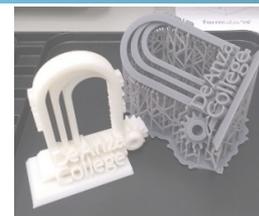


Design & Manufacturing Technologies (DMT)

Engineering & Manufacturing Career Pathways

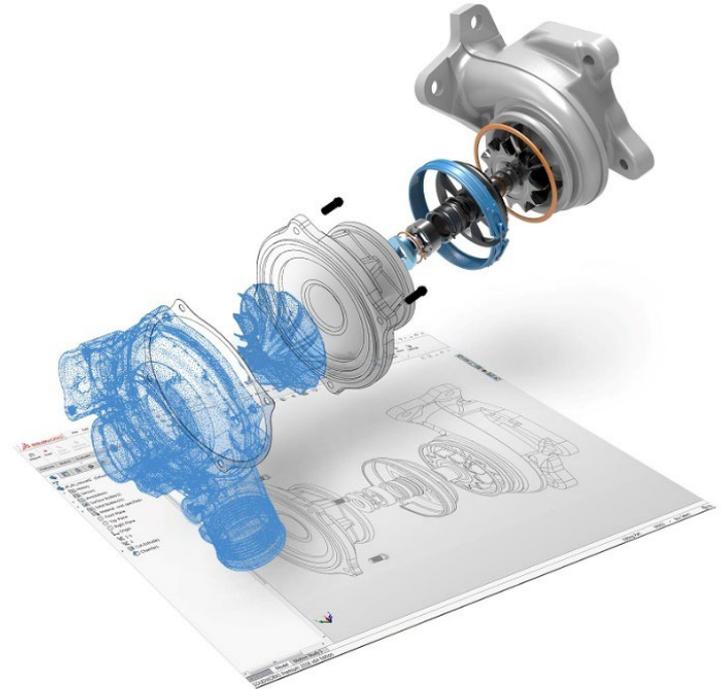
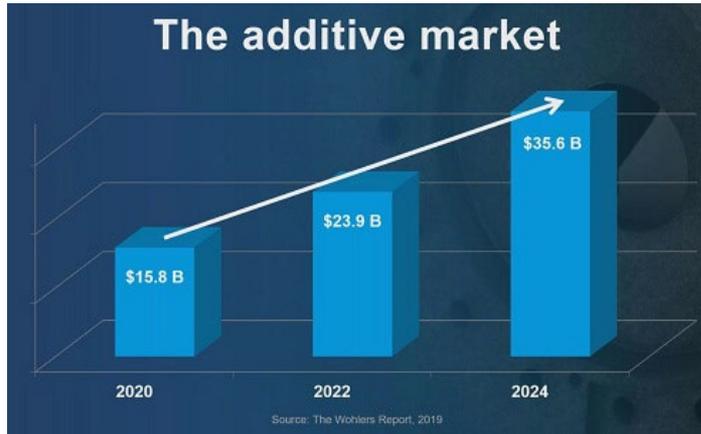
Skills for a future strong workforce



DMT - Skills for the future

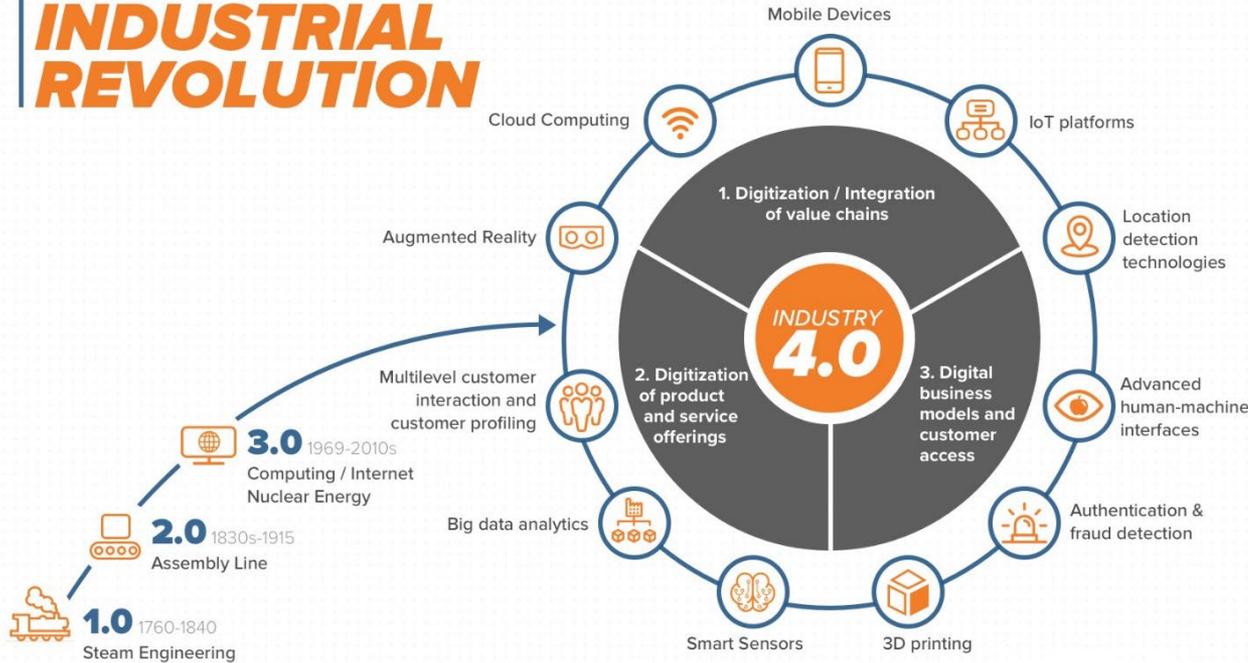
Critical skills for Engineers, Industrial Designers and more

- CAD - Parametric Mechanical Design tools
- 3D Printing / Additive Manufacturing “AM”
- Traditional Manufacturing, CNC & CAM



Charting a pathway to professional success in the 4th Industrial Revolution

THE DAWN OF THE **FOURTH INDUSTRIAL REVOLUTION**



AI-driven Generative Design





DMT Course Summaries

Dual Enrollment Program

DMT 55 *Survey of Design & Manufacturing Processes*

DMT 53 *Intro to Additive Manufacturing*

DMT 54 *Product Development with 3D Printing*

DMT 56 *3D Printing Technician*

DMT 57 *Design for Additive Manufacturing*

*Additive Manufacturing
Technician Certificate*



DMT 55: Survey of Design & Manufacturing Processes

DMT 55

- Survey of Computer Aided Design (CAD), Machining, and 3D Printing
- Build insight into how products are designed and fabricated
- Explore modern manufacturing processes & equipment
- Gain skills in CNC machine setup, blueprint reading, measurement tools, and rapid prototyping
- Work on team-based, real-world projects



DMT 55: Survey of Design & Manufacturing Processes

What you'll learn

Four weeks: Computer Aided Design (CAD)

- 3D modeling in **SolidWorks**, blueprint reading, workflows, and best practices.

Four weeks: CNC Machining & Measurement

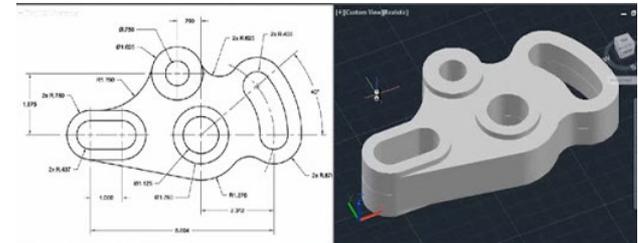
- Mill and lathe machining, CNC, and measurement tools.

