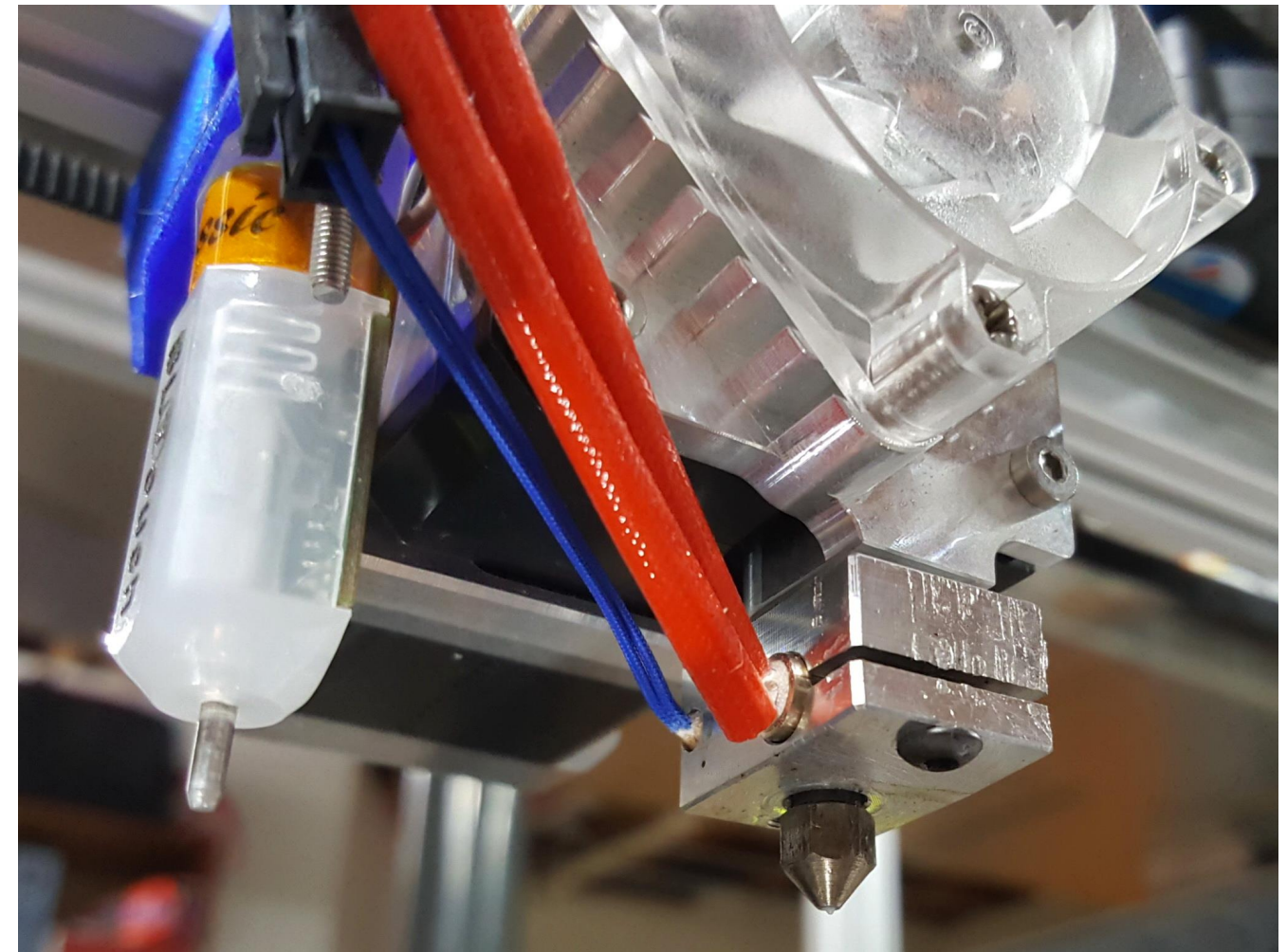
Matted Prints  
\$15 ea  
2 for ea





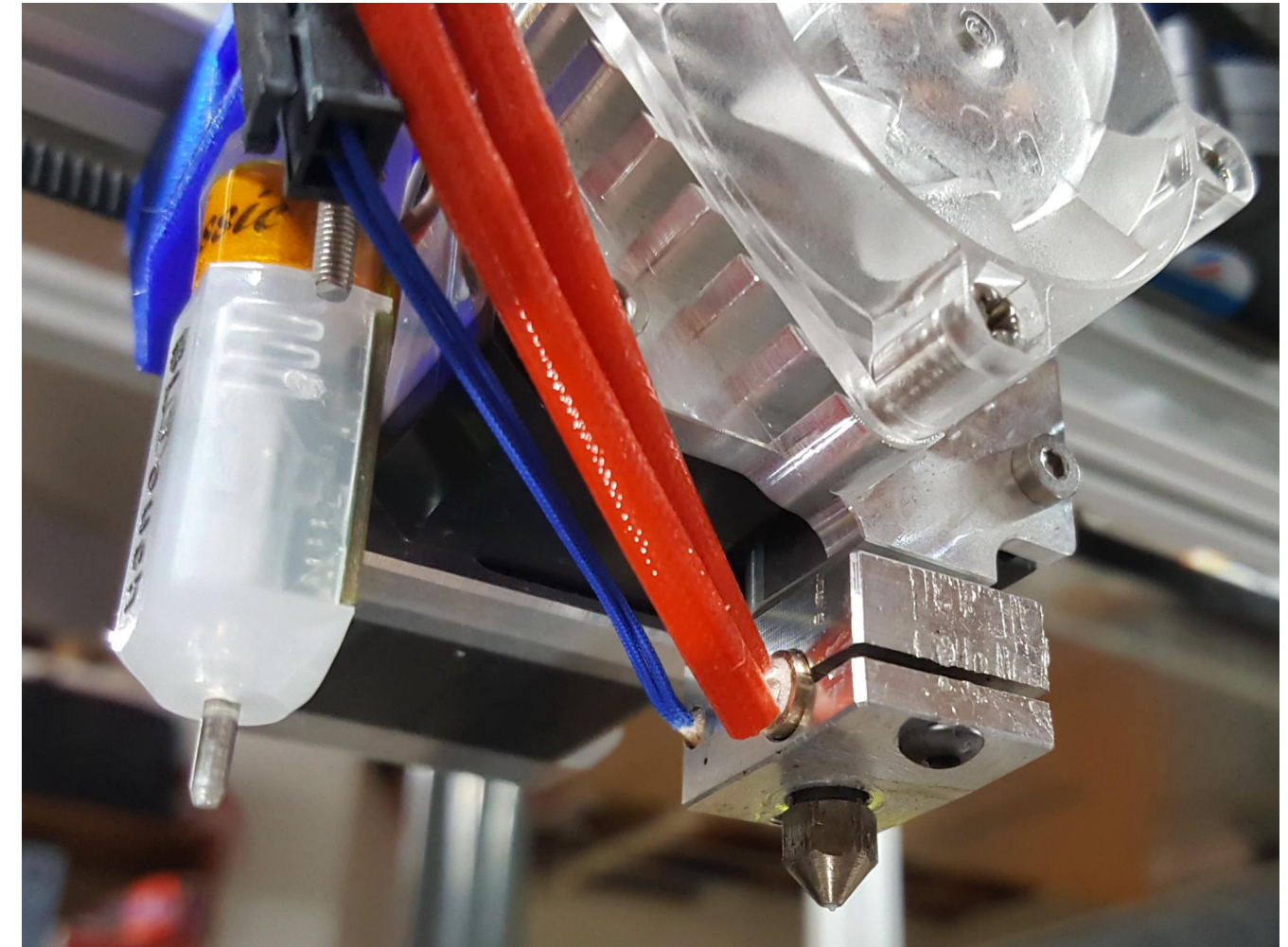
# Project Requirements

- Provide sufficient cooling
- Don't interfere with movement
- Remain clear of part
- Be 3D Printable



# Limitations

- Size
- Mounting
- Fan type (Centrifugal/Blower)
- Easy to print (Minimal support material)



