An Introduction to **3D Printing** for Mac Admins

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EPSON


EPSON


Canon
EOS
Rebel
T5i
CANON ZOOM LENS EF-S 18-135mm 1:3.5-5.6 IS STM
67mm


Handy Recorder
H4n

?!

What I've Learned

- The Output
- The Hardware
- The Software
- Models

The Output

Materials

Studio Neat

Made in Austin

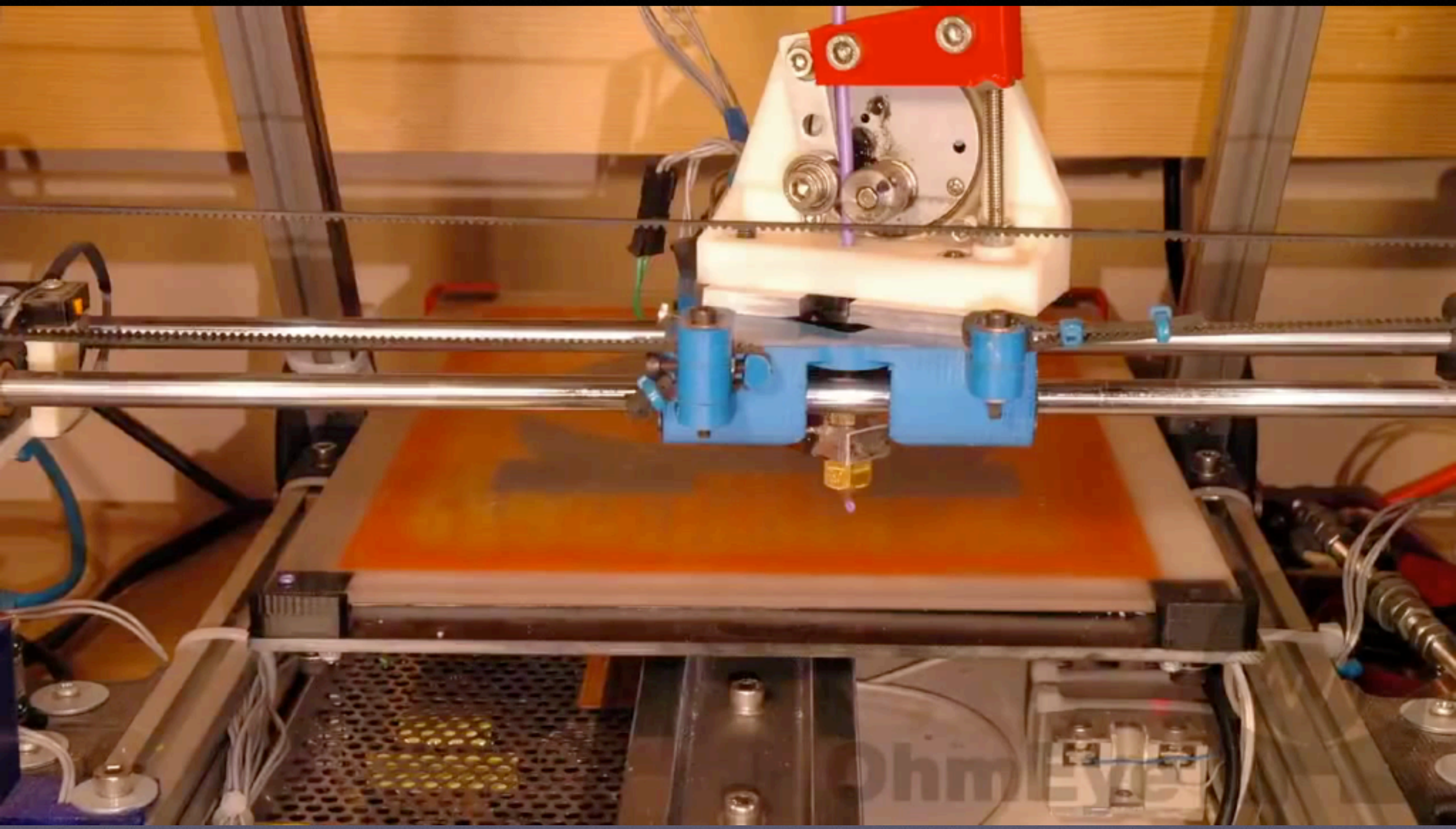
Our first in-house product.

The Apple TV Remote Stand is produced right here in Austin, TX. In Tom's garage, to be precise. We are using an X-Carve CNC machine to mill the walnut. This is our first product we've produced entirely in house.

Additive Manufacturing

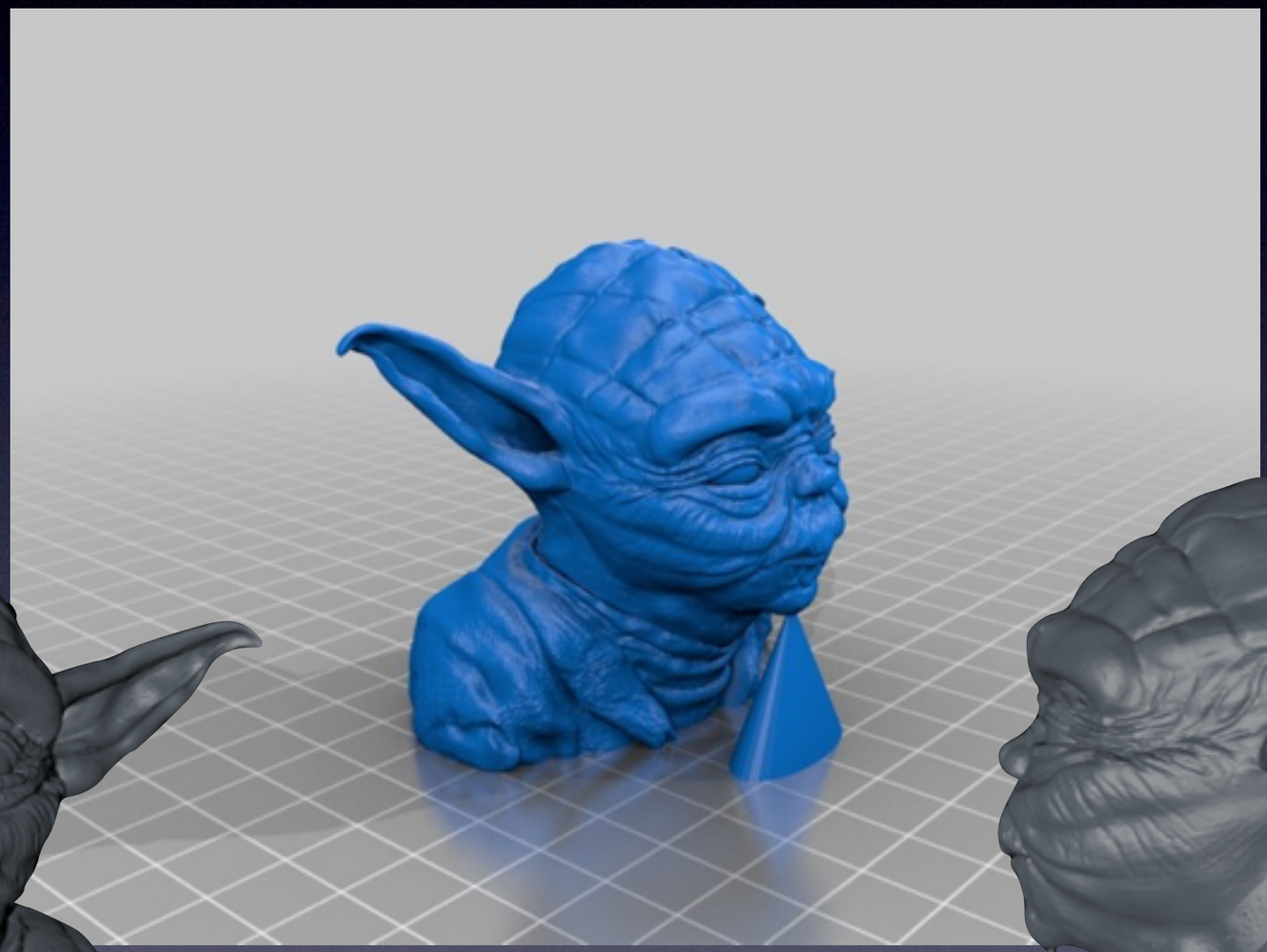
- Fused Deposition Modelling / Fused Filament Fabrication
- Layers of resin under UV lamp