4 weeks: 3D Printing

- Two projects using industrial grade 3D printers, slicing software, Design for Additive Manufacturing (DfAM)

project

precision



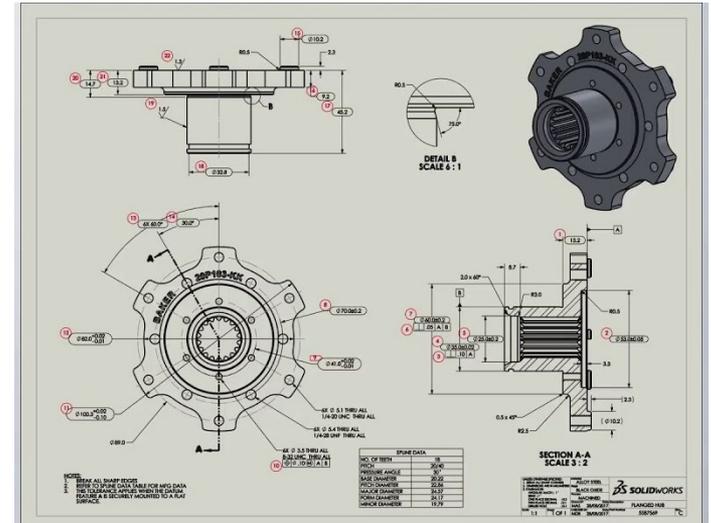
What is CAD?

CAD (Computer Aided Design): Software that designers and engineers use for product development and design.

- Helps **designers, engineers, architects, and others** create **accurate 3D models** and technical drawings.
- **Optimize designs** – prototypes can be printed, tested, and easily modified in CAD.
- **Creativity & invention:** Bring your own ideas to life



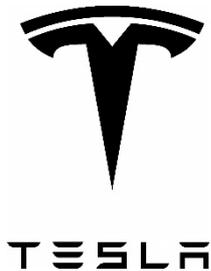
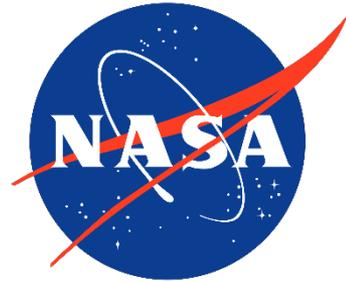
Speaker enclosure printed w/snap-fit joints
The 3D Printing Handbook, pg. 43



Local companies that use CAD to design products

CAD at De Anza College

- Creo Parametric
- Autodesk Inventor
- SolidWorks
- Siemens NX



Types of Manufacturing

Additive

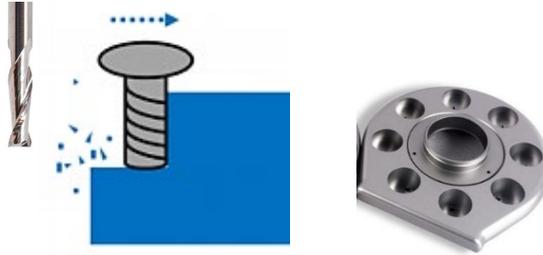
(e.g., 3D Printing)



- ❖ Affordable at low volume (prototyping)
- ❖ “Free Complexity”
- ❖ Limitations in strength & precision
- ❖ Post-processing required

Subtractive

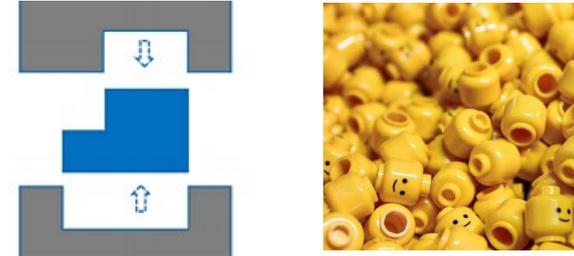
(e.g., CNC Machining)



- ❖ Strong, precise parts
- ❖ Limited complexity
- ❖ High investment for tooling / setup
- ❖ Material waste

Formative

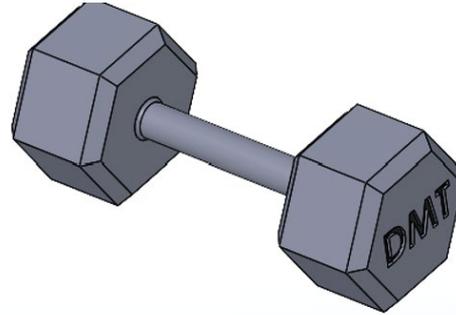
(e.g., Injection Molding)



- ❖ Great for **high volume production**
- ❖ Molding design & fabrication = **Even higher initial investment**

CAD (Computer Aided Design)

- Base-Extrude
- Chamfer1
- Boss-Extrude1
- Mirror All1
- Fillet1
- Cut-Extrude1

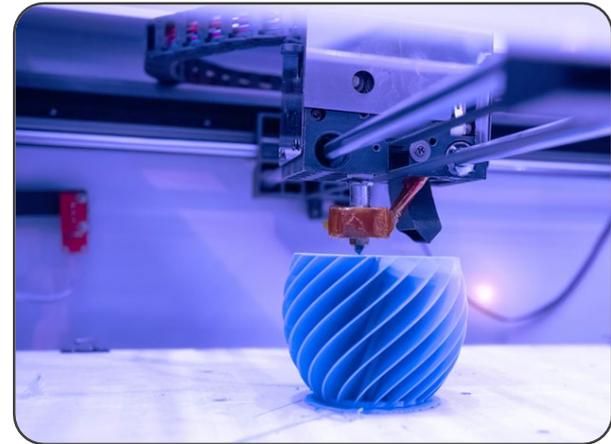


Machining



Subtractive Manufacturing

3D Printing



Additive Manufacturing

Manufacturing Process

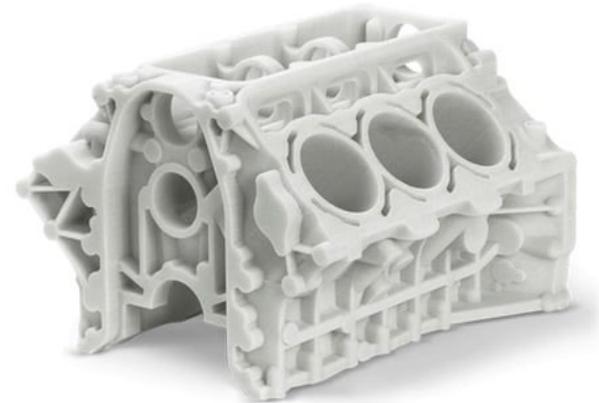
Machining complex parts

Expensive, but strong and precise



3D printing complex parts

Affordable, but reduced strength and precision



Choose the right tool for the job!