AU 2017 Prototypes

Data People

Upload New Folder

master

FT5 X Carriage Assembly  
8:12:13 PM

Part Cooling Duct - Rev 0  
10/6/17

Part Cooling Duct - Rev 1  
10/9/17

Part Cooling Duct - Rev 2  
10/9/17

Part Cooling Duct - Rev 3  
10/14/17

Part Cooling Duct - Rev 4  
10/14/17

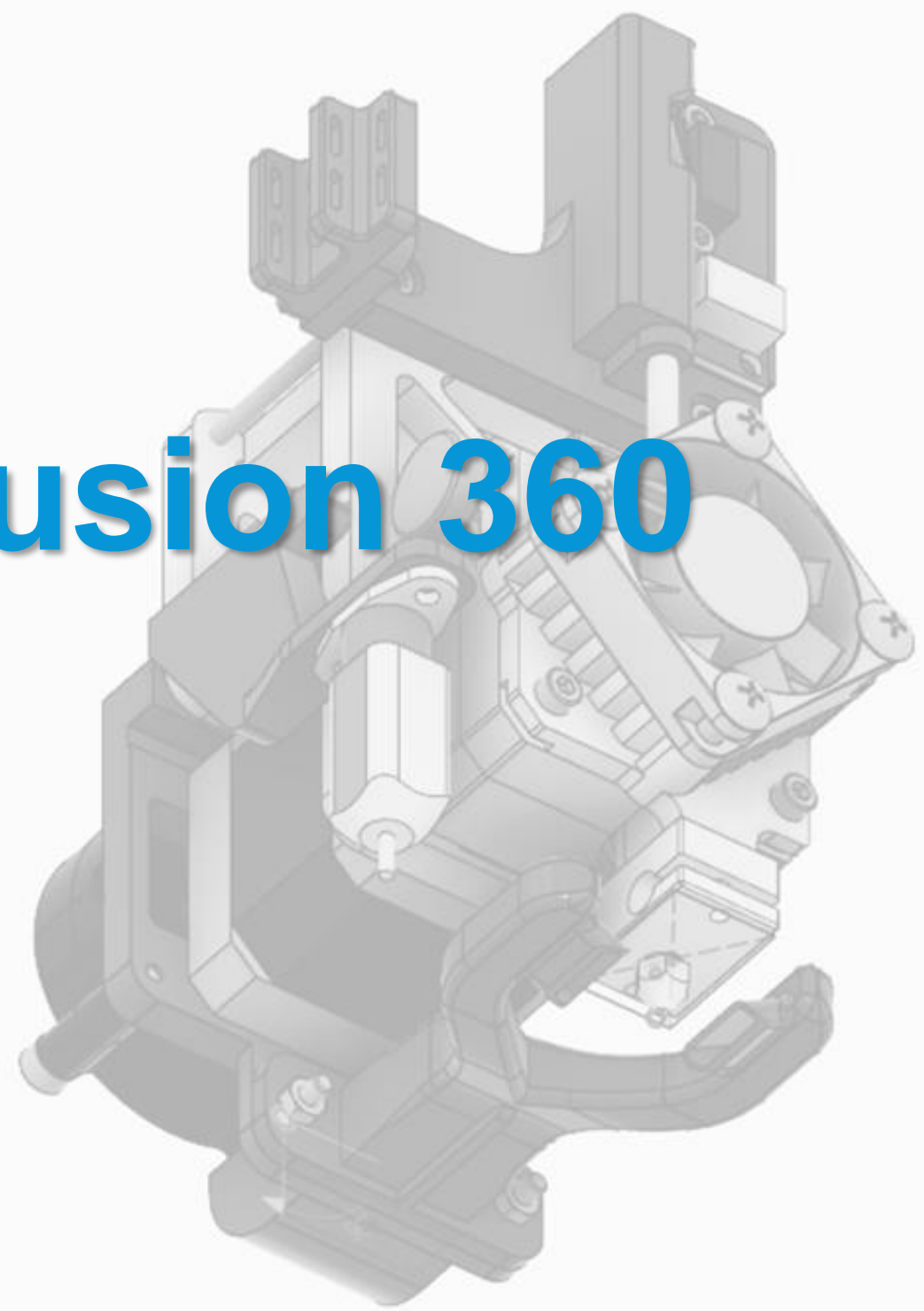
FT5 X Ca...embly v6

SCULPT CREATE MODIFY SYMMETRY UTILITIES SKETCH CONSTRUCT INSPECT INSERT SELECT

BROWSER

- FT5 X Carriage Assembly v6
  - Document Settings
  - Named Views
  - Selection Sets
  - Origin
  - Joints
  - 713Maker X-Carriage Assembly:1
  - ASM\_EX\_AERO\_175:1
  - NEMA\_17\_SIMPLE\_WANTAI:1
  - PTFE\_Tube:1
  - BL-touch:1
  - Filament Intake - Runout mount:1
  - BL Touch Mount:1
  - Runout Mount Wire Clips:1
  - ANSI B18.3.1M - M3x0.1
  - ANSI B18.3.1M - M3x0.2
  - ANSI B18.3.1M - M4x0.1
  - ANSI B18.3.1M - M4x0.2
  - ANSI B18.3.1M - M3x0 (1):1
  - ANSI B18.3.1M - M3x0 (1):2
  - AS 1112 - M3 Type 8:1
  - AS 1112 - M3 Type 8:2
  - ANSI B18.3.1M - M3x0.3
  - ANSI B18.3.1M - M3x0.4
  - ANSI B18.6.4 - 7-19 - 0:1
  - ANSI B18.6.4 - 7-19 - 0:2

# Autodesk Fusion 360

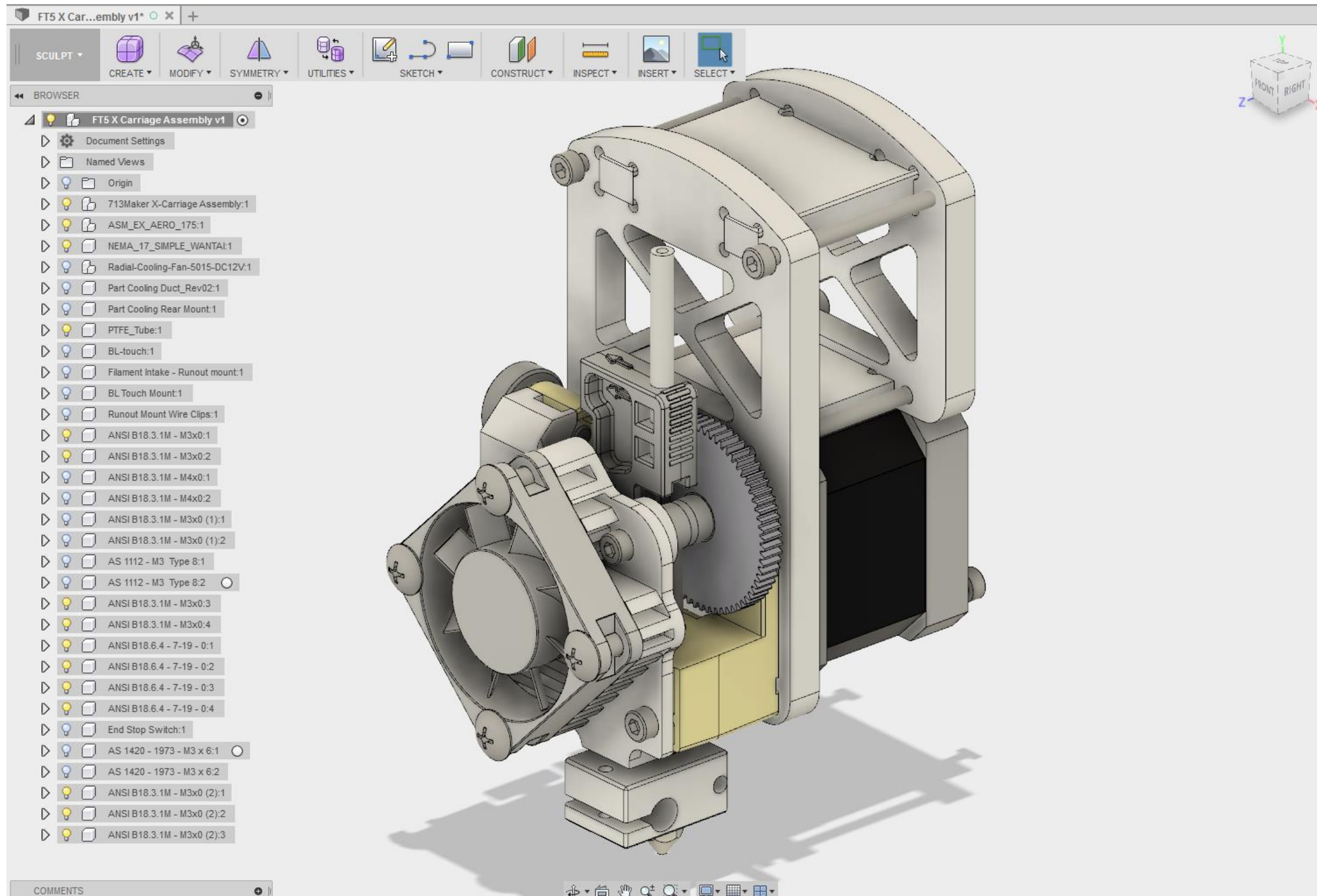


# Fusion 360 for Prototyping

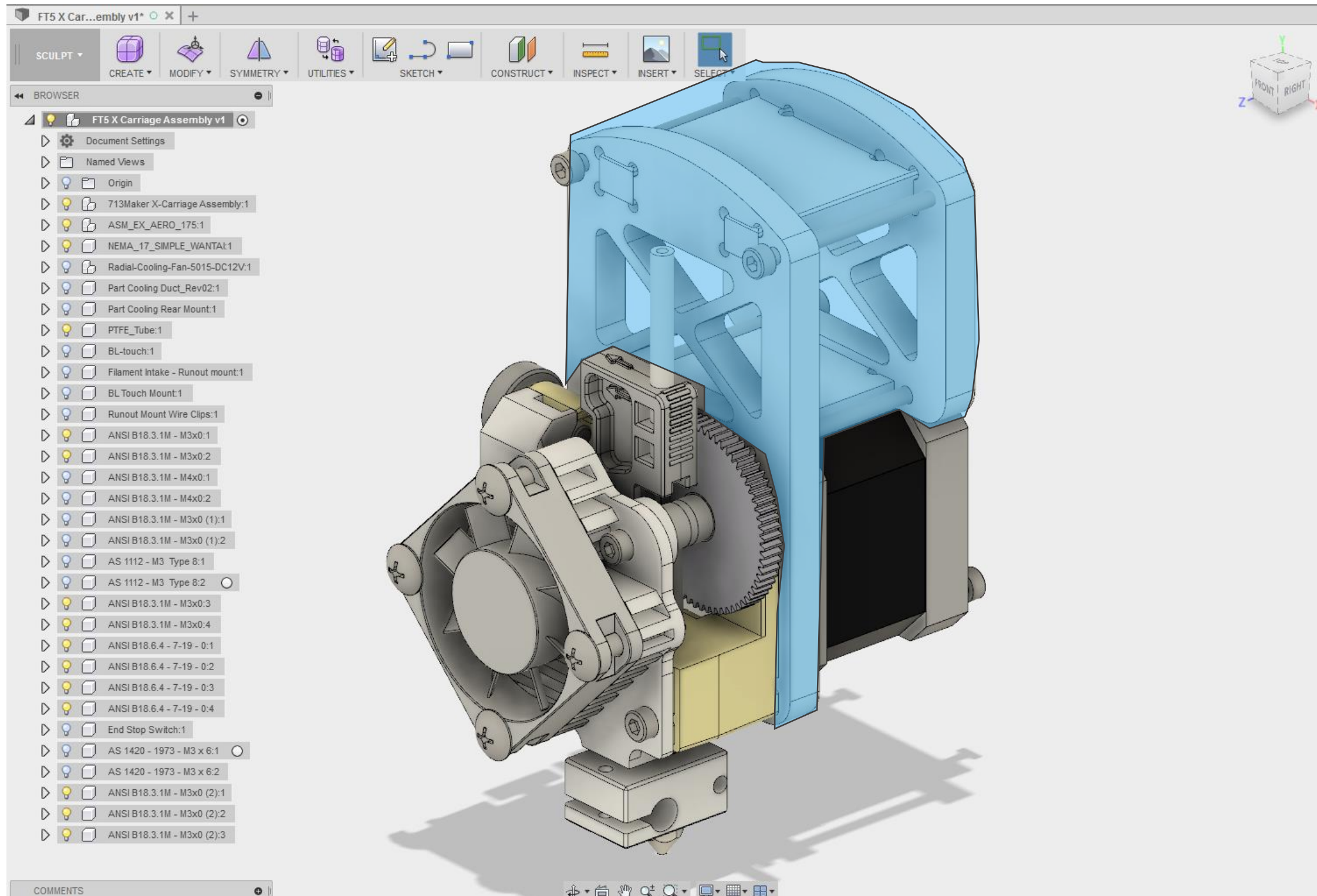
- Cloud-Centric
- Advanced Design
- Kinematic Simulation
- Finite Element Analysis
- CAM Simulation
- 3D Print / STL Export