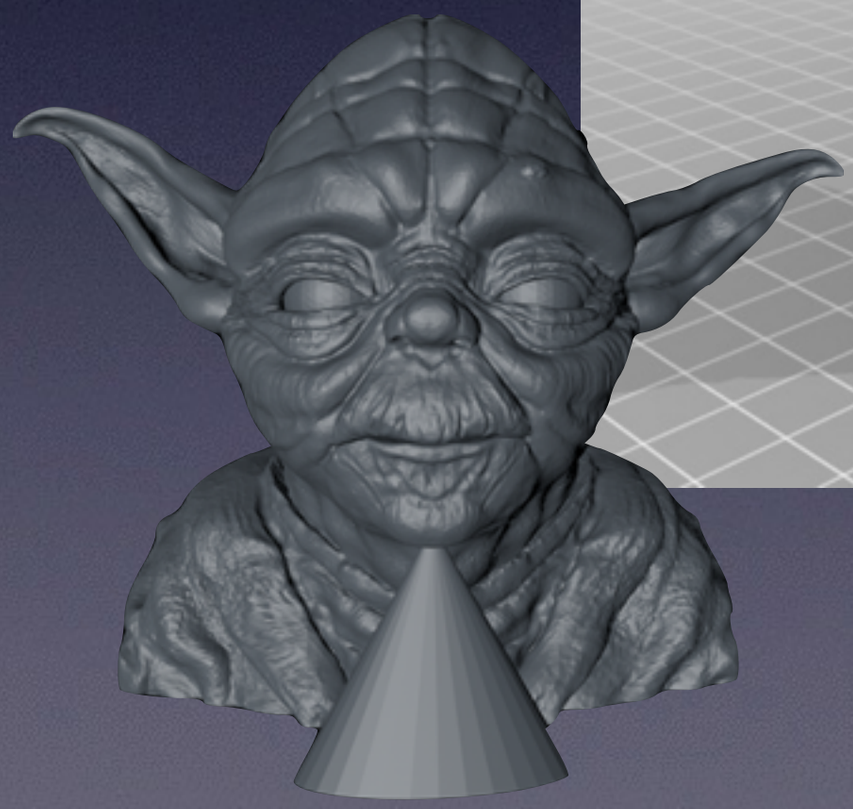
Credit: OhmEye (Creative Commons License)
https://youtu.be/1213kMys6e8