DMT 53: Intro to Additive Manufacturing

DMT 53

- Understand how modern industries use 3D printing in engineering, medicine, product design, and manufacturing
- Gain hands-on experience printing with industrial-grade machines
- Setup, design, and assess 3D printed parts across major technologies
- Discover the latest trends and future technologies in additive manufacturing



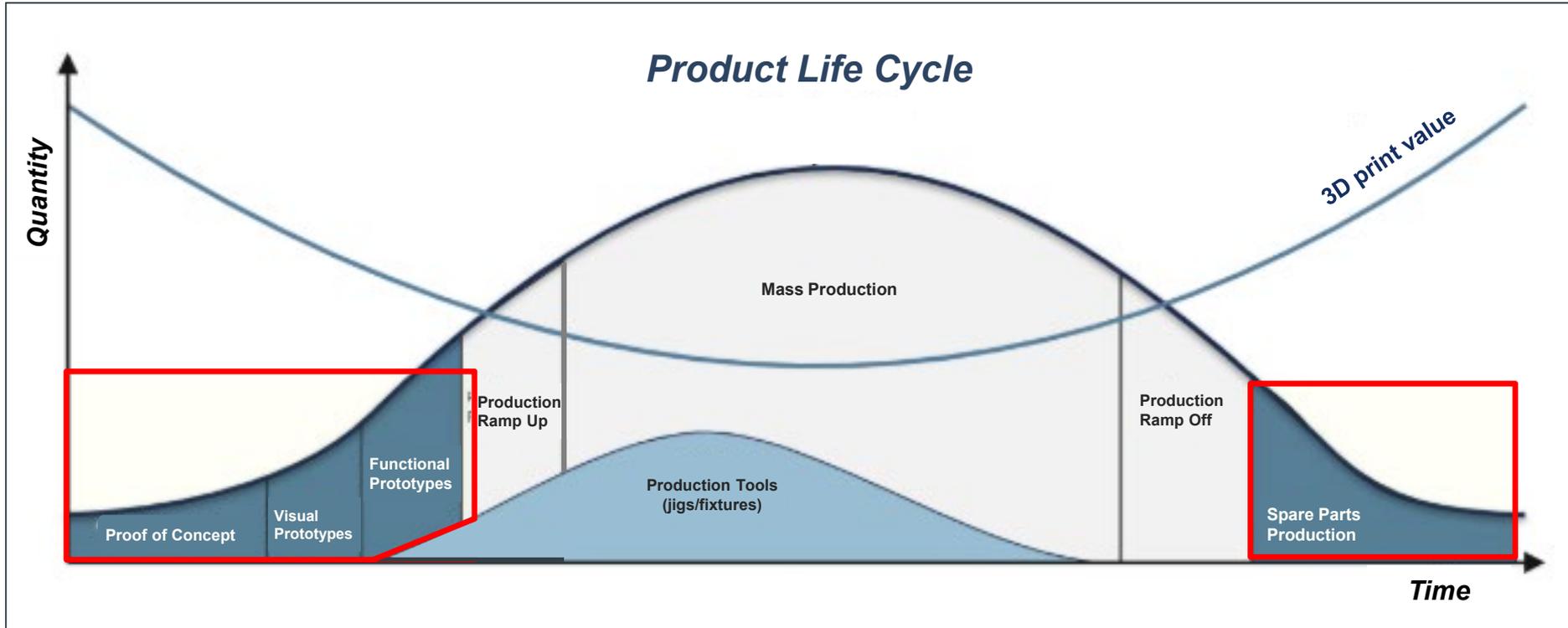
3D Printing (*“Additive Manufacturing”*)

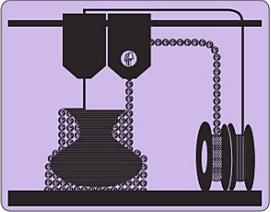
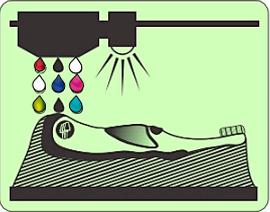
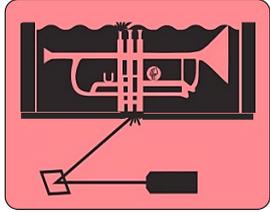
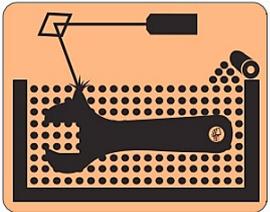
- Additive Manufacturing is rewriting the rules for how we design, build, and create in every major industry.
- From consumer product and industrial design, automotive, medical to Aerospace industries, the landscape is changing fast and we are here to train the future workforce.

www.deanza.edu/dmt/

Product Life Cycle: Where does AM fit?

The most effective use of 3D printing technology is at the first and last stages of a product's life cycle



<p>Process:</p> <p>Abbreviation:</p>	<p>Material Extrusion</p> <p>(MEX)</p> 	<p>Material Jetting</p> <p>(MJT)</p> 	<p>Vat Photo-polymerization</p> <p>(Vat Pho or VPP)</p> 	<p>Powder Bed Fusion</p> <p>(PBF)</p> 	<p>Binder Jetting</p> <p>(BJT)</p> 
<p>Description:</p>	<p>Material (usually melted thermoplastic) is extruded through a nozzle in tracks.</p>	<p>Droplets of photopolymer resin are deposited from nozzles and cured from above with UV light</p>	<p>A vat of photopolymer resin is cured through exposure to UV light.</p>	<p>A bed of powdered material is selectively fused via melting or sintering using a heat source such as a laser.</p>	<p>Liquid binder is applied to a powder bed. Metal BJT is sintered in a furnace after printing.</p>
<p>Typical materials:</p>	<p>Thermoplastic filaments such as PLA, ABS, ASA; metal rods, cement, food, etc.</p>	<p>UV curable photopolymer resins and support material</p>	<p>UV curable photopolymer resins</p>	<p><u>SLS</u>: Thermoplastic powder, e.g. nylon and TPU <u>SLM</u>: Metal powder</p>	<p>Plastic & metal powder, ceramics, glass, sand</p>
<p>Alternate Names:</p>	<p>FFF: Fused Filament Fabrication FDM: Fused Deposition Modeling</p>	<p>Polyjet</p>	<p>SLA: Stereolithography DLP: Digital Light Processing mSLA: (LCD) Masked Stereolithography CLIP: Continuous Light Interface Production</p>	<p>SLS: Selective Laser Sintering SLM: Selective Laser Melting EBM: Electron Beam Melting L-PBF: Laser Powder Bed Fusion</p>	<p>BJT: Binder Jetting MBJ: Metal Binder Jetting MJF: Multi Jet Fusion</p>



FOOTHILL-DE ANZA
Community College District

3D Printing Technologies @ De Anza

“Additive Manufacturing” 3D Printing Lab

Industry Technologies:

- *Fused Deposition Modeling (FDM)*
- *HP Multi-Jet Fusion (MJF)*
- *Selective Laser Sintering (SLS)*
- *Bound Metal Deposition*
- *Stereolithography (SLA)*
- *Polyjet*



3D Printing Technologies @ De Anza

Powder Bed Fusion

~ Strength & design complexity



FDM / MEX:

*Engineering Grade
Thermoplastics*



Photopolymer Resins

*~ Detail & color
~ Medical*



DMT Dept' offers professional engineering pathway skills

- **Dual Enrollment Course HHS**
- Current high school student can enroll for College credits as a 7th period class
- Sign up by contacting your guidance counselor
- Email Derek Chan - derek_chan@fuhsd.org
- Gain experience with college-level studies
- Advance your career and future University prospects at De Anza College
- Opportunity to explore potential majors and career paths
- DMT 55 starts Sept. 22nd at De Anza College
- DMT 53 starts Jan. 5th 2026
- www.deanza.edu/dual/fuhsd/
- Tiffany Rodriguez-Tran rodrigueztrantiffany@fhda.edu