# Starting Model

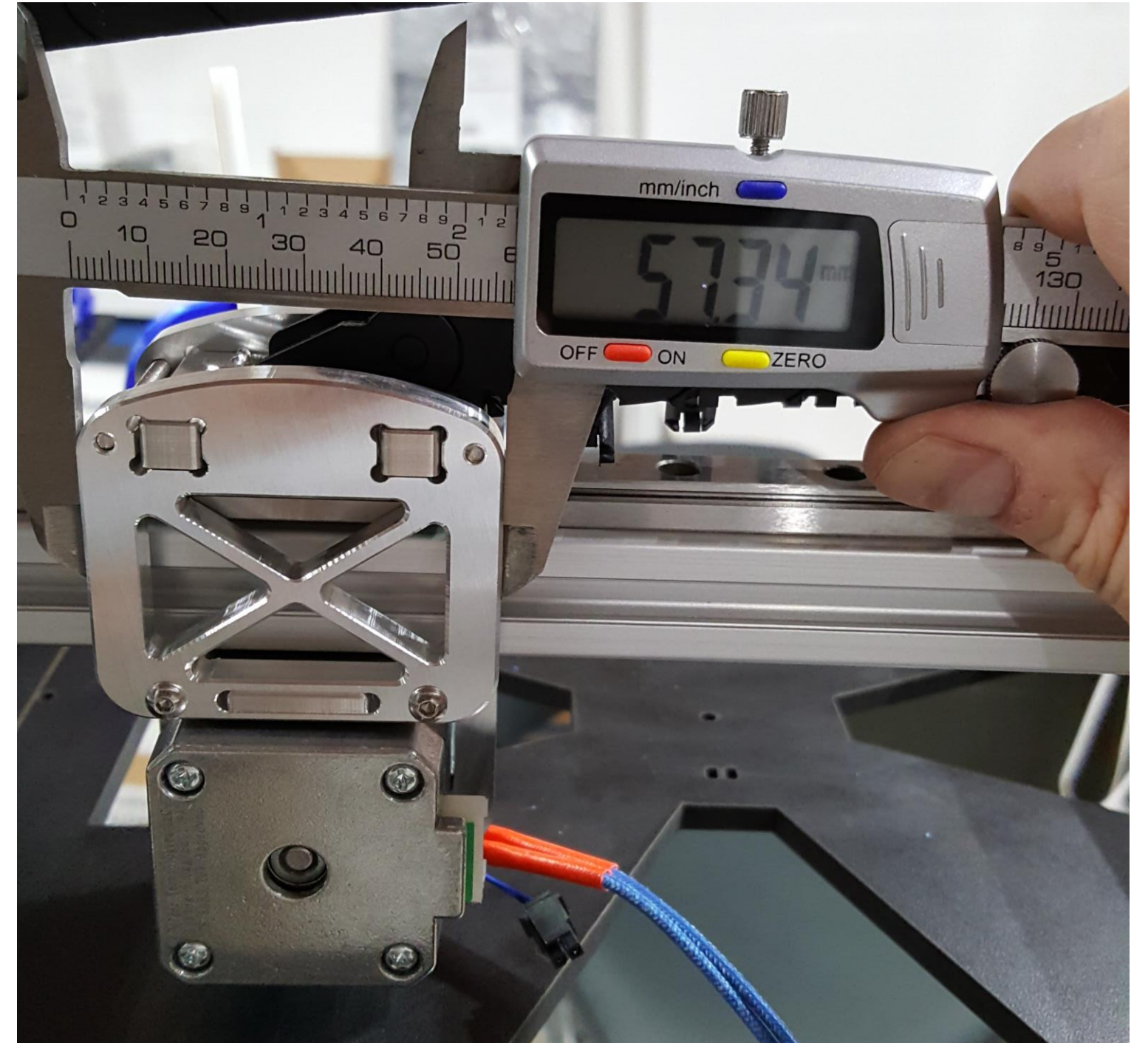


# Starting Model



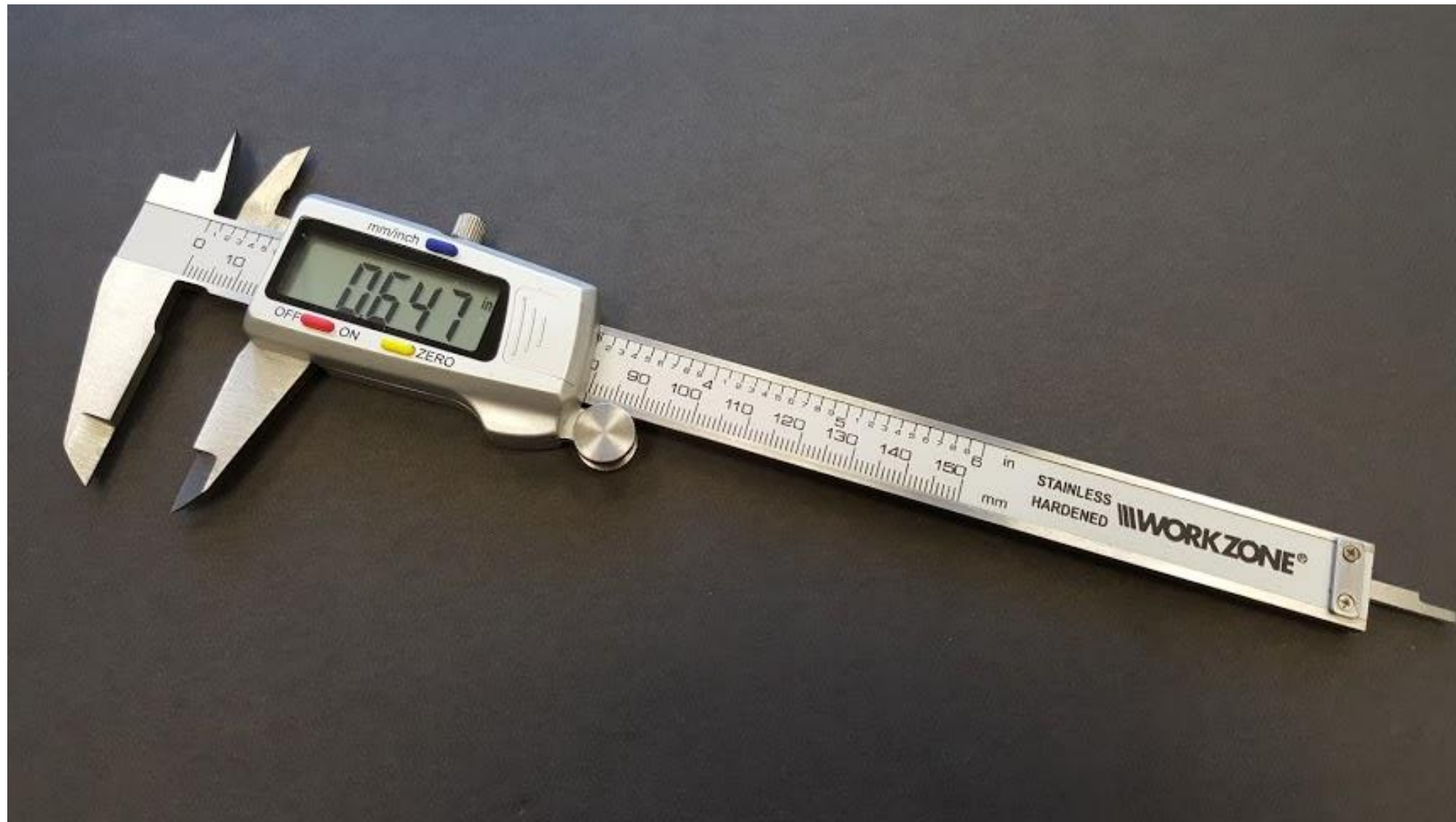
# Taking Measurements

- Good reference = Easier modeling
- Take accurate measurements

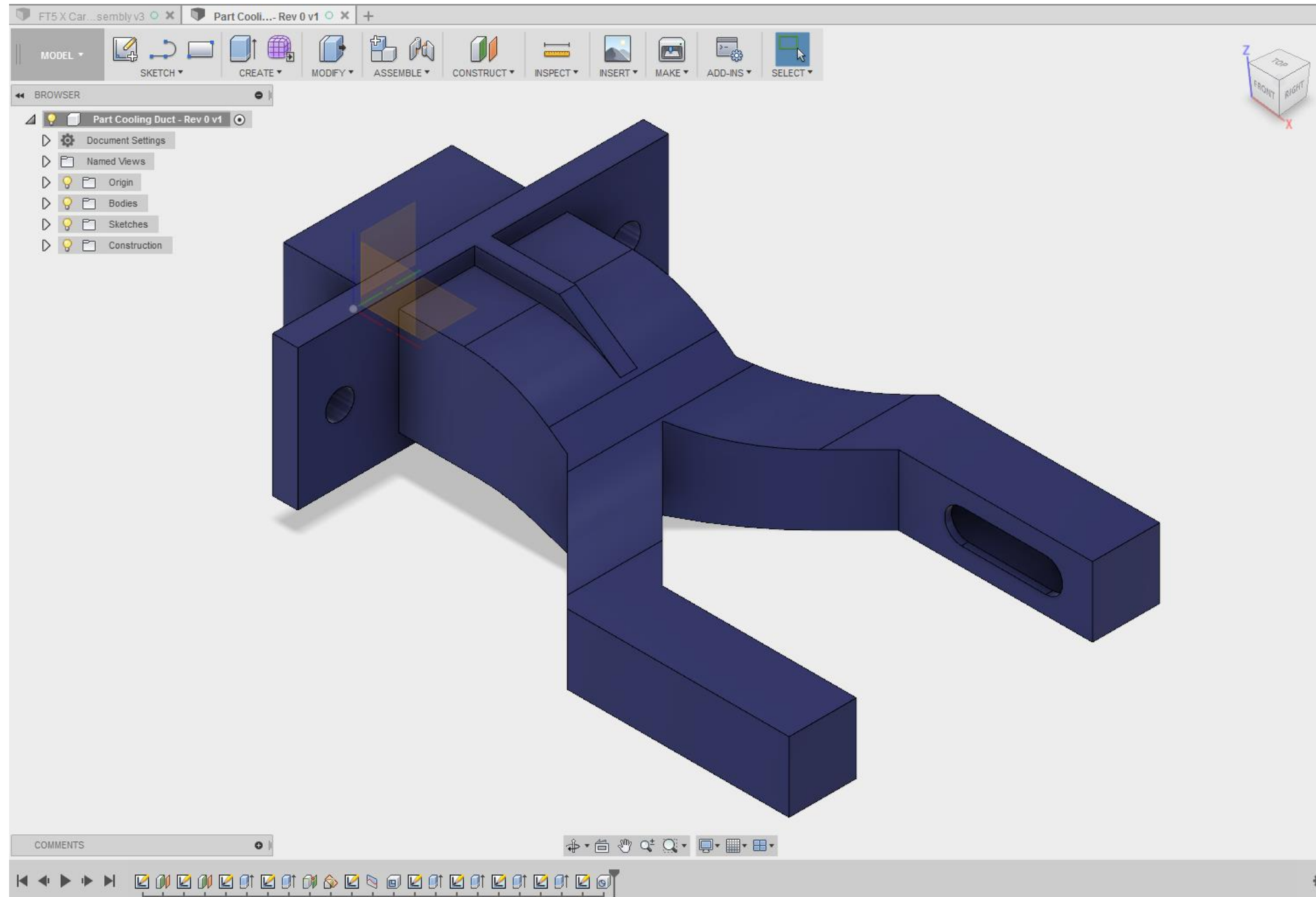


# Taking Measurements

- Accuracy counts, Get calipers!