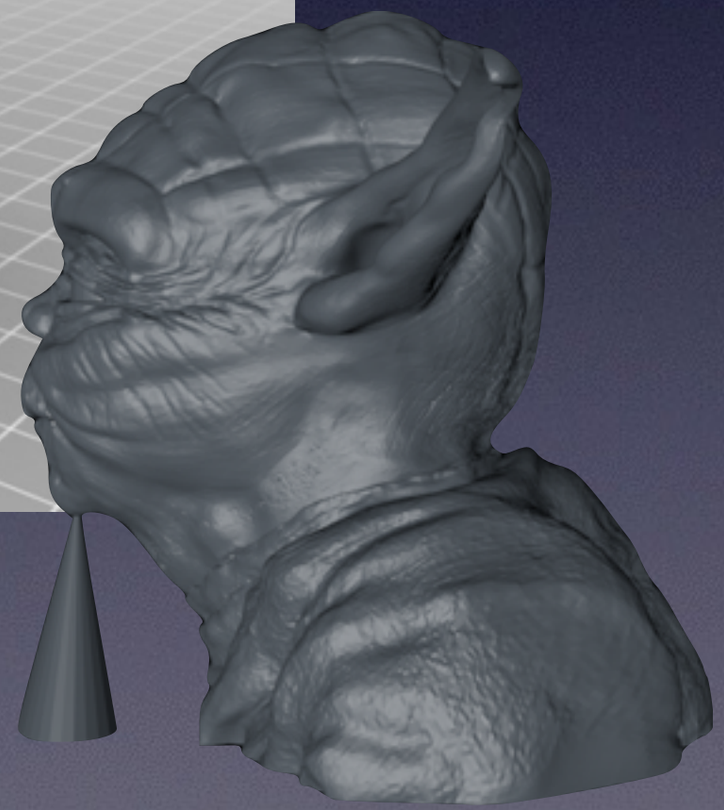


Credit: OhmEye (Creative Commons License)
https://youtu.be/NzQF7SRU_1E

FDM/FFF







FDM/FFF

FDM/FFF

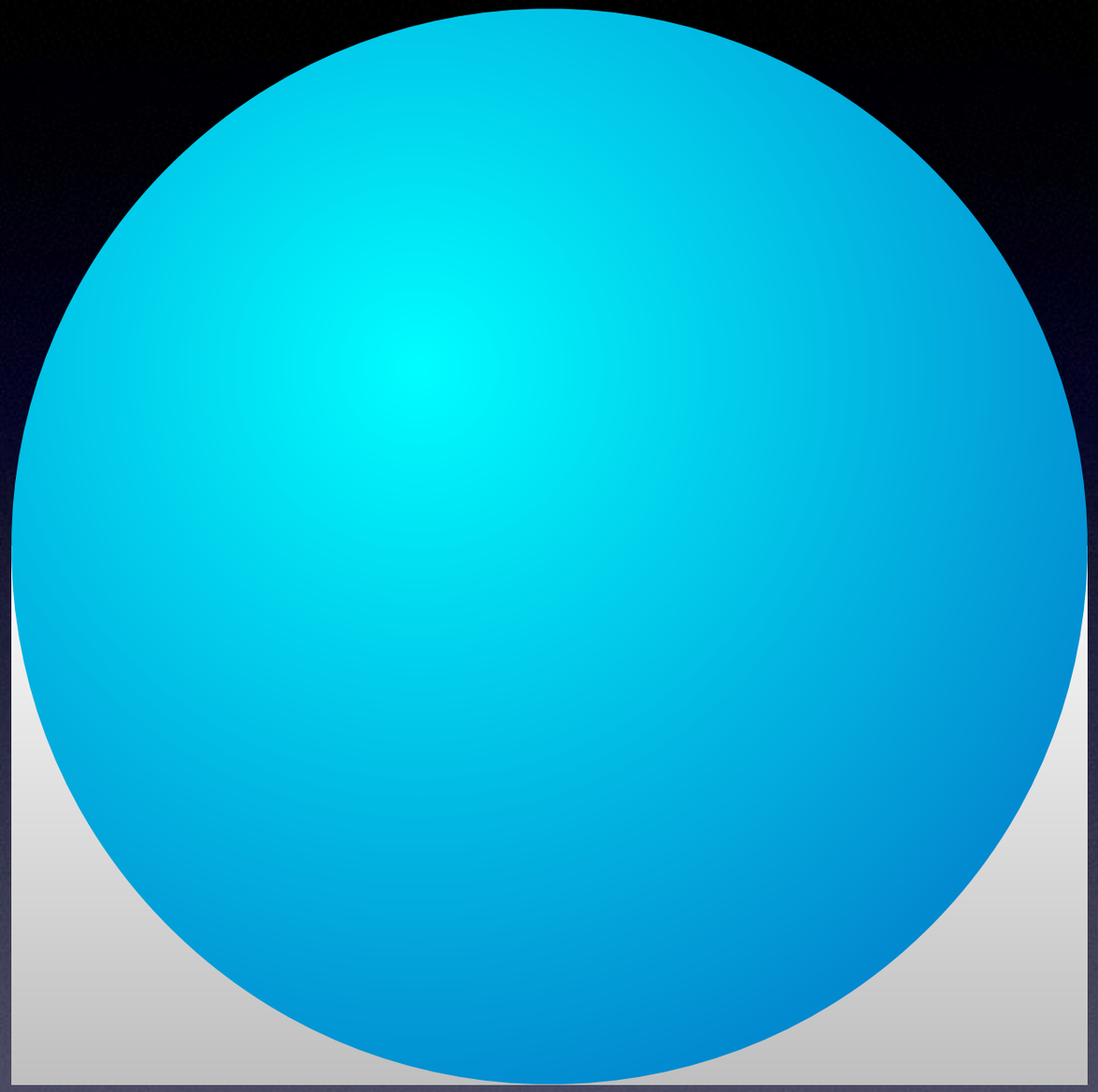
FDM/FFF

- Less expensive printers & materials
  - *Often print hollow*
- Variety of materials & colours
  - *PLA, ABS, Nylon, Wood*
- Printing angle a consideration
- Some designs can’t be printed
- 100 µm (0.1 mm) minimum thickness (250 µm typical)