Nearly every industries uses CAD & Many use 3D Printing



The Aerospace industry

All of the major aerospace companies embrace Additive Manufacturing



6 HIGH-VALUE MINOR DEGREES FOR MECHANICAL ENGINEERS

- 1 Additive Manufacturing
- 2 Environmental Eng/Sustainability
- 3 Robotics
- 4 Internet of Things (IoT)
- 5 Smart Cities
- 6 Artificial Intelligence Engineering

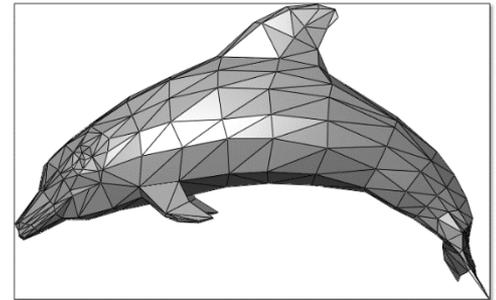
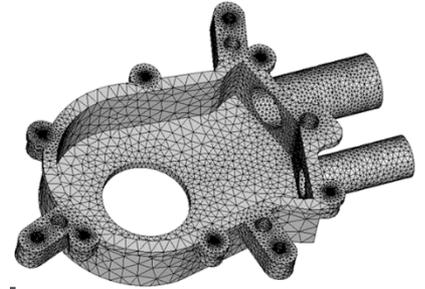


<https://www.youtube.com/watch?v=7le2EoJ8b8Q>
<https://jobs.gecareers.com/global/en/ge-additive-careers>

<https://youtu.be/A2d96-bCpvo>
<https://www8.hp.com/us/en/printers/3d-printers.html>

Universal aspects of all 3D printing

- Parts are built Layer by Layer
 - 3D Geometry is converted to 2D slices, then recompiled during printing
- CAD to Print File
 - Software translates between your CAD geometry & 3D Printing process (slicing software)
 - STL "stereolithography" file

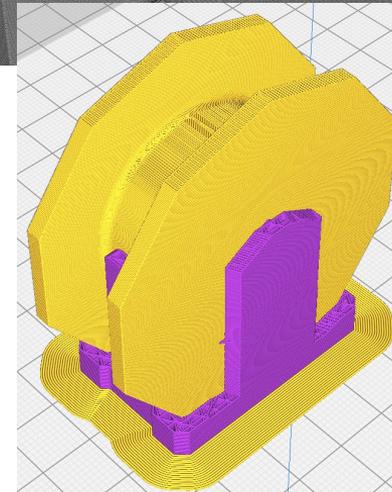
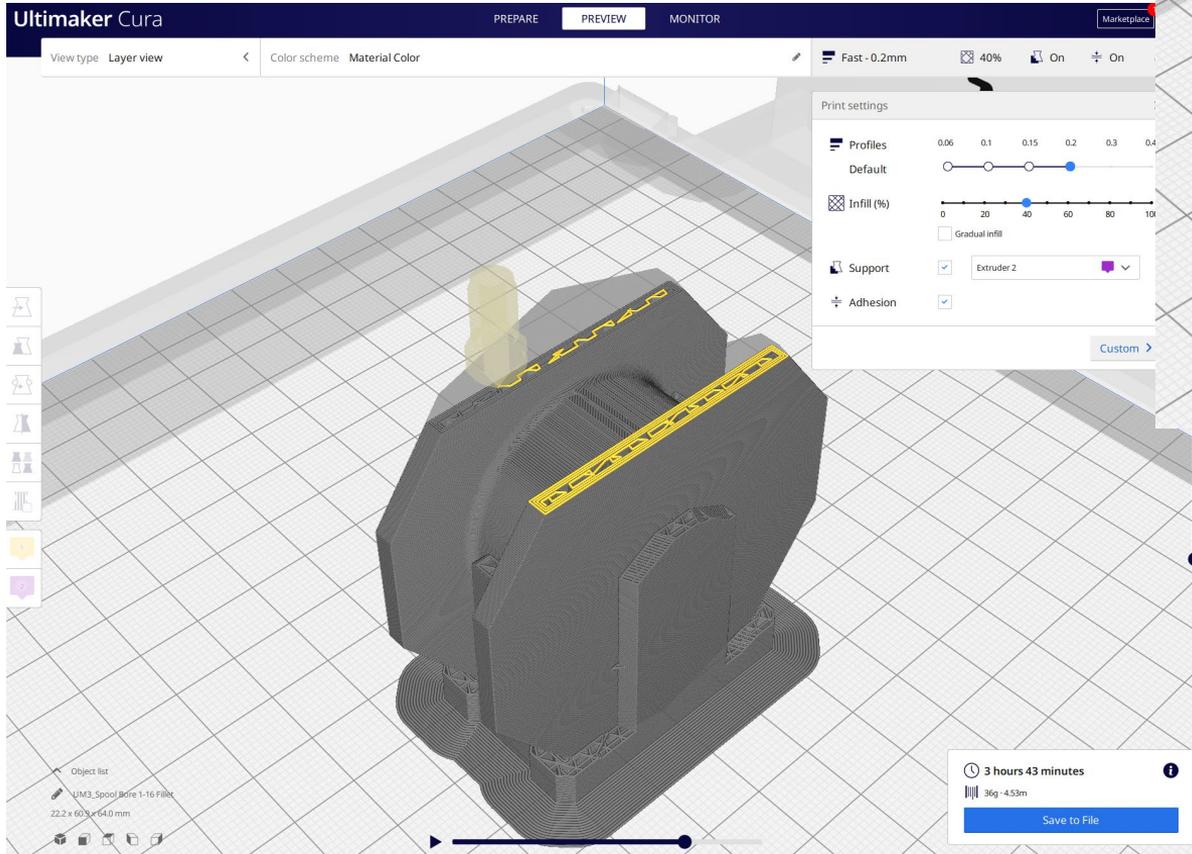


Basics of 3D Printing Technology

- CAD to Print File, Typically STL or 3MF
- Printing Process Mechanism (Pros & Cons)
 - FDM/FFF
 - SLS, MJF & DLMS
 - SLA & DLP
 - MJP - Material Jetting
- Post Processing
- Maintenance and Scalability