# Create Duct in Fusion 360 (demo)





**Take a Break!**

4:10 PM

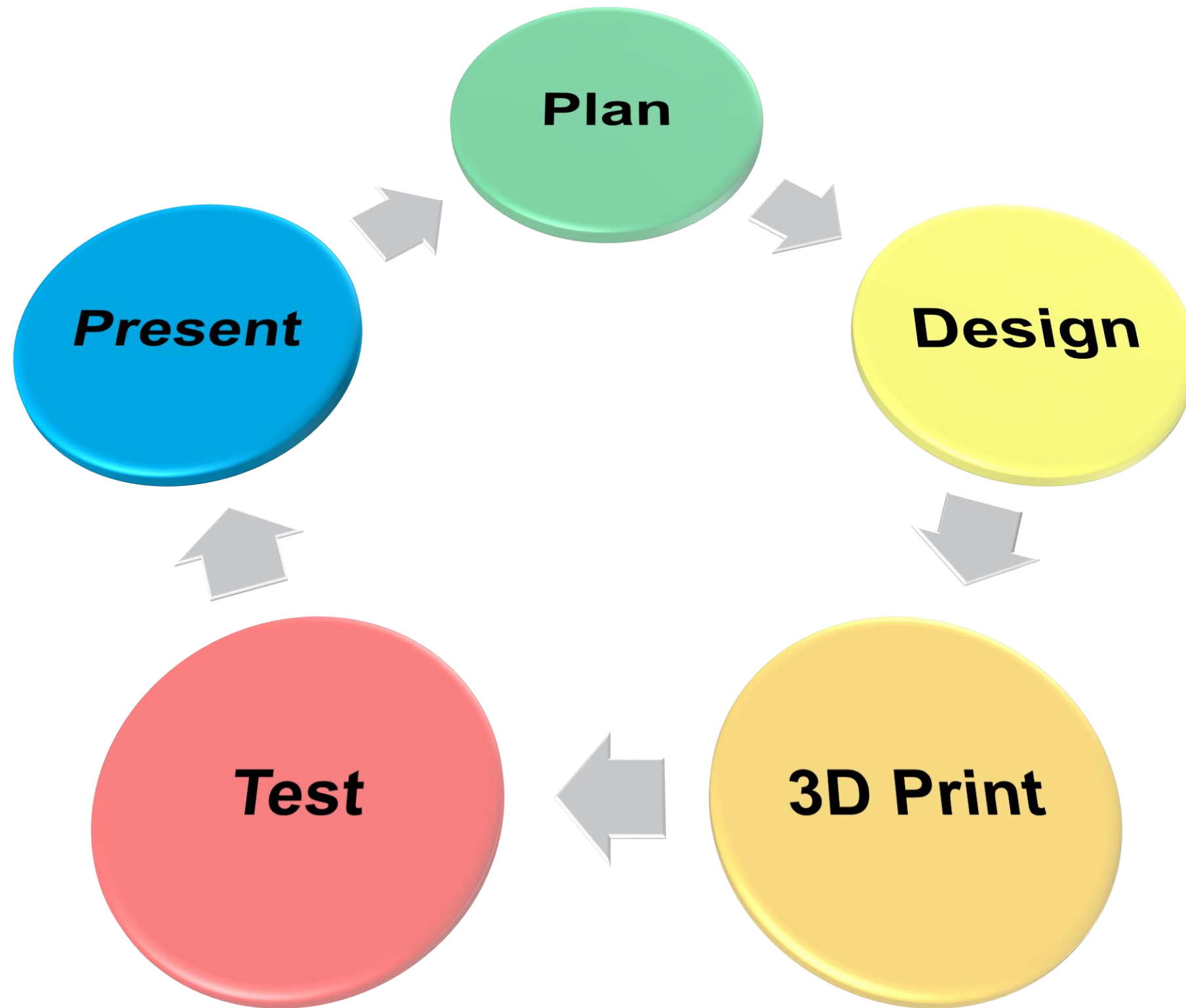
1:30 PM



2

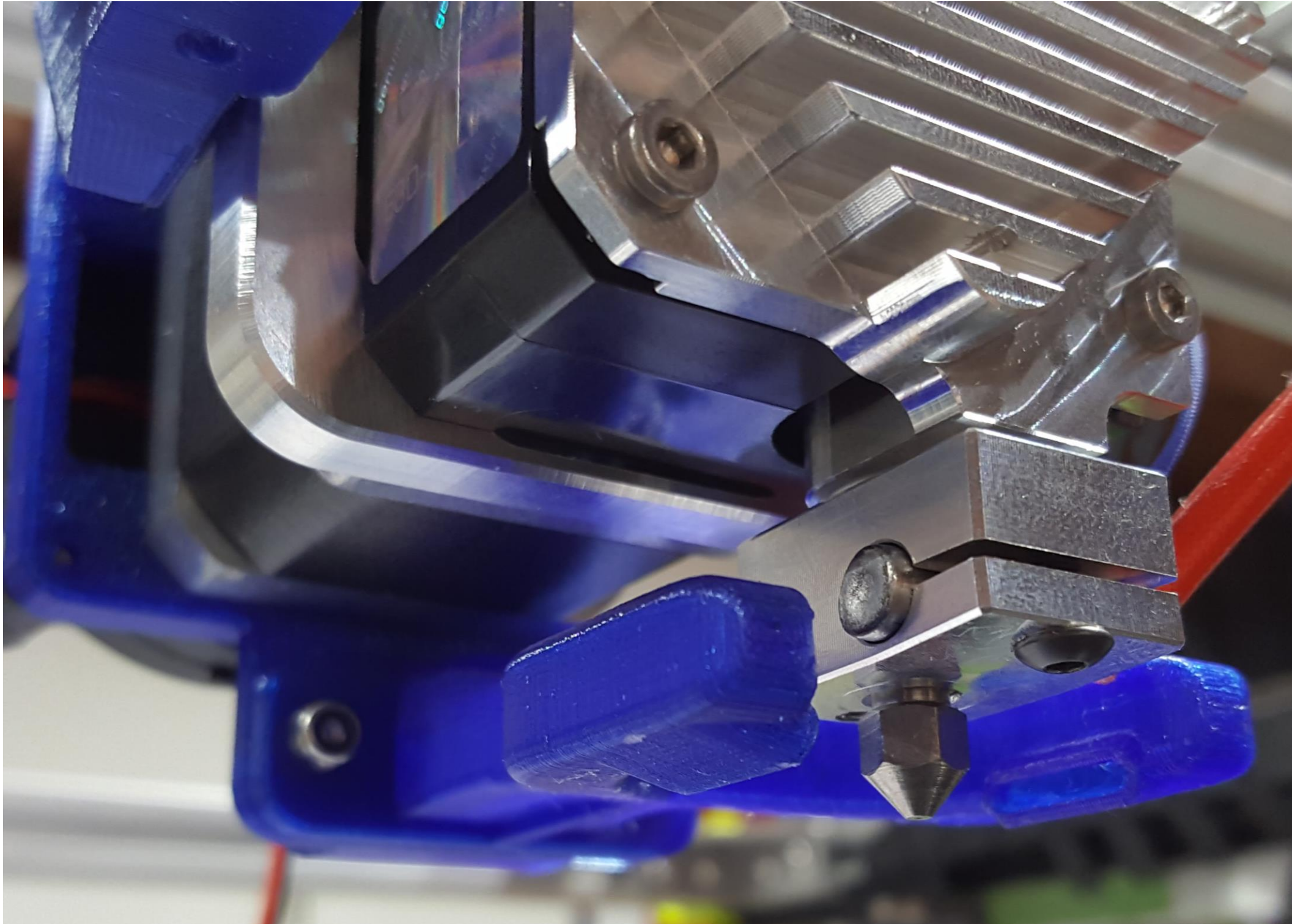
# The Design Process



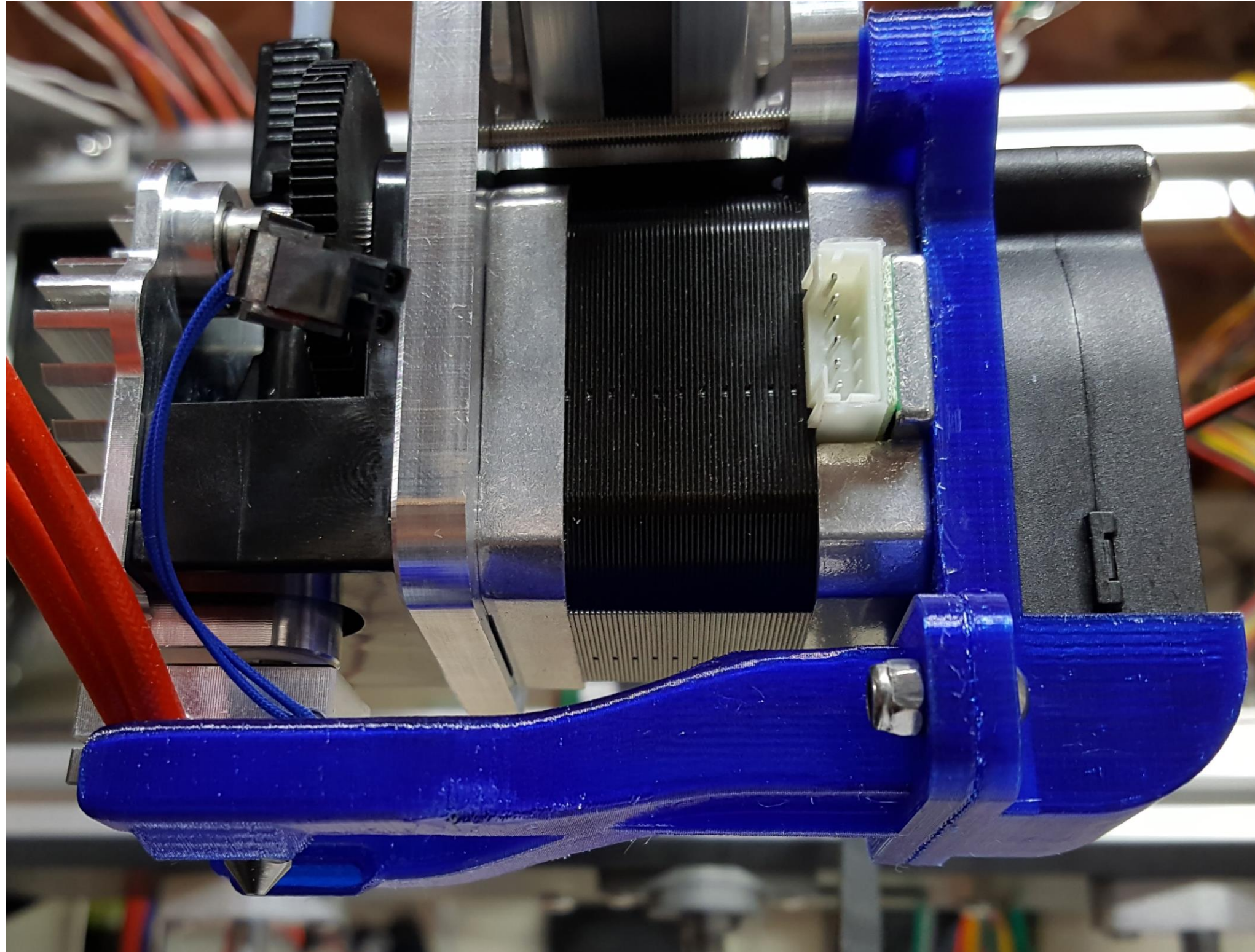


# Evaluating the 1st Prototype

# Initial Prototypes

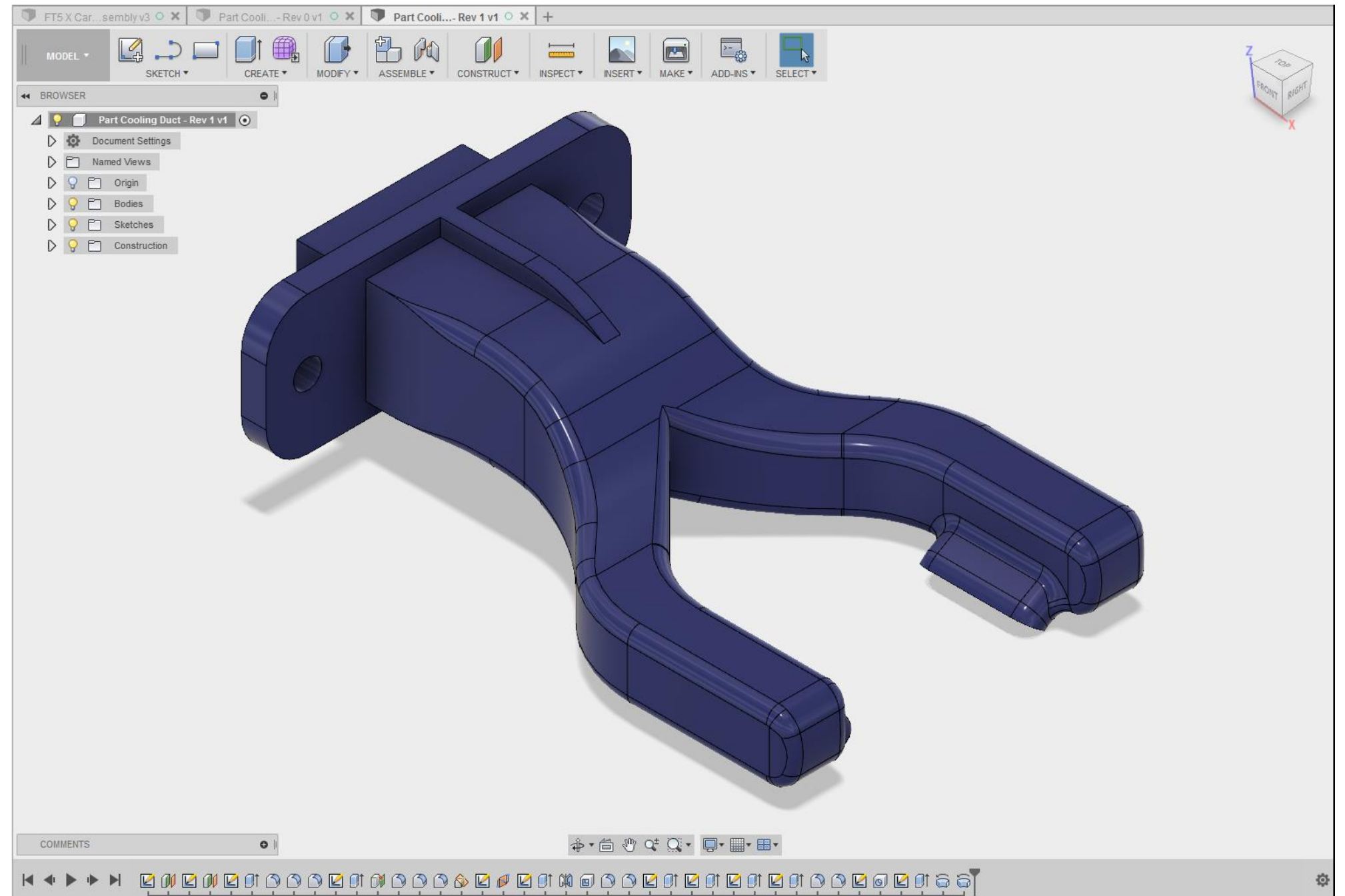


# Fit Testing



# Prototype Evaluation

- Insufficient airflow
- Cooled nozzle



AU 2017 Prototypes

Data People

Upload New Folder

master

- FT5 X Carriage Assembly  
8:12:13 PM  
V6
- Part Cooling Duct - Rev 0  
10/6/17  
V3