Resin

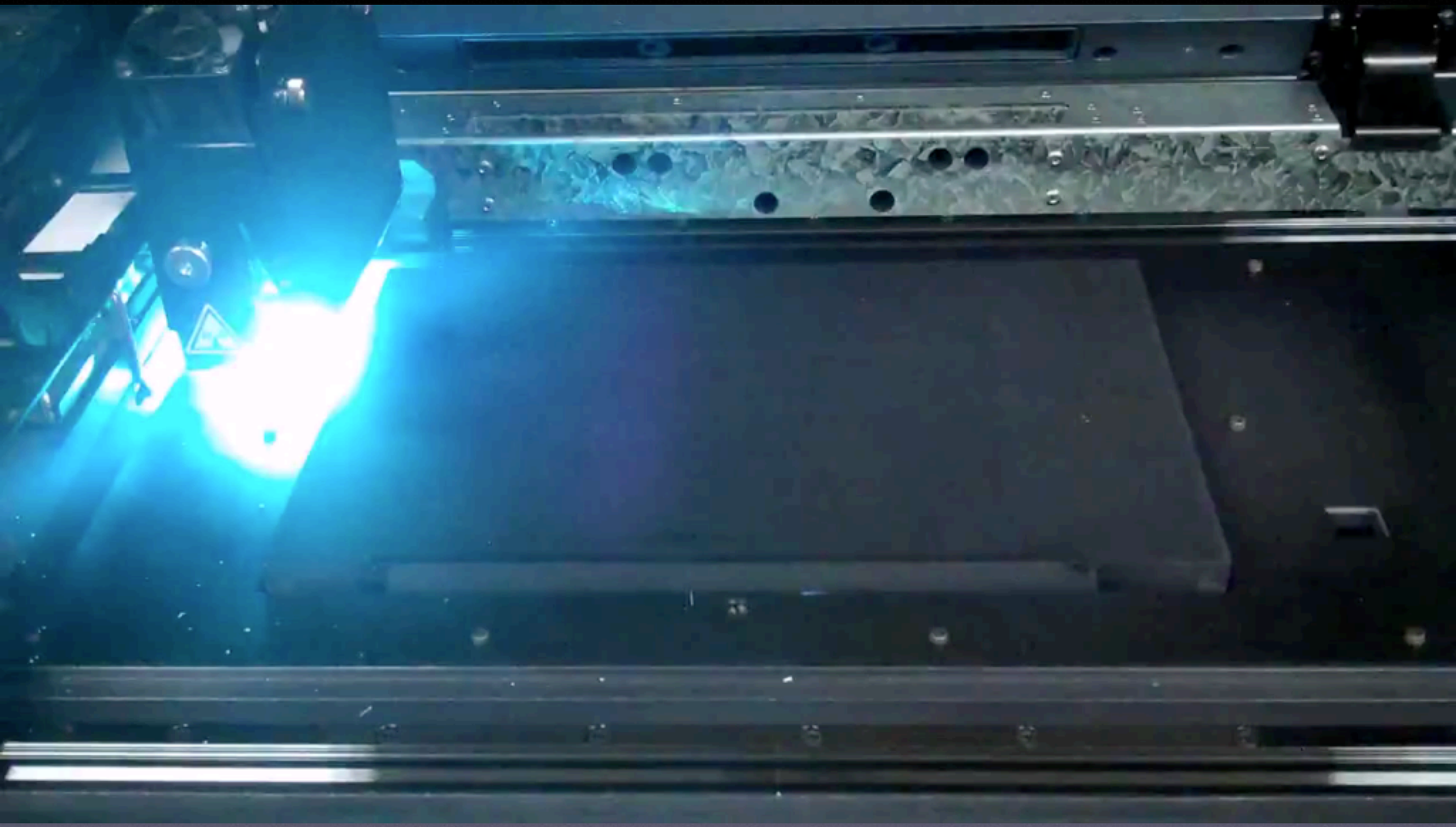
- Build Material
- Support Material

Build Material



Support Material

Credit: James Thornburgh (Creative Commons License)
https://youtu.be/AKca08-ggX0

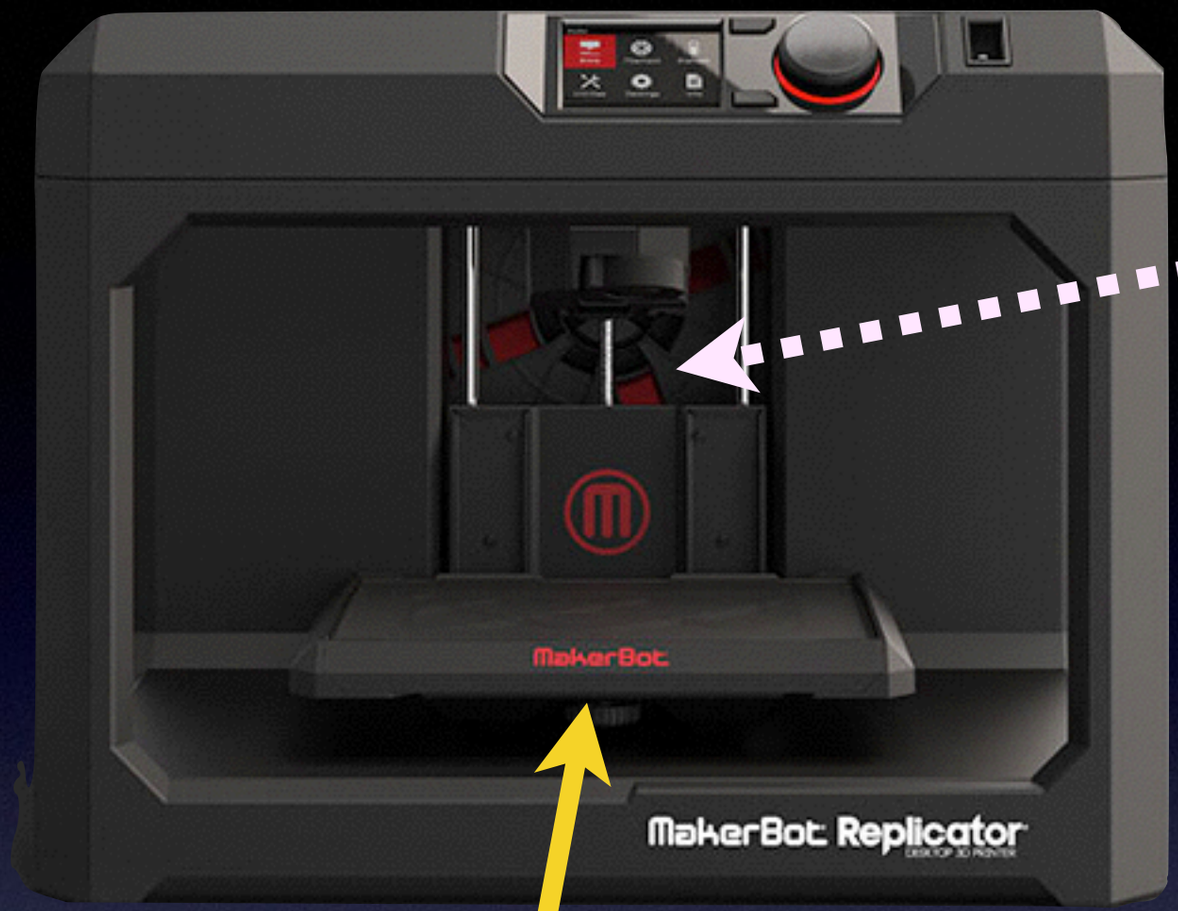


Credit: James Thornburgh (Creative Commons License)
https://youtu.be/-rJnVPey_5Q

Resin

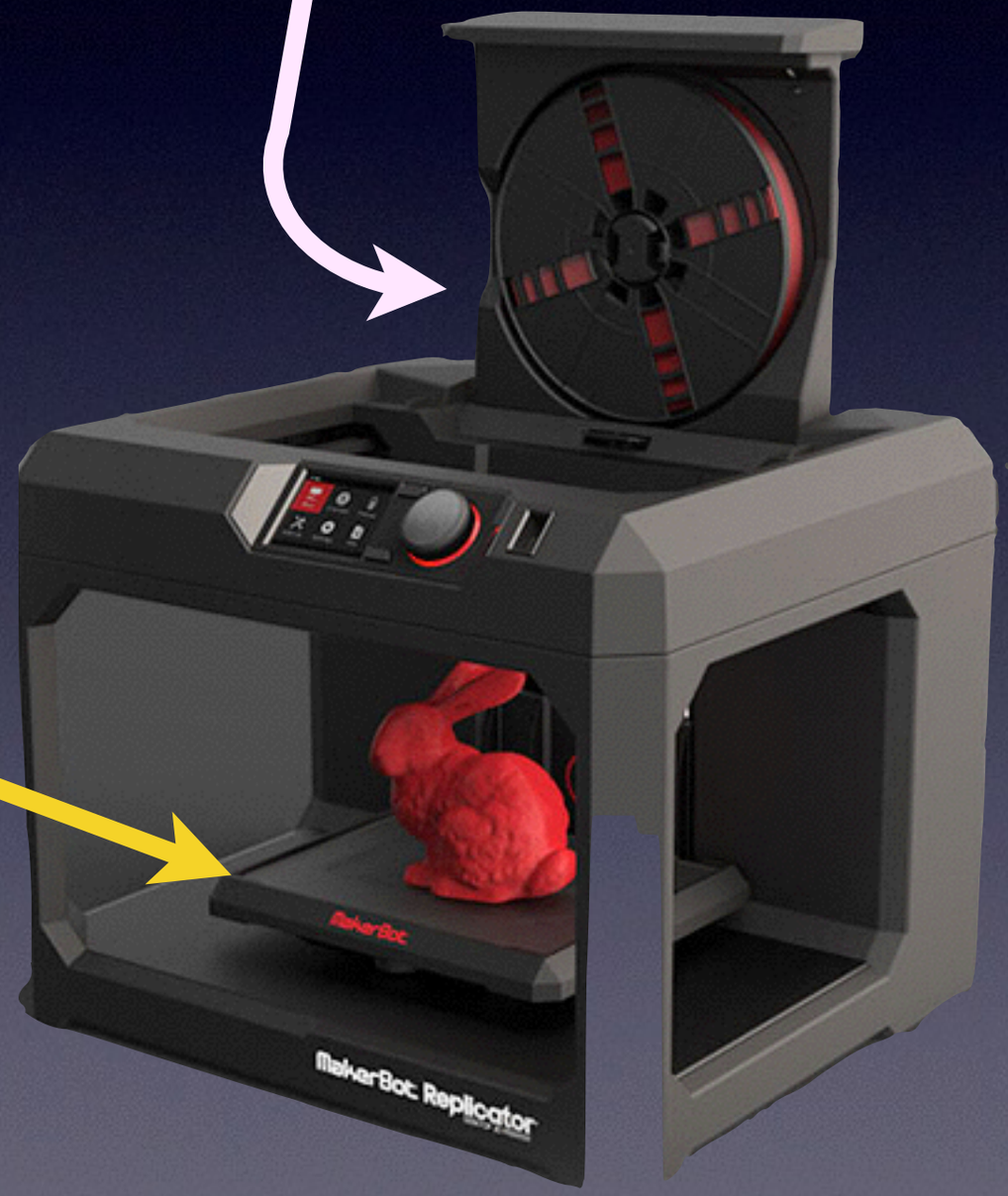
- More expensive – proprietary
- Material variety increases with cost of printer
- No angle restrictions
  - *Solid objects*
- 28 µm typical (0.028 mm)
- Hazardous waste
- Model cleaning required