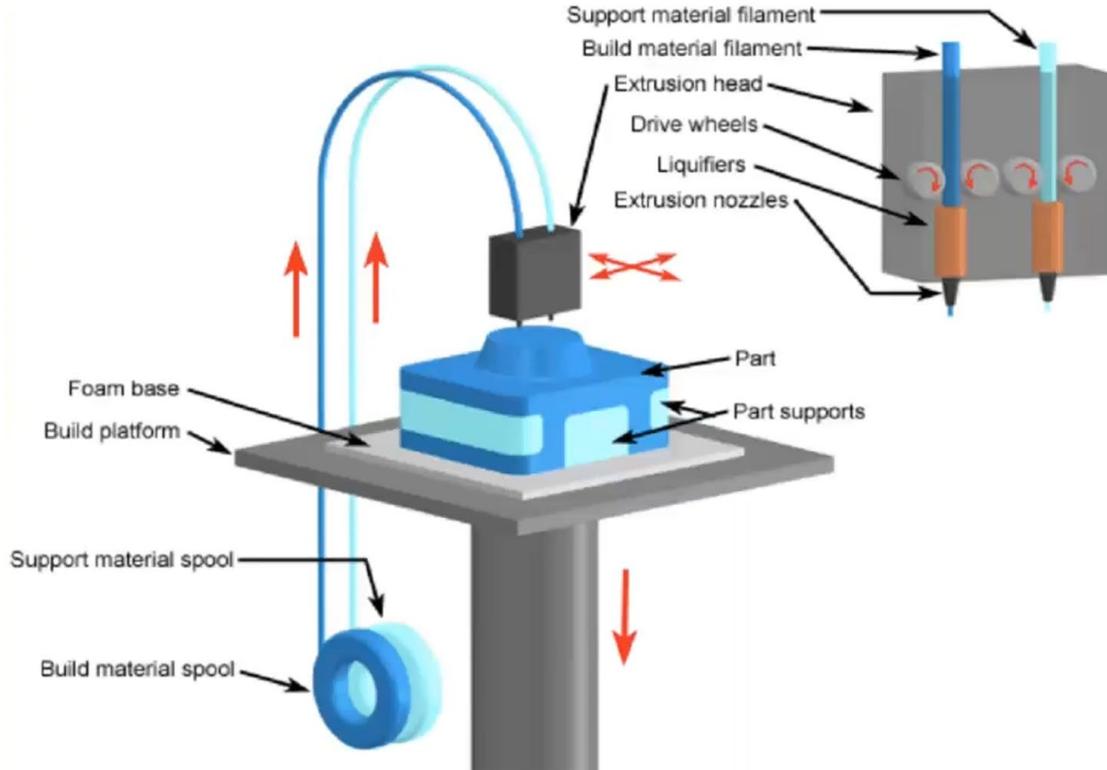
FDM slicing with support structure



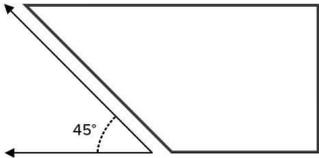
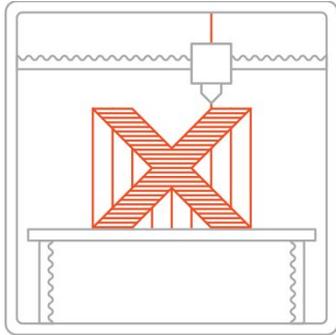
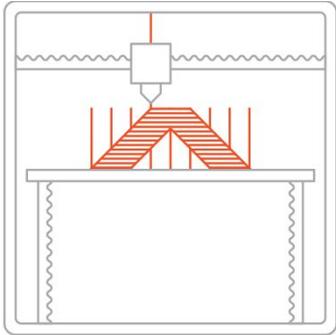
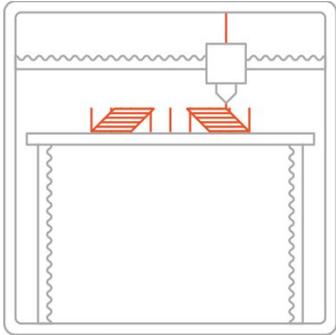
Considerations when picking print technology

- **Print Process Mechanism**
 - How it Works
 - Advantages
 - Design considerations
- **FDM / FFF**
 - Fused Deposition Modeling / Fused Filament Fabrication

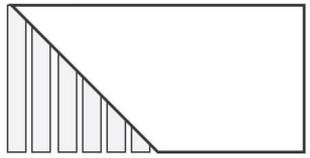
Fused Deposition Modeling / Fused Filament Fabrication



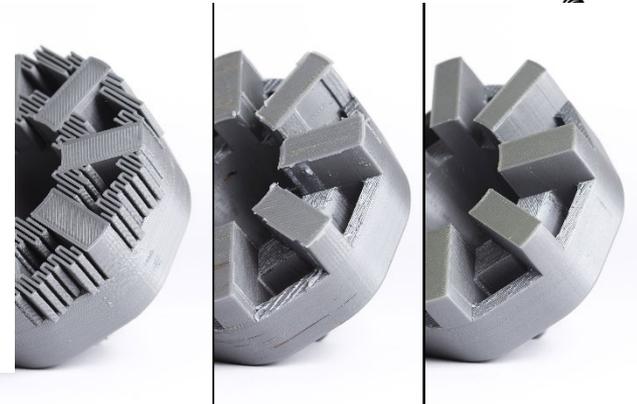
FDM Print Often Requires Support Structures



Overhang of less than 45 degrees
No support is needed



Overhang of more than 45 degrees
Support is needed



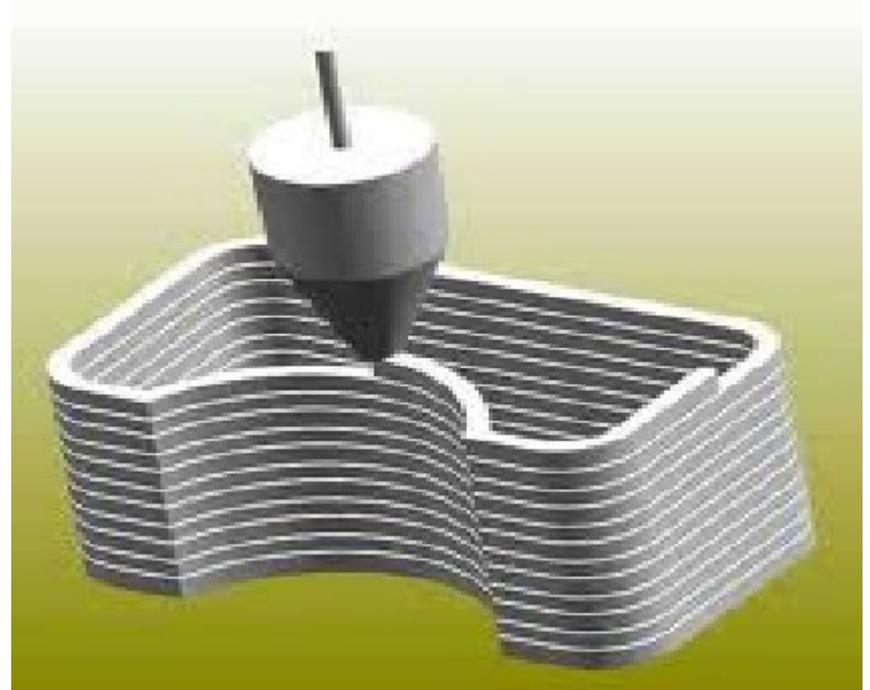
FDM is not solid like other processes

“Infill & Shell Thickness”



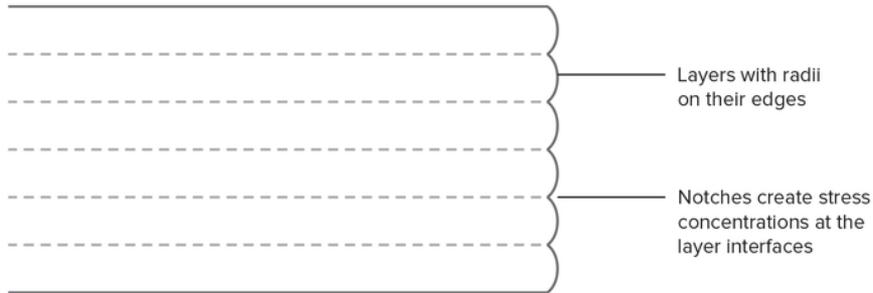
FDM parts are usually not printed solid to reduce the print time and save material. Instead, the outer perimeter is traced using several passes, called the shell, and the interior is filled with an internal, low-density structure, called the infill.