- Part Cooling Duct - Rev 1  
10/9/17
- Part Cooling Duct - Rev 2  
10/9/17  
V3
- Part Cooling Duct - Rev 3  
10/14/17  
V7
- Part Cooling Duct - Rev 4  
10/14/17  
V6

Part Cooli...- Rev 2 v3

MODEL

SKETCH CREATE MODIFY ASSEMBLE CONSTRUCT INSPECT INSERT MAKE ADD-INS SELECT

BROWSER

- Part Cooling Duct - Rev 2 v3
  - Document Settings
  - Named Views
  - Origin
  - Bodies
  - Sketches
  - Construction



# Modifying the CAD Model

4:20 PM J

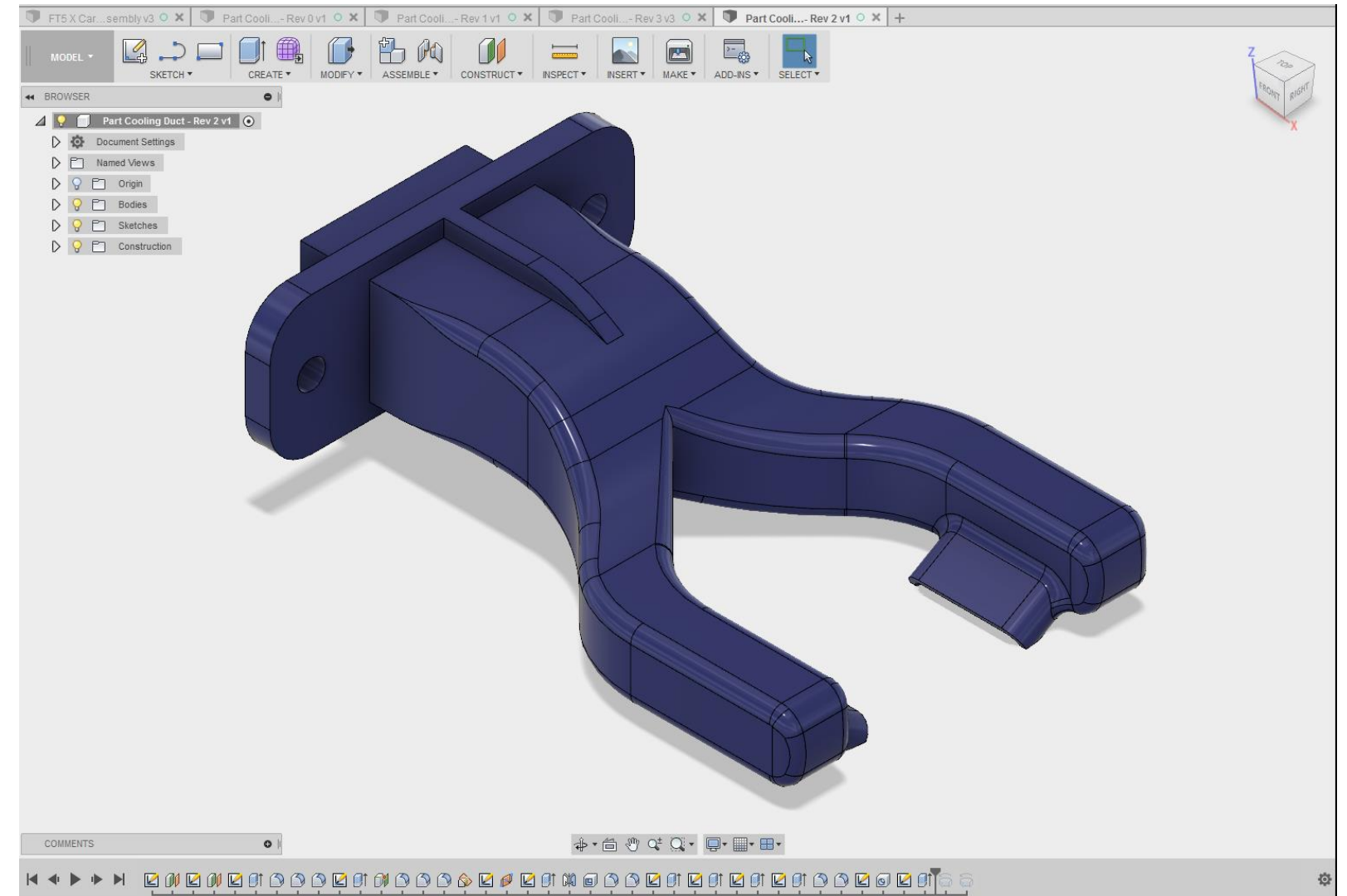
1:30 PM

COMMENTS

Navigation icons: back, forward, home, search, etc.