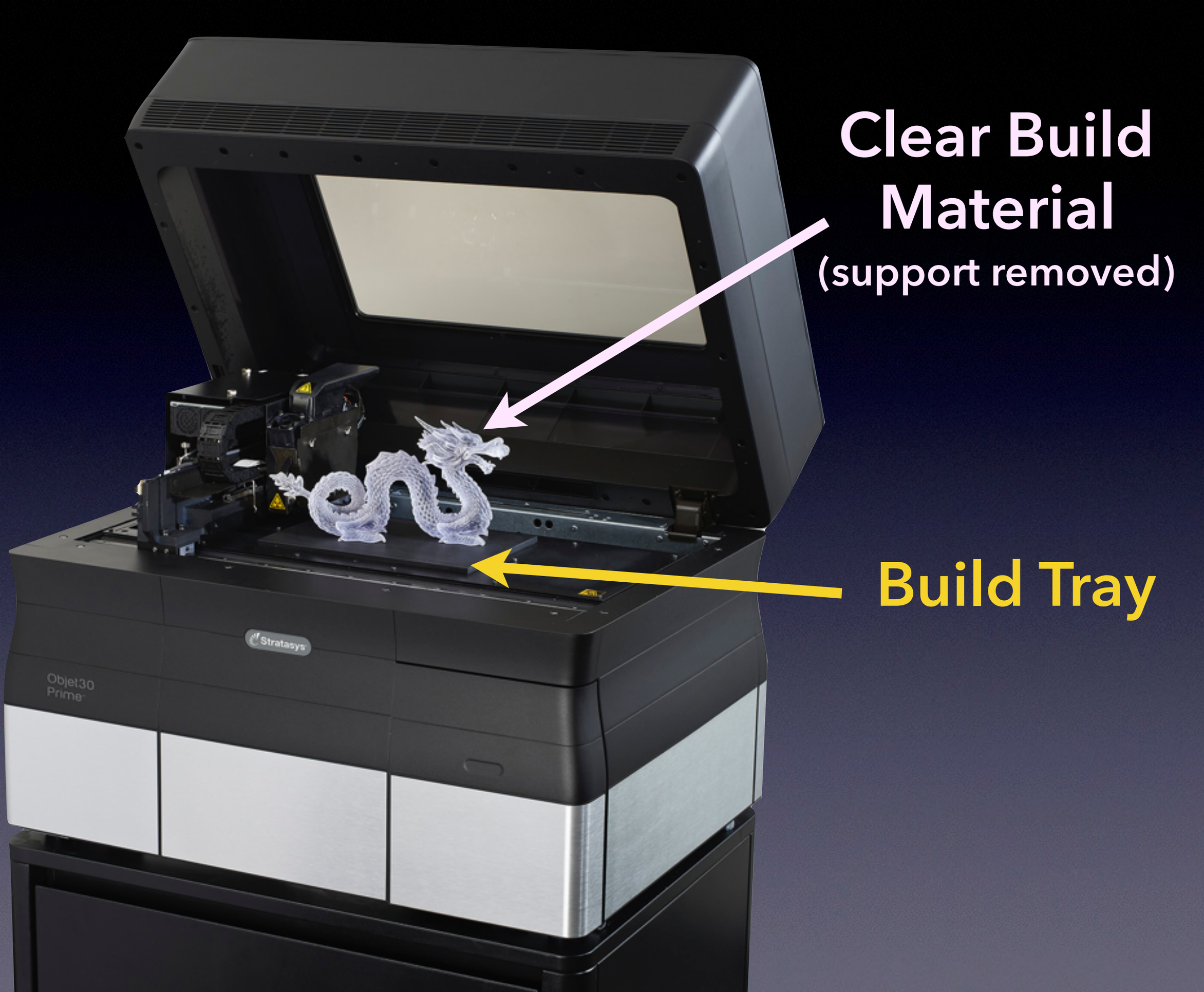
The Hardware



Filament
(Build Material)

Build Tray




Clear Build Material
(support removed)
Build Tray
Stratasys
Objet30 Prime

Setup & Operating Considerations

Setup & Operating Considerations

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Setup & Operating Considerations

Setup & Operating Considerations

The Software

.sc1

.zpr, .zbr

.ma

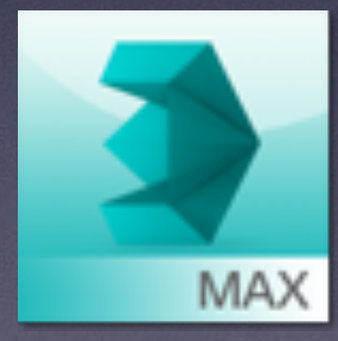
.blend

.c4d

.mud

.mlp

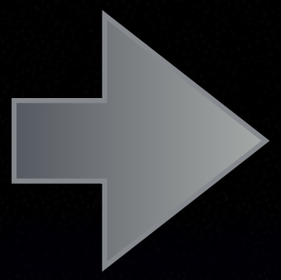
.vwx



.3ds

.STL

.OBJ

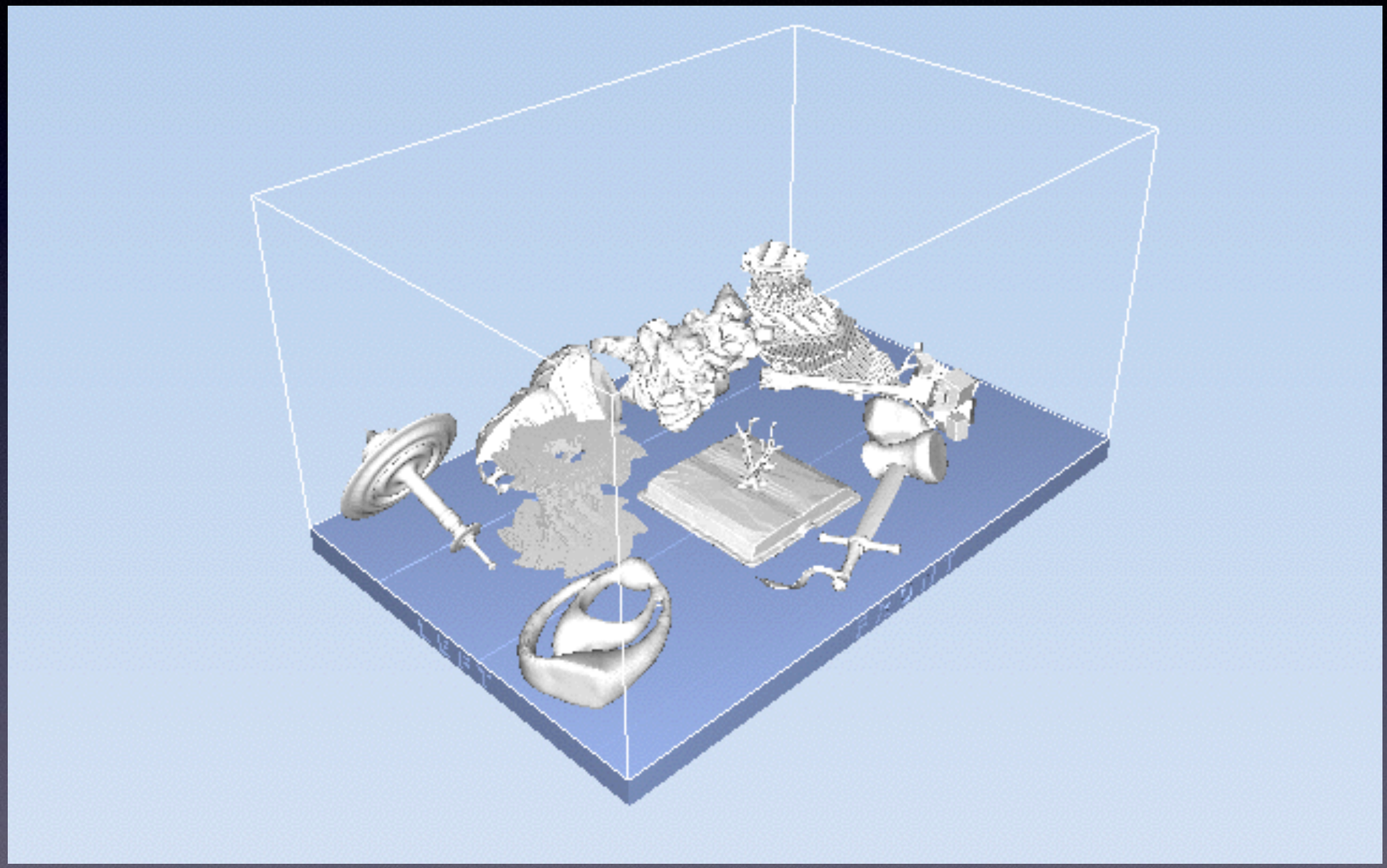


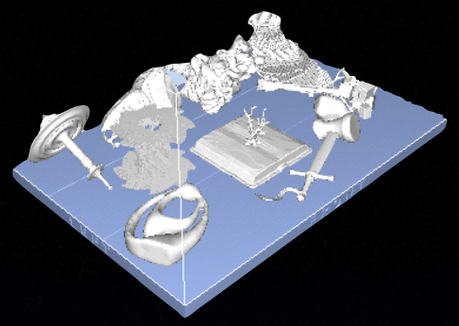
File Conversion Tools

- The App that created it
  - *Might need to use an intermediary format*
- MeshLab
  - *meshlab.sourceforge.net*
- A commercial app with STL export
  - *e.g., Cinema4D (maxon.net)*