Design considerations for FDM: More significant layer lines compared to SLS, SLA, DLP



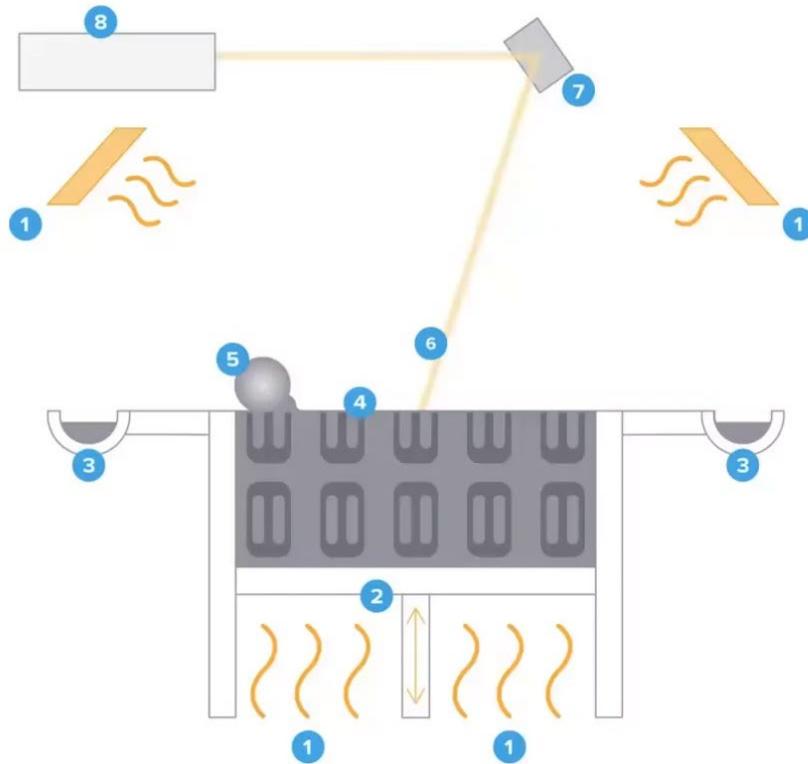
It may be difficult to produce parts with fine features, textures or very thin walls

FDM Parts are generally not watertight or airtight



This issue can be mitigated with post processing but will add time and labor to part

SLS: Selective Laser Sintering

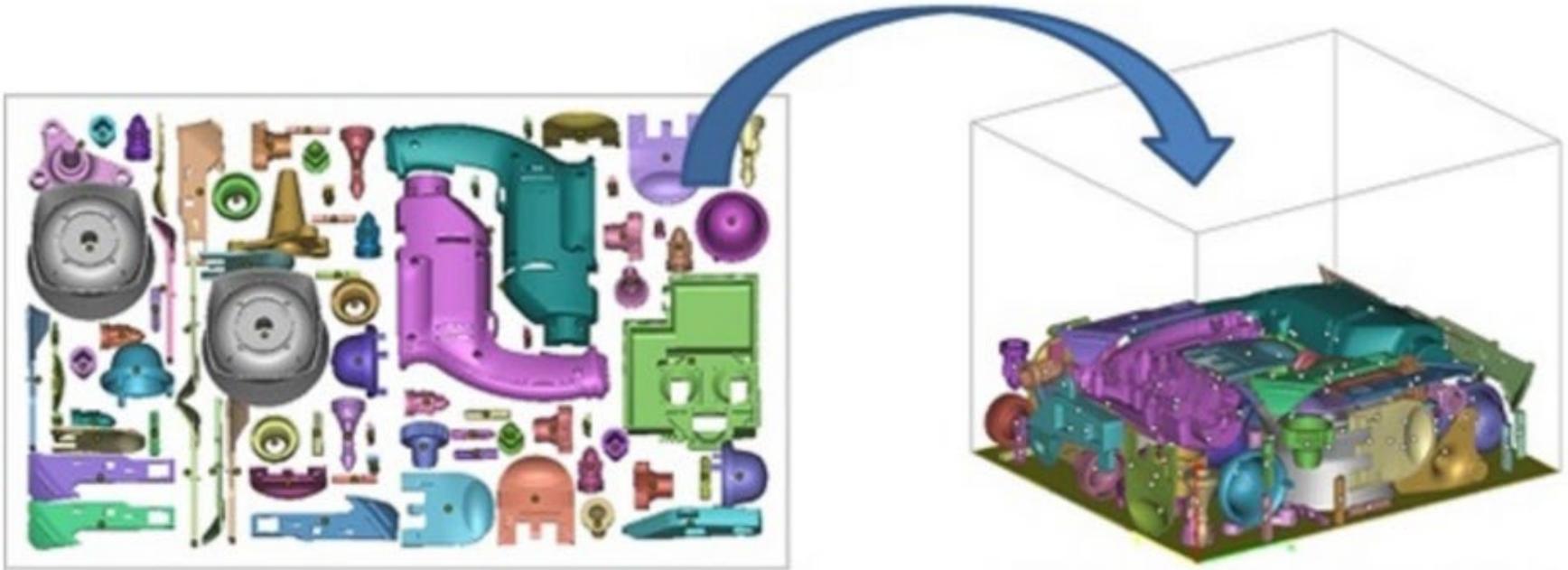


Selective Laser Sintering

- 1 Heaters
- 2 Build Chamber
- 3 Powder Delivery System
- 4 Printed part
- 5 Recoater
- 6 Laser Beam
- 7 X-Y Scanning Mirror
- 8 Laser

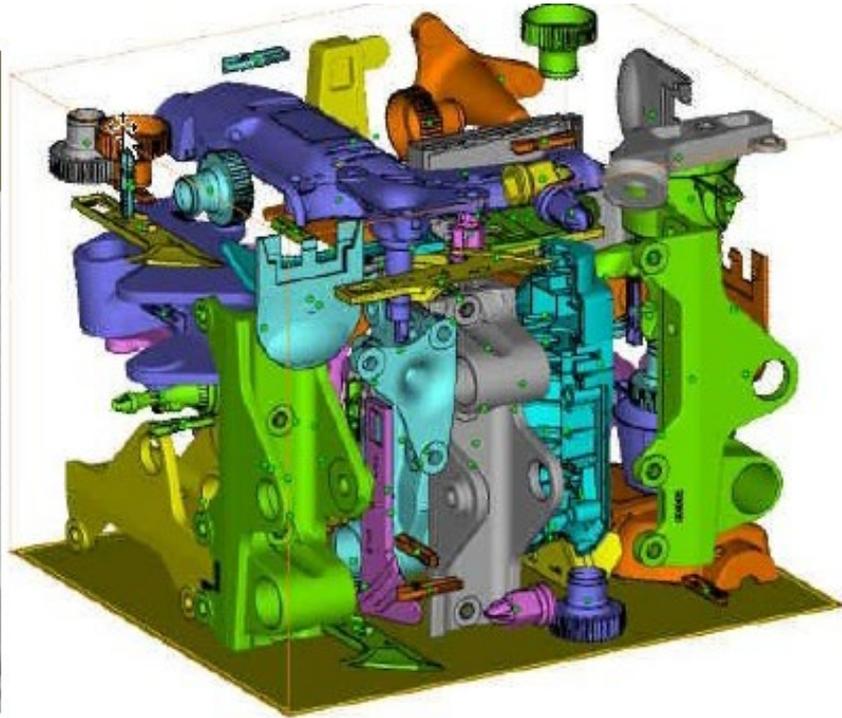
SLS has becoming more popular and does not require support structures

SLS: All part geometry's are functionally self-supporting



Unfused powder supports parts during printing. Parts can also be nested on top of each other