# Model Revision

- Faster turn-around time
- No need to rebuild from scratch
- Timeline editing

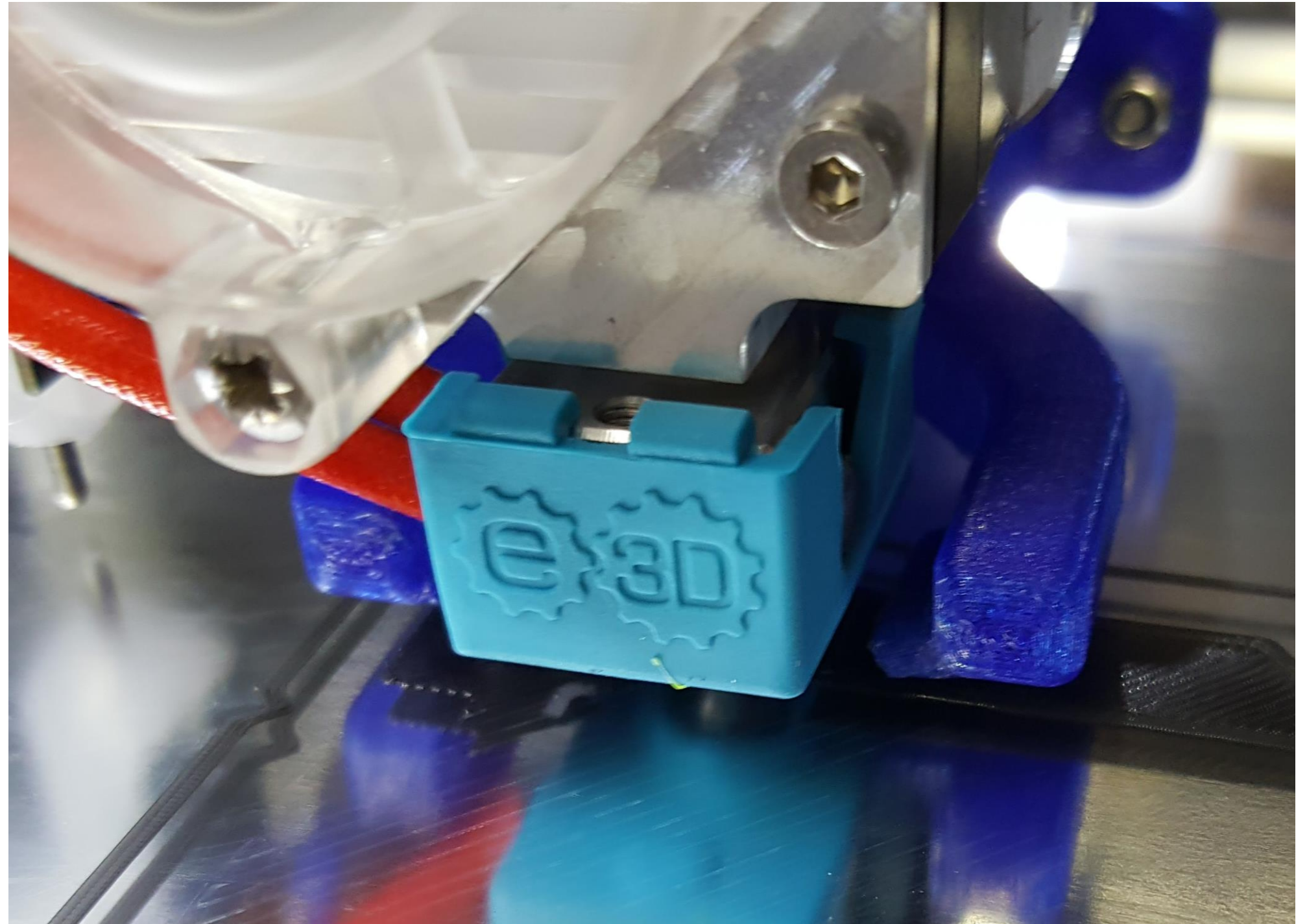




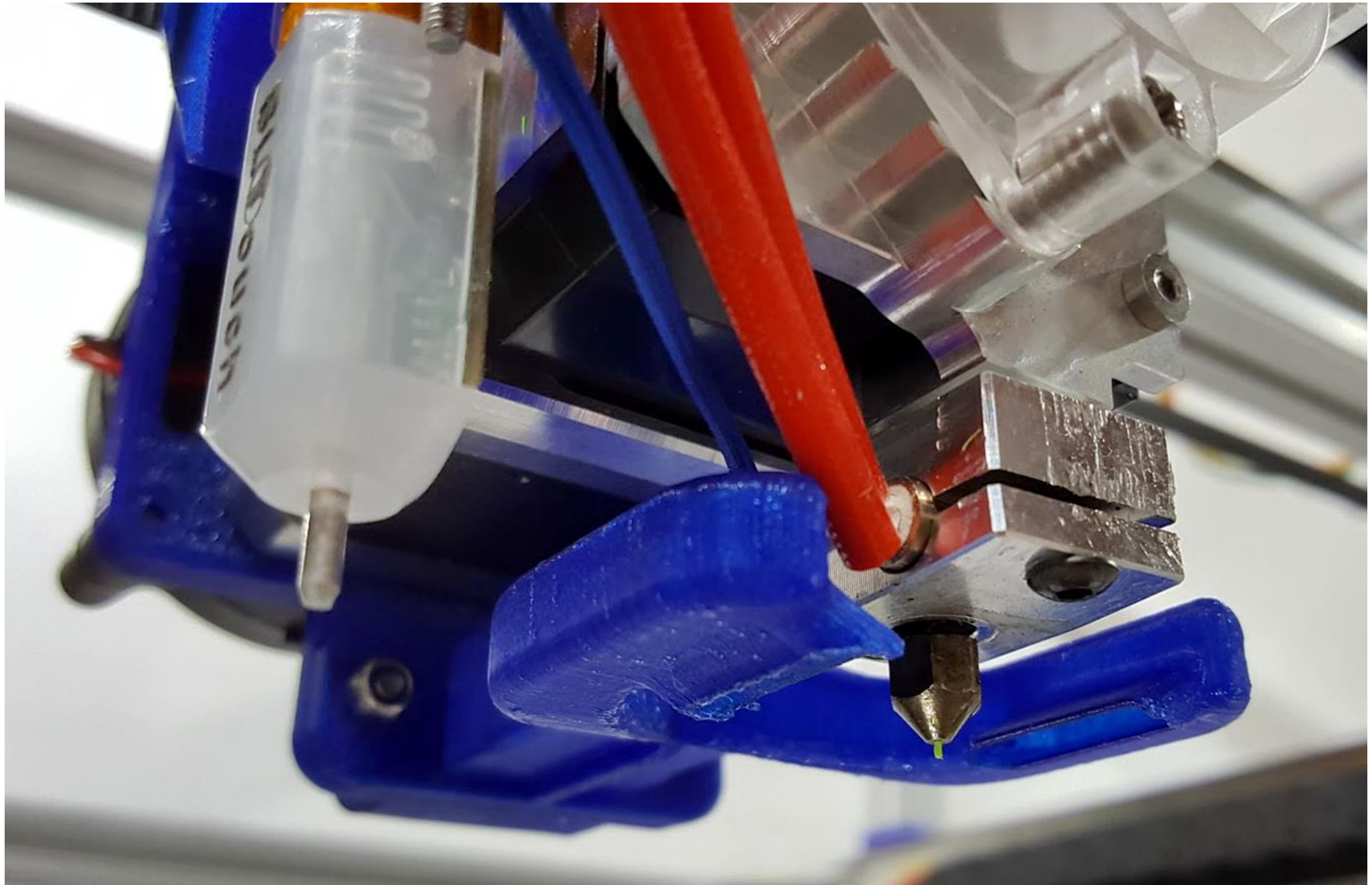


# Problems!!!

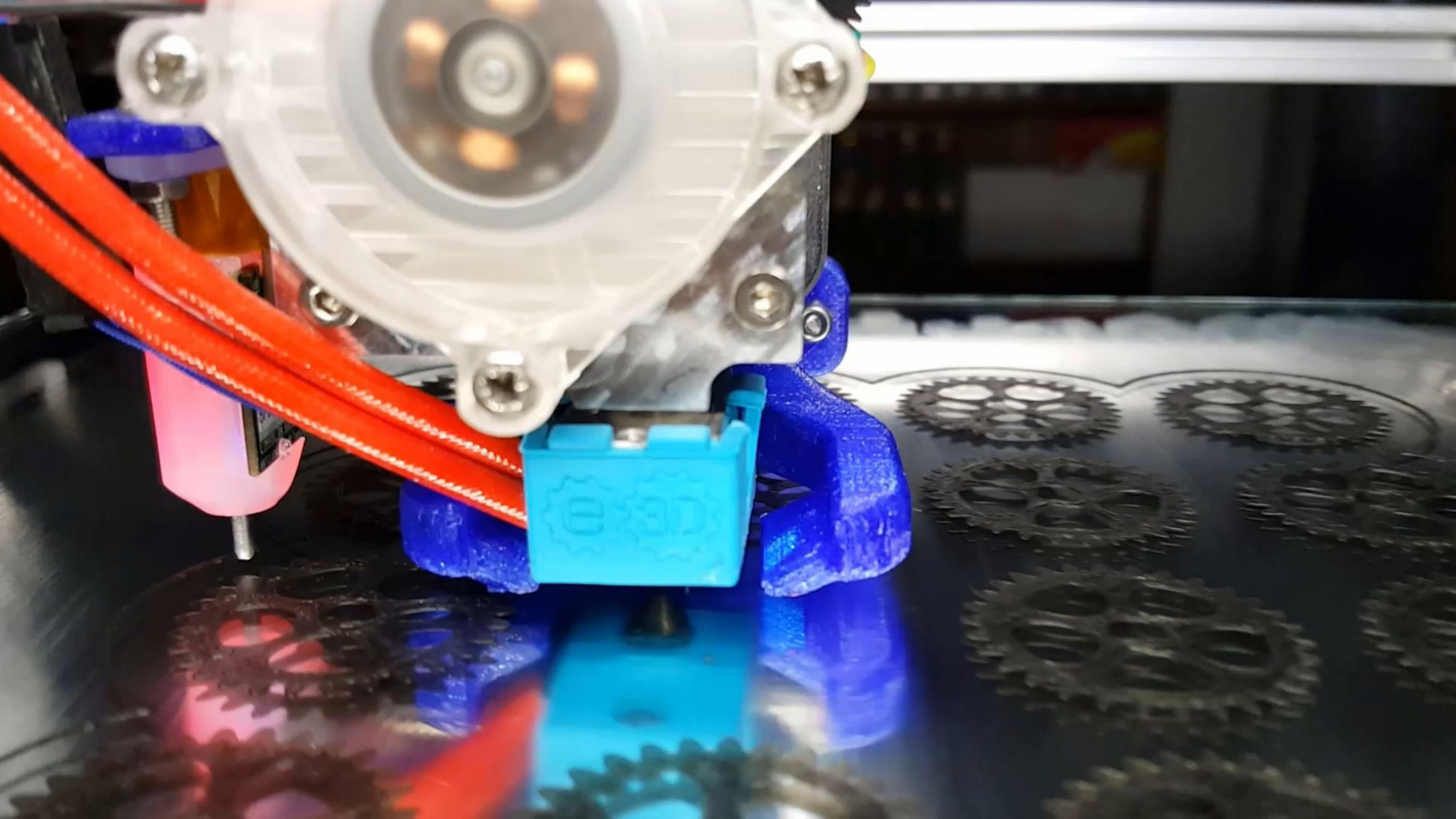
- Hot end clearance
- Wire clearance



Revision 3



Revision 4

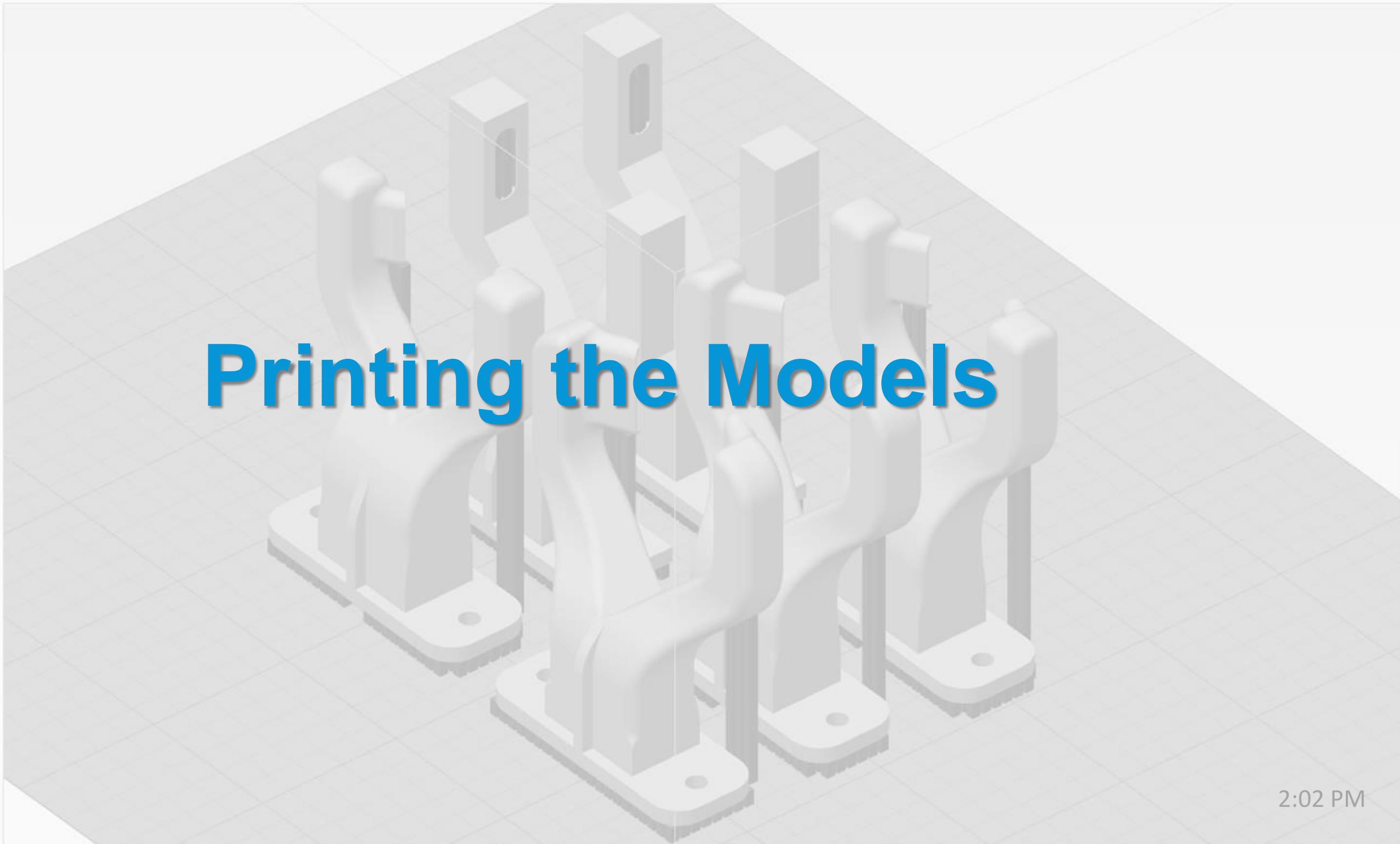


Models (double-click to edit)

- Part Cooling Duct R...
- Part Cooling Duct R...
- Part Cooling Duct R...
- Part Cooling Duct R...
- Part Cooling Duct R...
- Part Cooling Duct R...