Software & Services

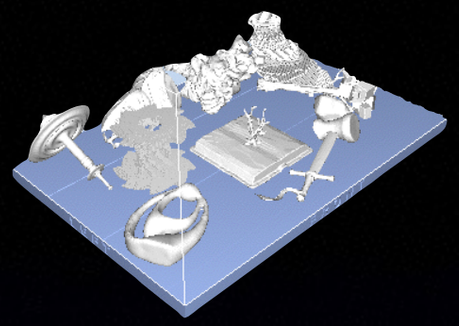
Making a Tray





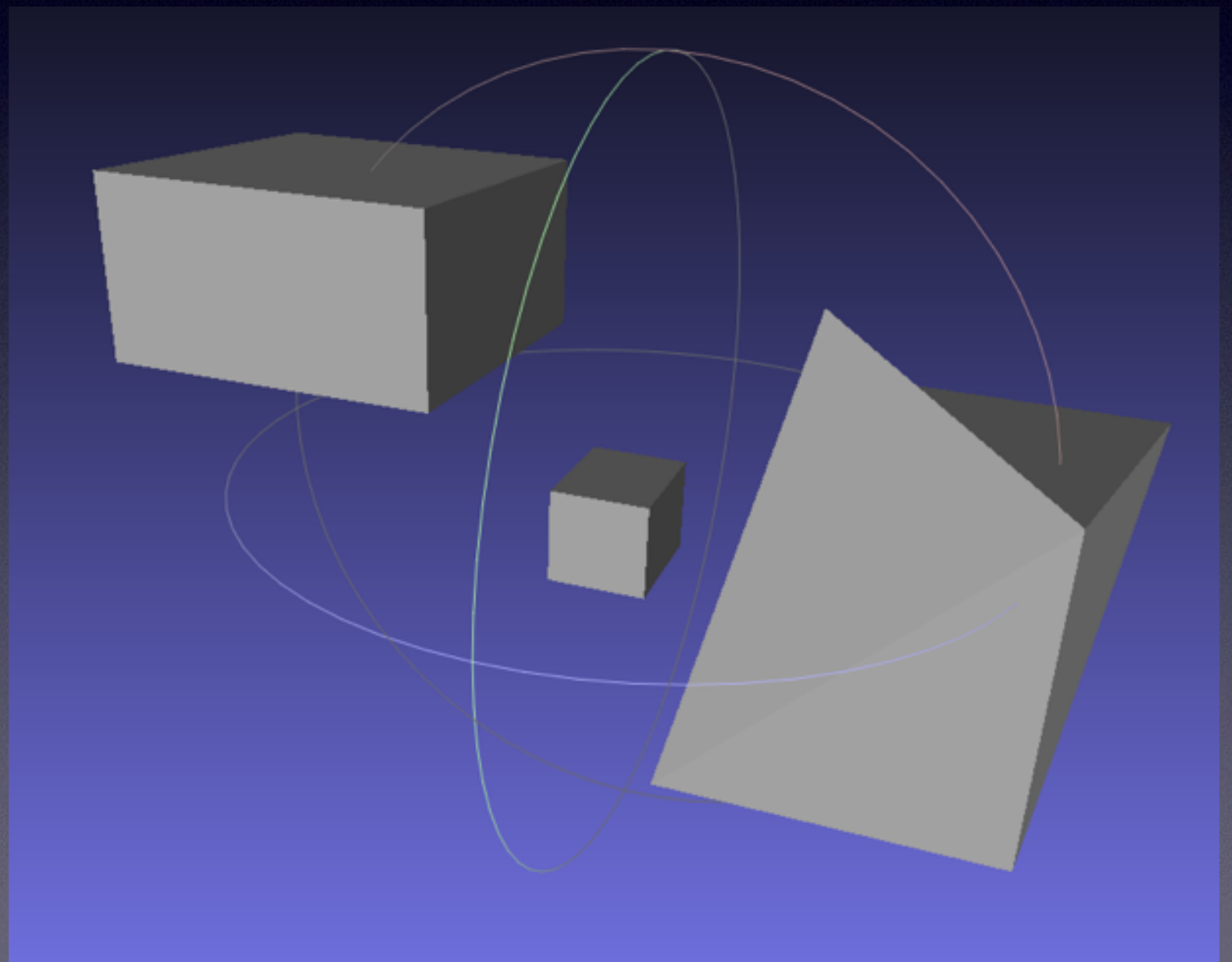
Making a Tray

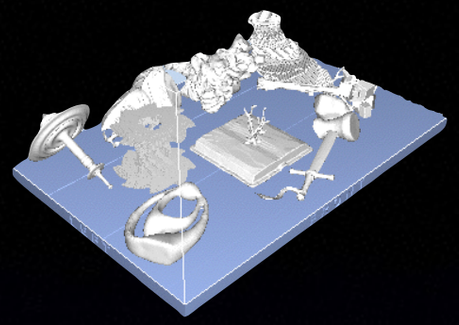
1. Collect your STL model(s)
2. Open the software (VM is OK)
3. Import each model, specifying scale units (mm or inch)
4. Adjust placement (auto or manual)
5. Verify tray
6. Estimate materials & Save Tray



Making a Tray – Issues

2+ models in 1 STL file

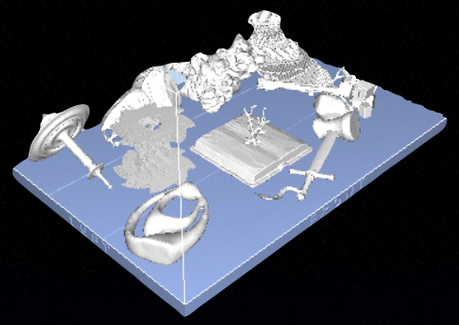




Making a Tray – Issues

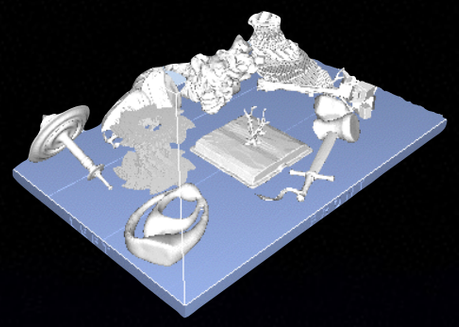
2+ models in 1 STL file

- User exports models separately
- Split with an app:
  NetFabb Basic (Free)
  - *www.netfabb.com/downloadcenter.php?basic=1*



Making a Tray – Issues

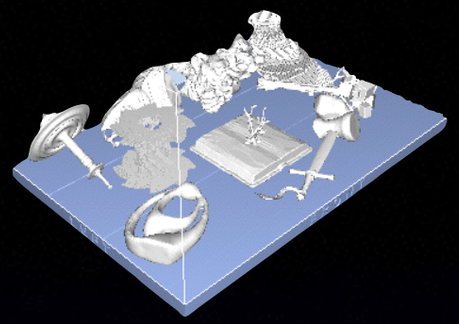
Unclosed contours, vertices, other defects



Making a Tray – Issues

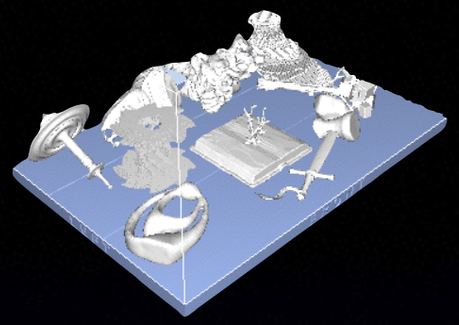
Unclosed contours, vertices, other defects