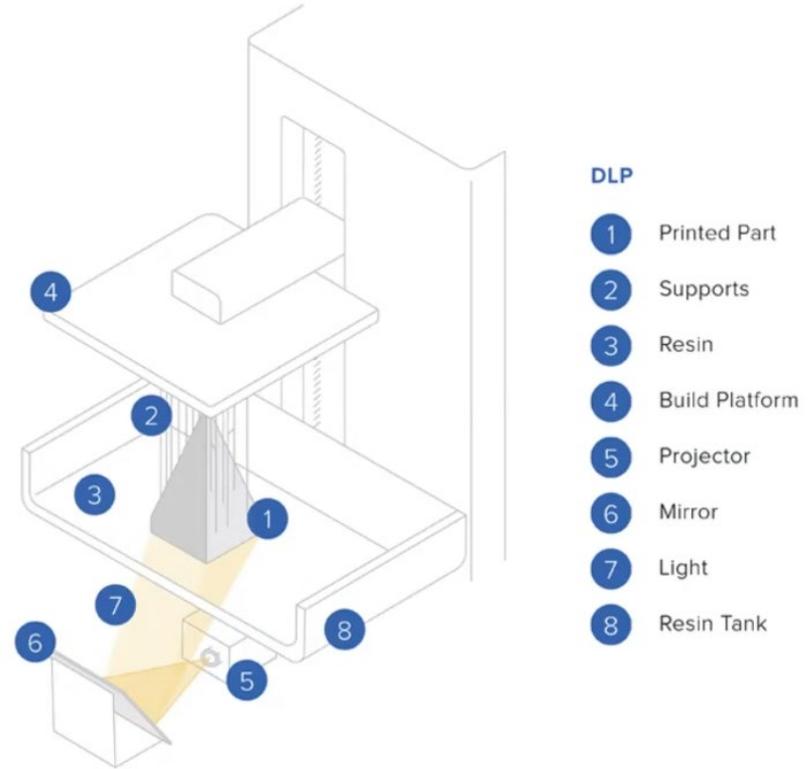
3D Nesting in SLS powder bed fusion “cake”



The unused Nylon powder can be recycled for future prints

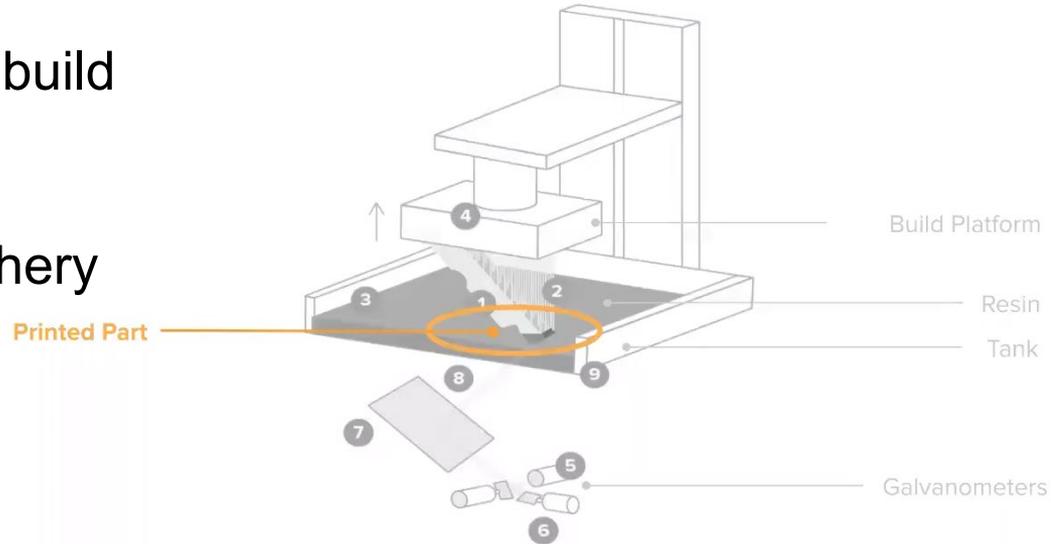
SLA & DLP

- Photopolymers
- DLP is much faster, uses LED projection
- SLA finer resolution uses laser
- Watertight
- Post cure time



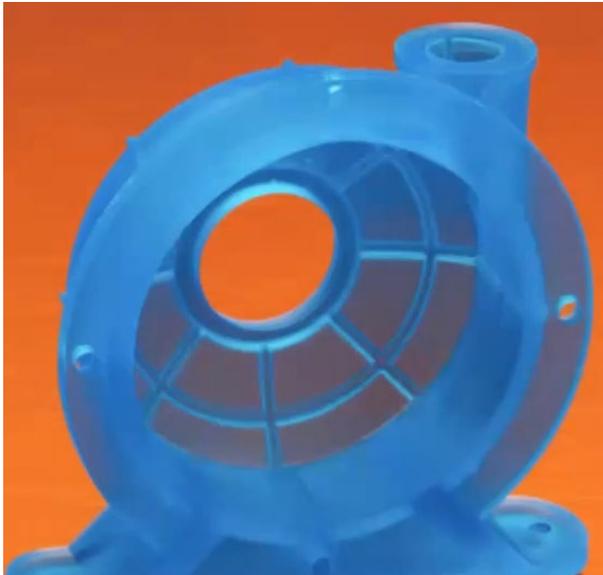
- Very fine resolution 25 micron layers
- Liquid Thermoset polymers
- watertight parts
- Supports are needed to keep build on plate
- All layers must have some connections, no island or feathery features without support

STEREOLITHOGRAPHY PROCESS

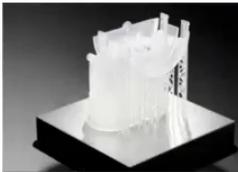
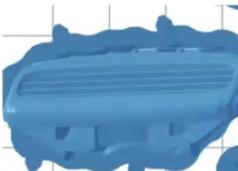