Processes (double-click to edit)

Name	Type
Process1-1	FFF
Process1-2	FFF

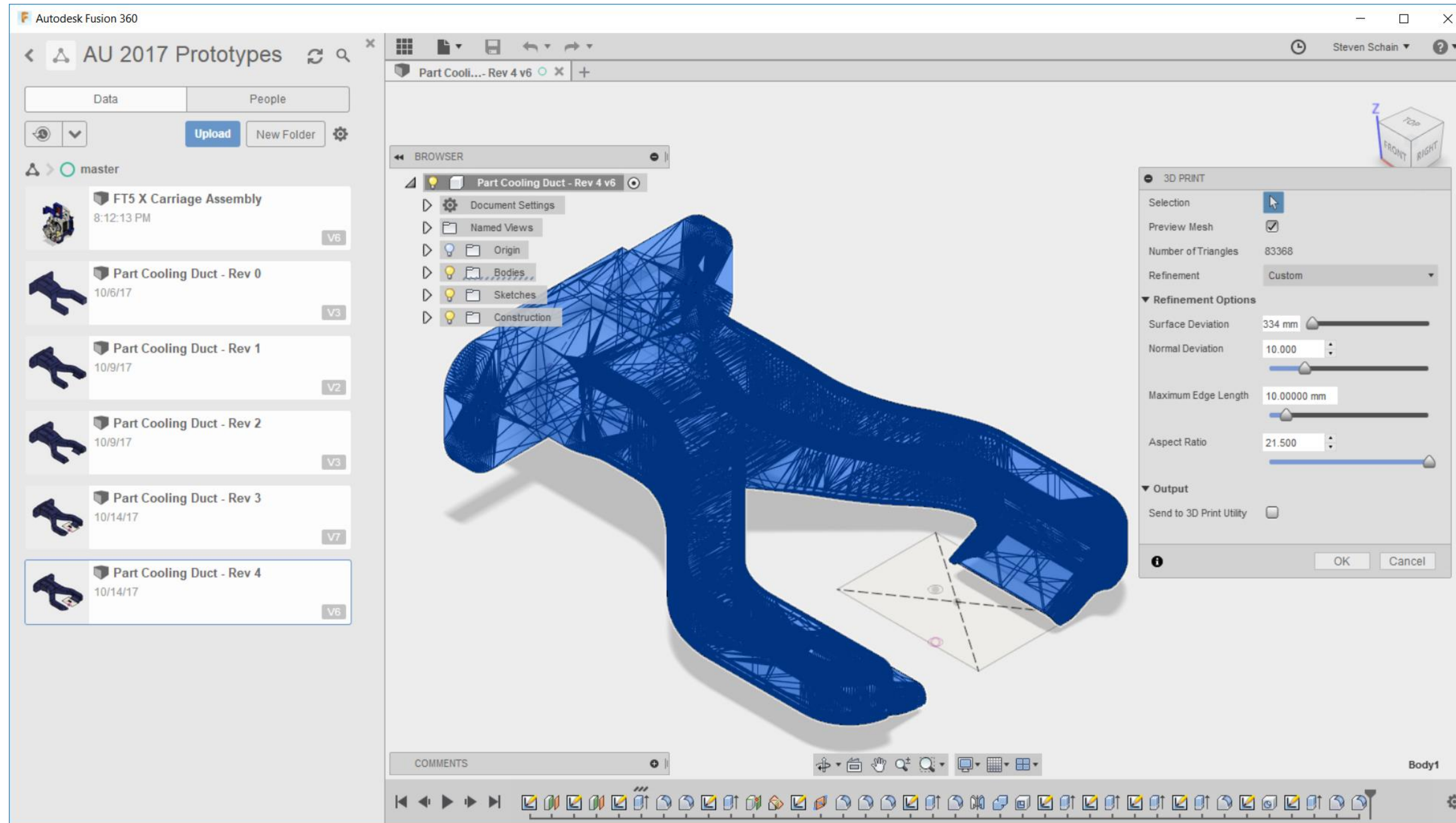


# Printing the Models

4:27 PM J

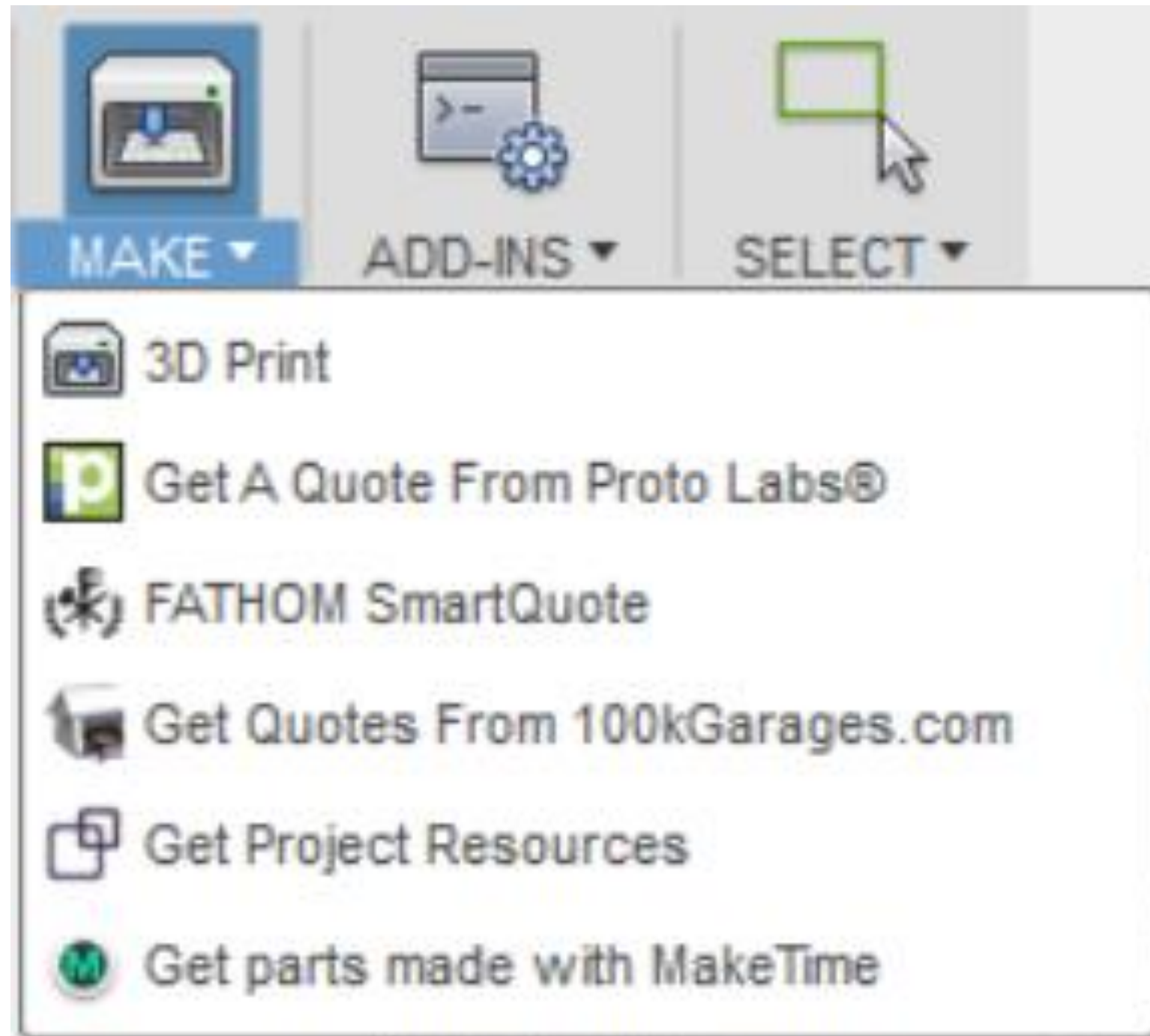
2:02 PM

# Exporting STL Files



3D Printing Environment

# 3D printing Service?



# Printing the Parts

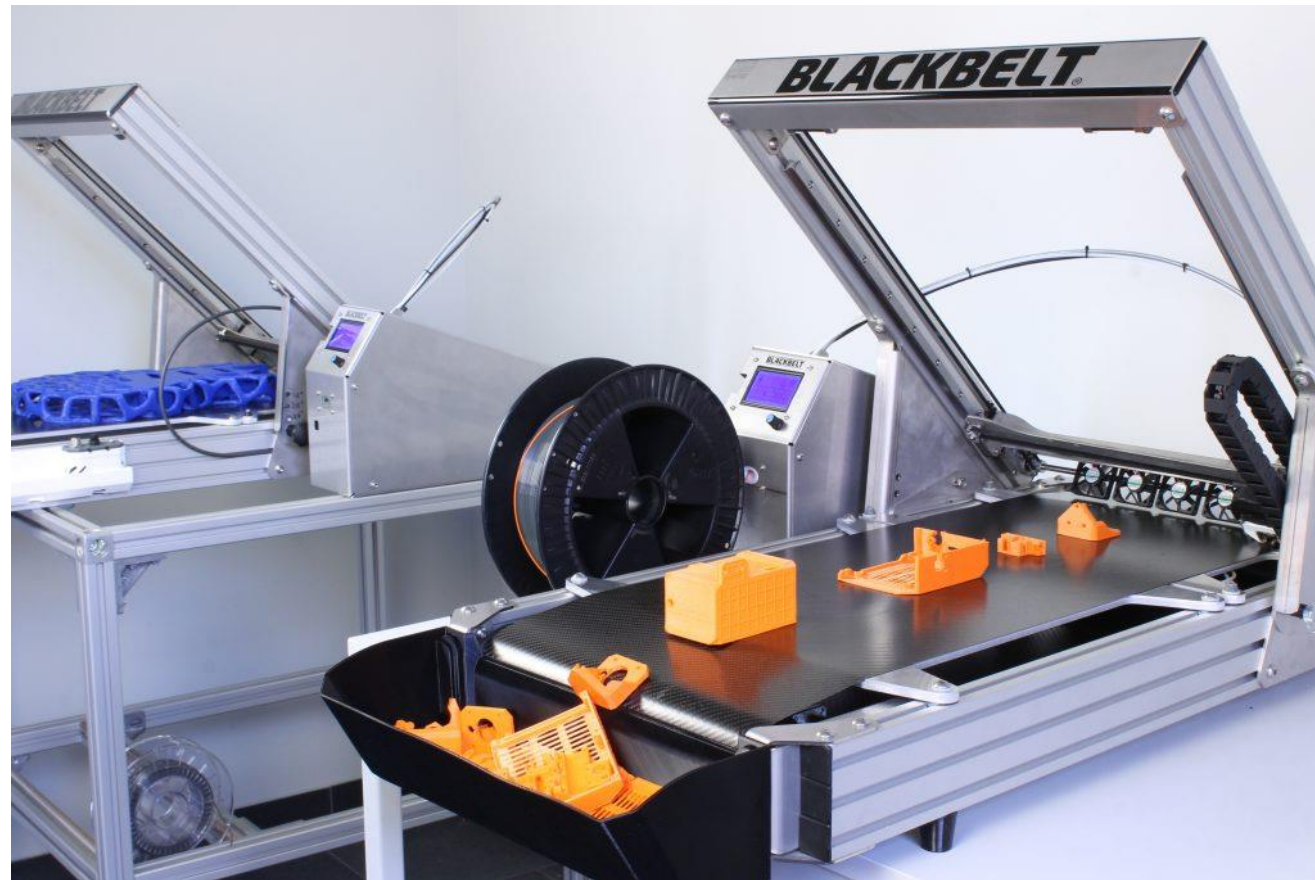
- The Printer (Consumer)