- NetFabb Basic
- MeshLab
- NetFabb online (“cloud”) service
  - *https://netfabb.azurewebsites.net/*
  - *Requires (free) Microsoft account*
- NetFabb Private (“personal”)
  - *US$300*
- NetFabb Professional ($$$$)



Making a Tray – Issues

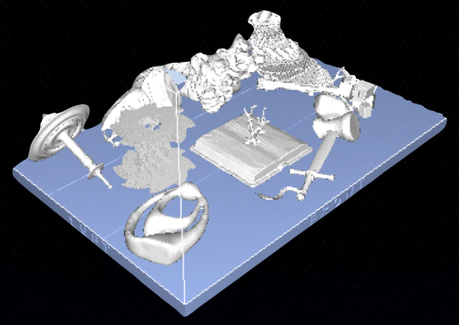
Model too large



Making a Tray – Issues

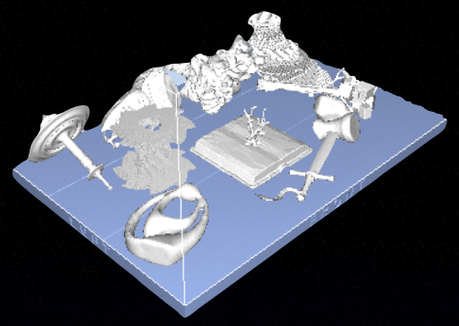
Model too large

- Scale the model
  - *printer software*
  - *any design software*
- Split the Model
  - *NetFabb Basic*
- Resin: re-orient the model



Making a Tray – Issues

Speed of Printing



Making a Tray – Issues

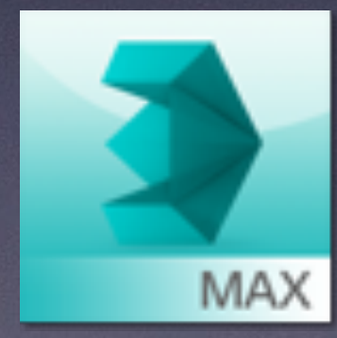
Speed of Printing

- Resin: Z-axis is slowest
  e.g., 25×50×100 mm (1×2×4"):
  - *9h when z=100 mm*
  - *5h when z=50 mm*
  - *3h when z=25 mm*
- Fill the tray
  - *6h for 4 copies on 1 tray when z=25 mm*

Models

Free

Open Source



Open Source

Making Models

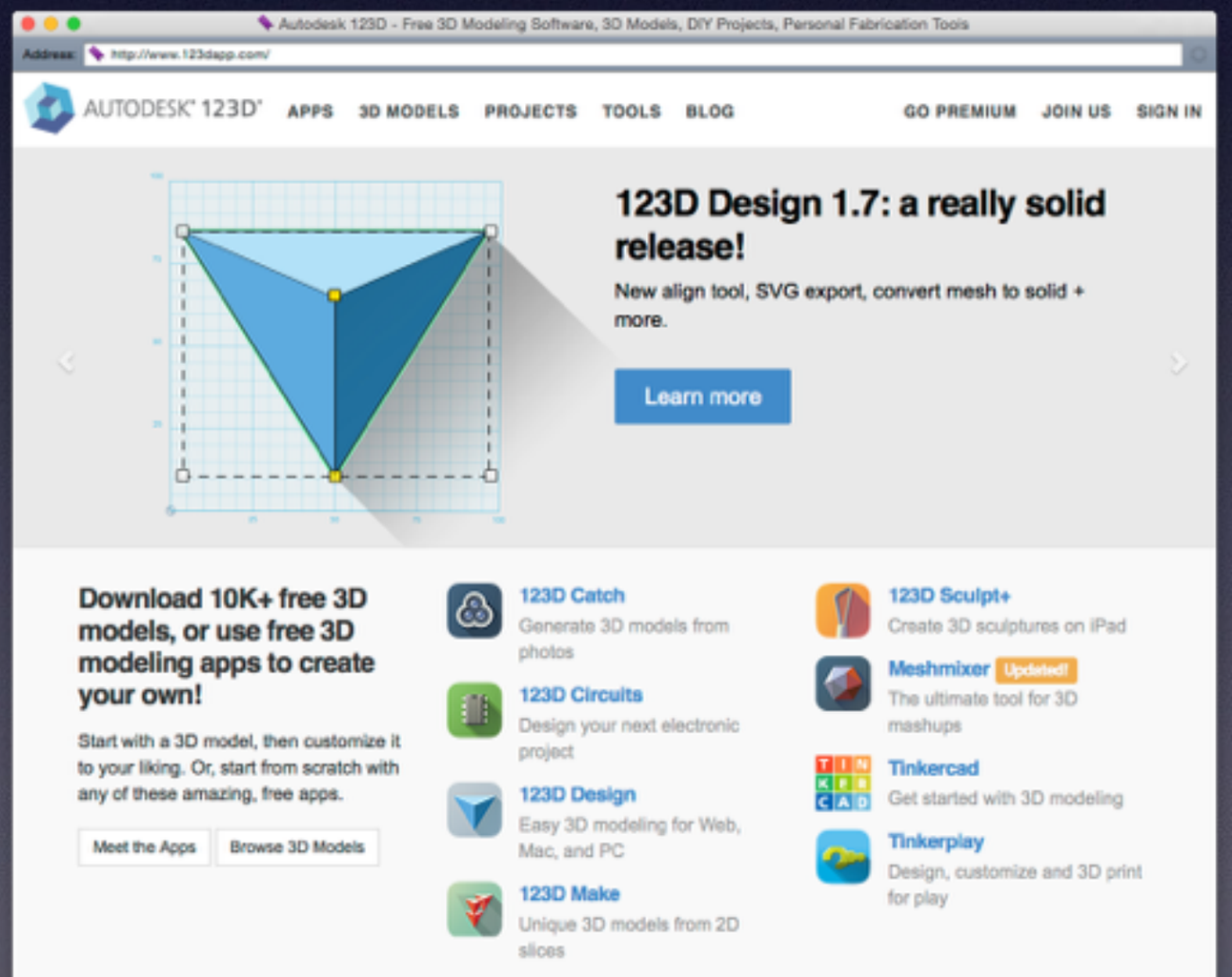
- Sculptris (Pixologic)
  - *pixologic.com/sculptris/*