SLA – super fine resolution

- Can produce highly detailed & translucent parts

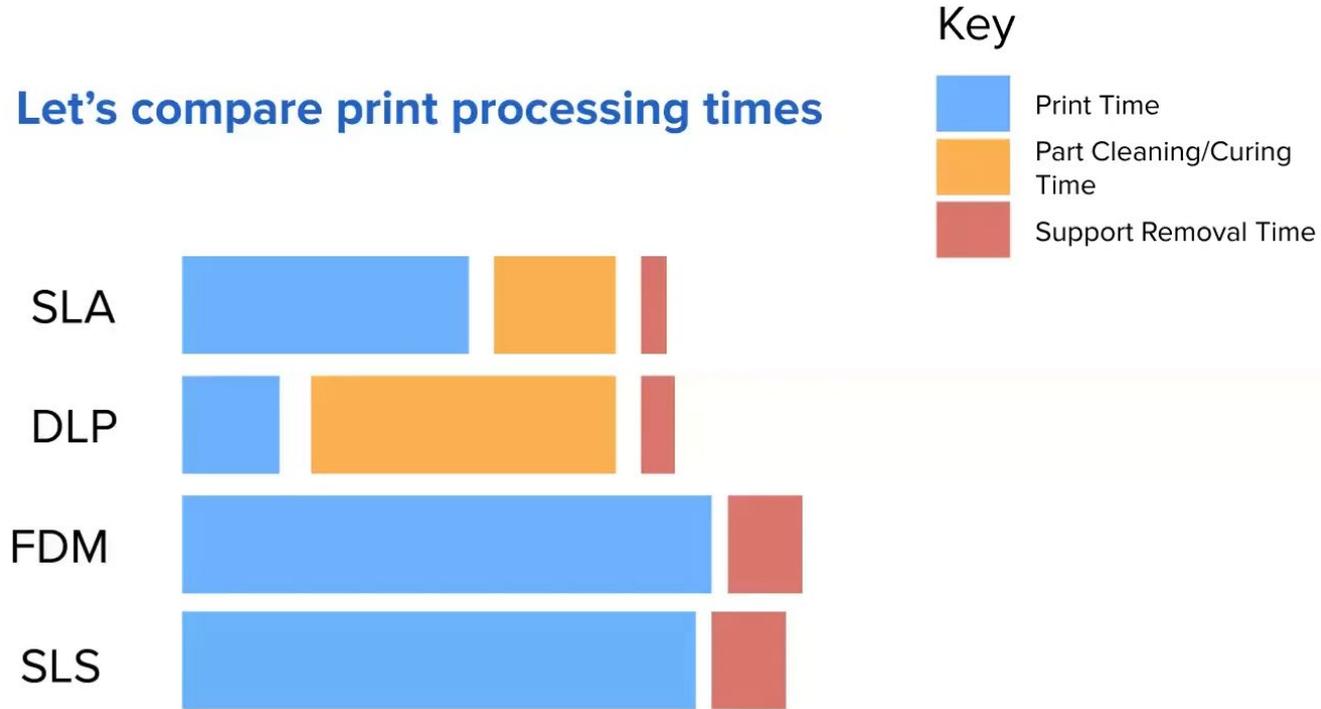


Print Speed comparison

	FDM	SLA	SLS
	150 - 340 minutes	75 - 350 minutes	120-200 minutes
	420 - 1275 minutes	150 - 660 minutes	660 minutes
	21 parts 690 - 1710 minutes 33 - 81 minutes per part	12 parts 90-420 minutes 7,5-35 minute per part	300 parts 2400 minutes (40 hours) 8 minutes per part

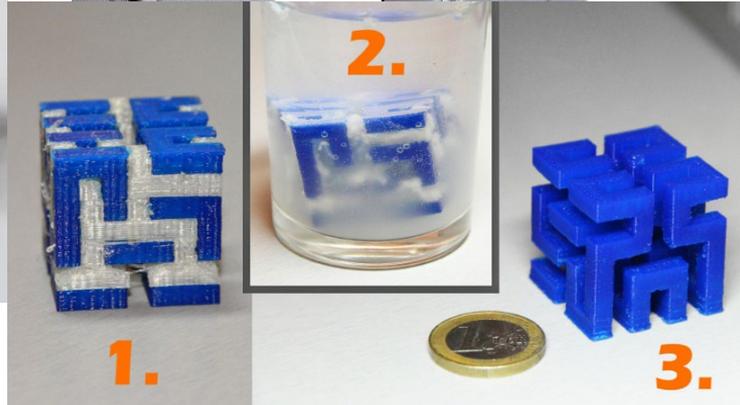
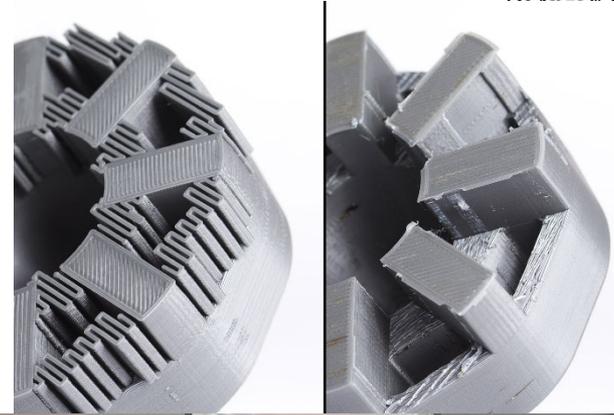
Post Processing considerations

Let's compare print processing times



Support removal – FDM – dissolvable or break away

Support Removal (FDM)



Support removal – SLA – break away



Support
removal
(LFS)



Support removal – SLS powder



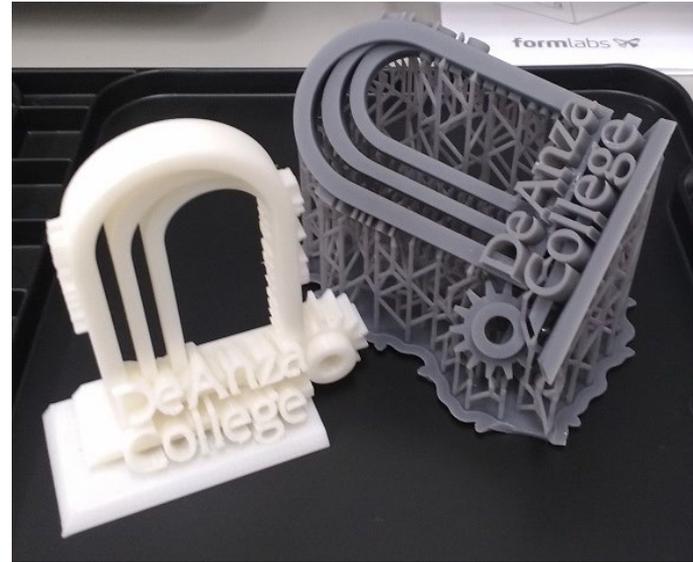
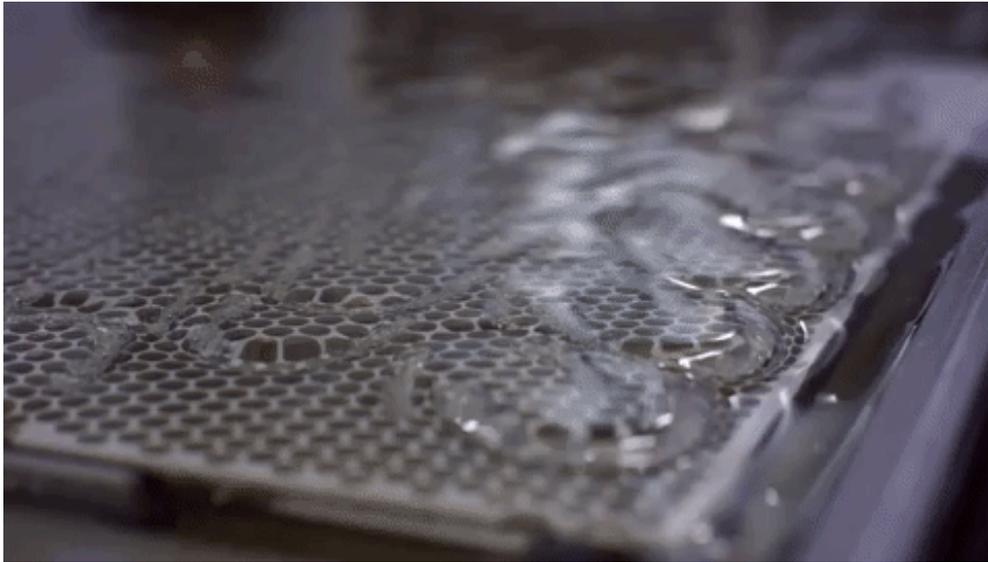
Great skills and technical training for a strong future!



3D Printing; Mass is expensive and complexity is free

This and more at De Anza College in the DMT Dep't

www.DeAnza.edu/DMT



Build your skills and career opportunities with us now and for the future



De Anza College

www.deanza.edu/dmt/