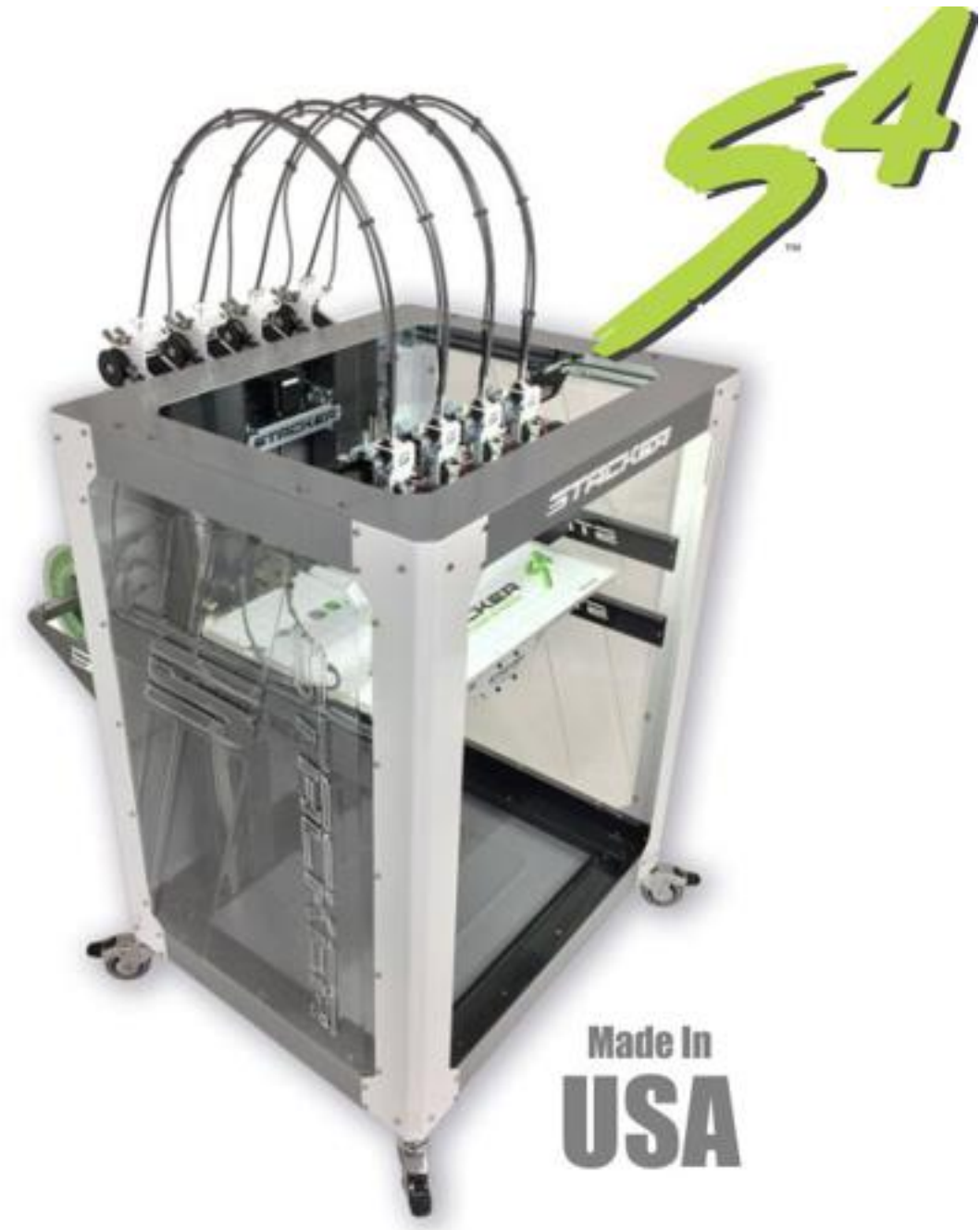
Craftunique  
Craftbot Plus

# Printing the Parts

- Printers (Production)



Blackbelt 3D Printer



Stacker 3D



# Blackbelt Continuous Printing

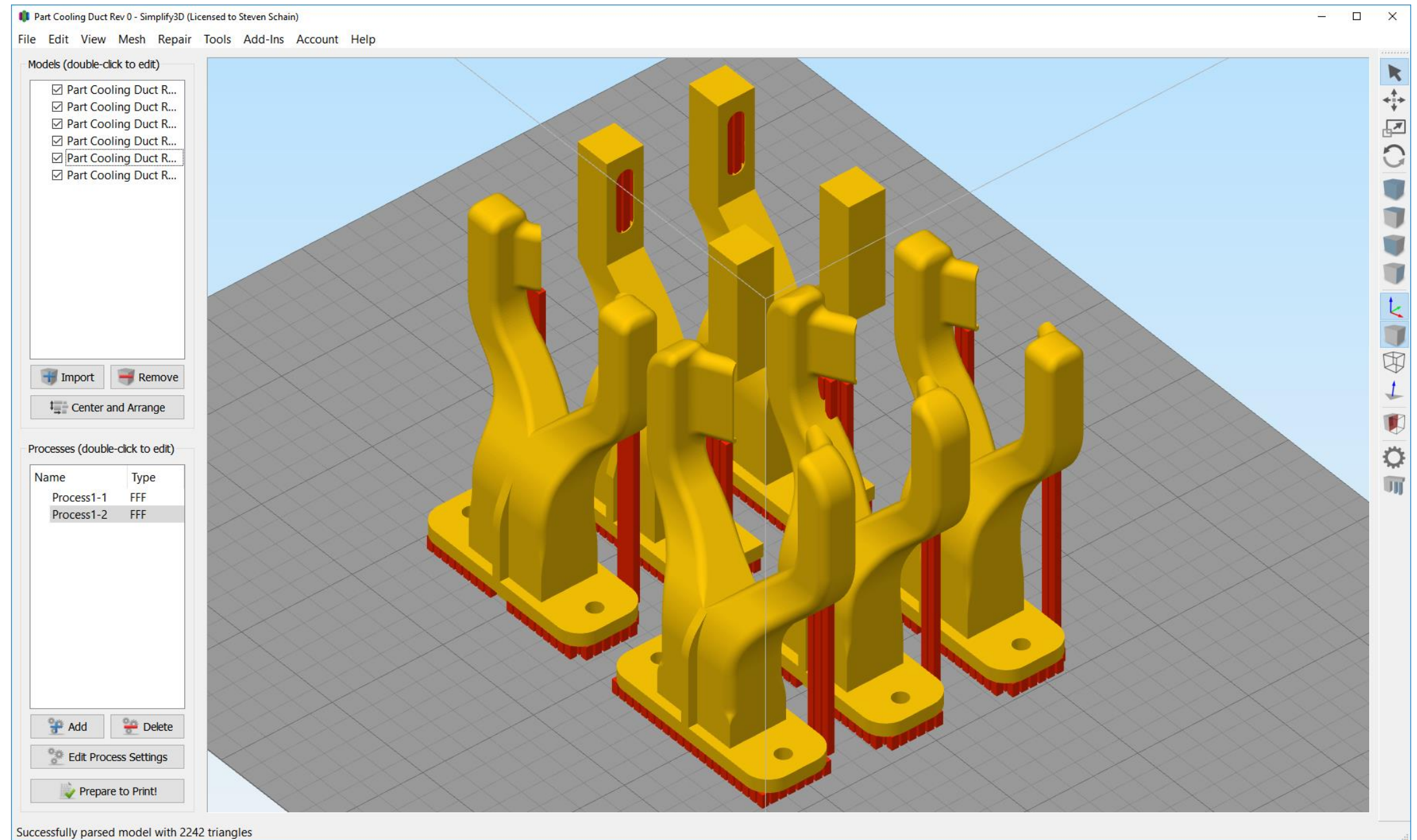


# Stacker3D S4 Multiple Parts



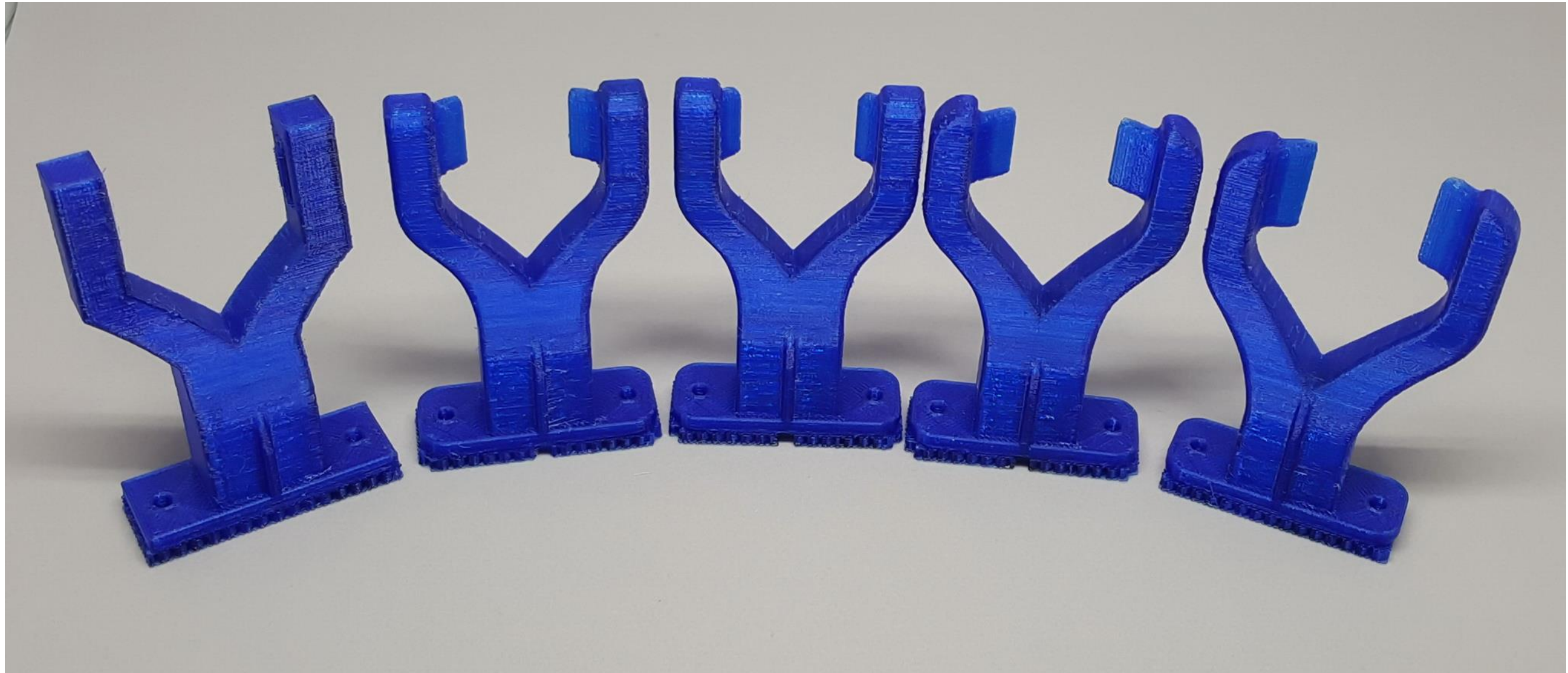
# Printing the Parts

- Slicing Software



Simplify 3D

# Printed Prototypes



# Recap

- Talked about prototyping
- Compared design for Manufacture vs. 3D printing
- Show object creation in Fusion 360
- Explained the timeline for part modification
- Discussed exporting and 3D printing

**Thank You**

Thank you for your time.

Steven Schain – Post Production Supervisor / M & E Content Developer

Jerry Berns - Manufacturing Content Manager

4D Technologies | CADLearning

[www.cadlearning.com](http://www.cadlearning.com)

sschain@cadlearning.com

# How did we do?

- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**



**Get your free gift Now!**



# Questions



4:50 PM

1:30 PM

For more information:



[www.cadlearning.com](http://www.cadlearning.com)



[sschain@cadlearning.com](mailto:sschain@cadlearning.com)



[www.cadlearning.com/about/theblastarchive](http://www.cadlearning.com/about/theblastarchive)



[www.facebook.com/CADLearning](http://www.facebook.com/CADLearning)



[@3dprofessor](https://twitter.com/3dprofessor)



[Linkedin.com/in/sschain](https://www.linkedin.com/in/sschain)



Make anything.

6:45 PM

Autodesk and the Autodesk logo are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product and services offerings, and specifications and pricing at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

1:30 PM