- Blender
  - *www.blender.org*

- MeshLab
  - *meshlab.sourceforge.net*

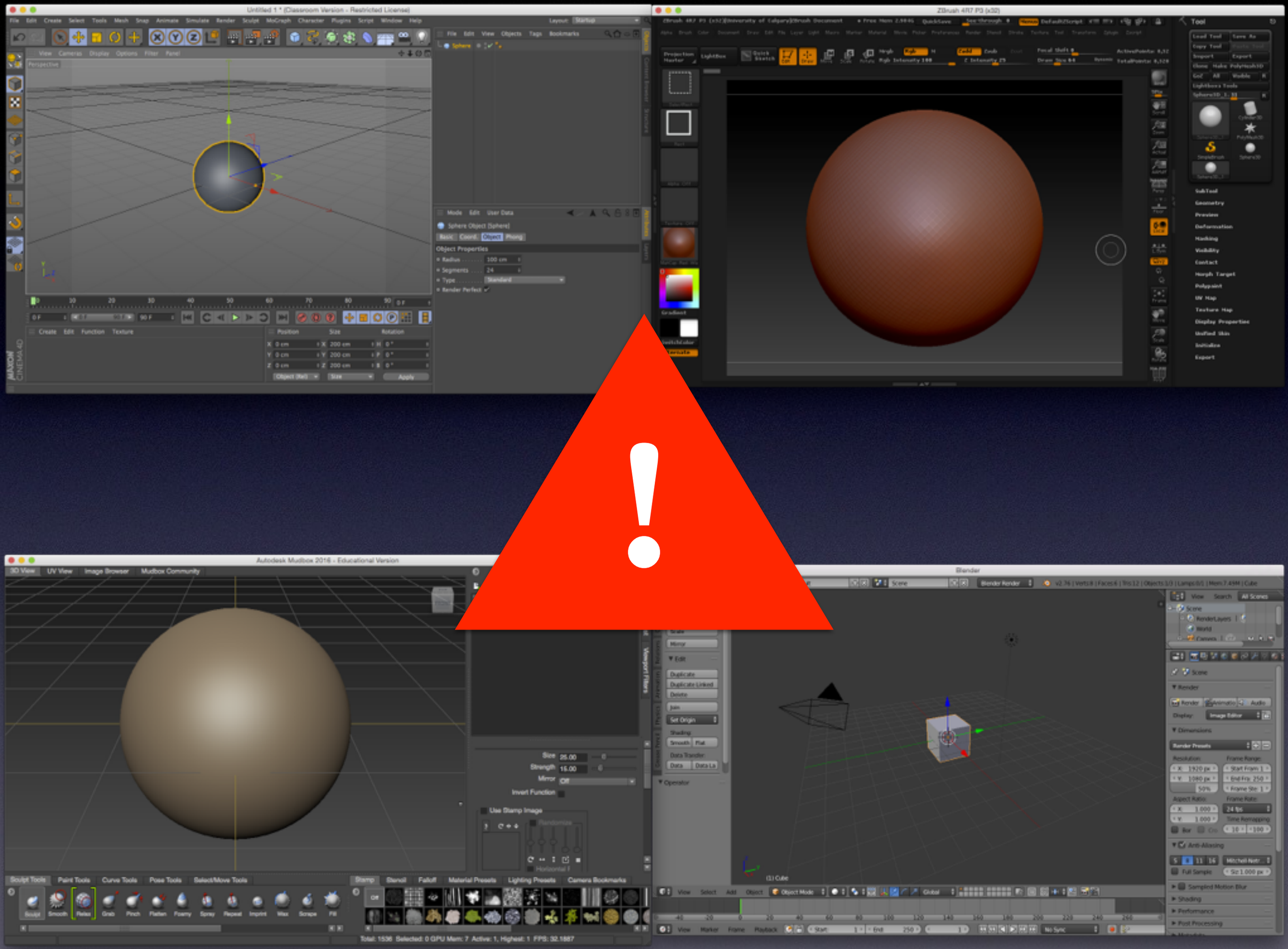
Making Models

- Autodesk 123D
  - *www.123dapp.com*



Making Models

- SketchUp Make
  (Trimble Navigation)
  - *www.sketchup.com*
  - *Ruby API*
  - *SDK*

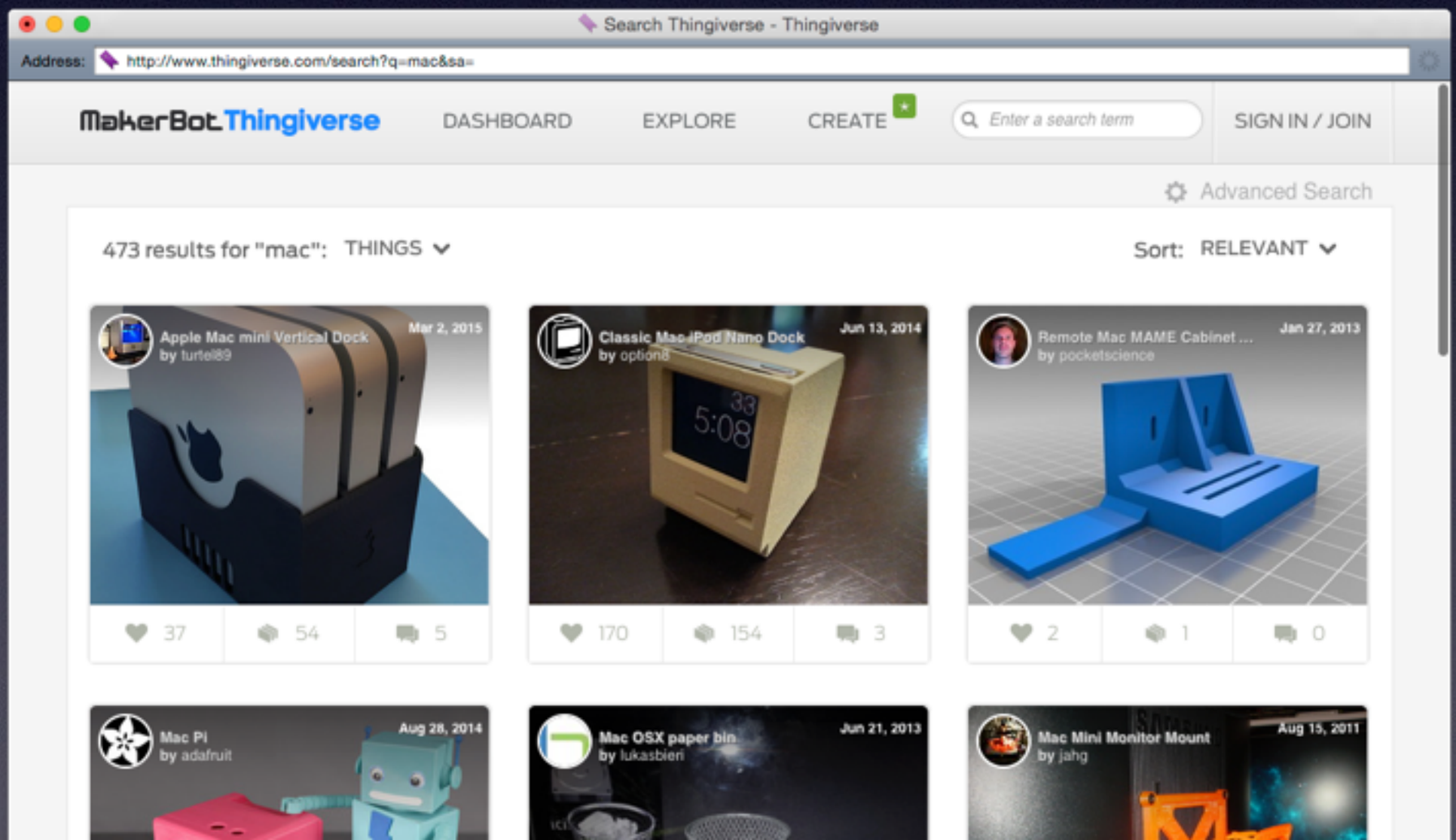

Untitled 1 * (Classroom Version - Restricted License)
ZBrush 4R7 P3 (x32)
Autodesk Mudbox 2016 - Educational Version
Blender

3D Scanning

- Different Kinds, Different Sizes
- Notorious for needing model cleanup

Community

- Thingiverse (Makerbot)
  - *www.thingiverse.com*



Community

- 3D Warehouse (SketchUp)
  - *3dwarehouse.sketchup.com*
- TurboSquid
  - *www.turbosquid.com/Search/3D-Models/free*
  - *Paid royalty-free models as well*

Many Thanks

- MacTech Conference
  - *Ed Marczak*
- Rob Furr
  - *Instructor, Dept. of Art, University of Calgary*
- Natasha Shevchenko
  - *Student Tech, IAML, University of Calgary*

ucalgary.ca/iaml/help/pro/3dprint

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