DMT

DESIGN & MANUFACTURING

TECHNOLOGIES

De Anza College

www.deanza.edu

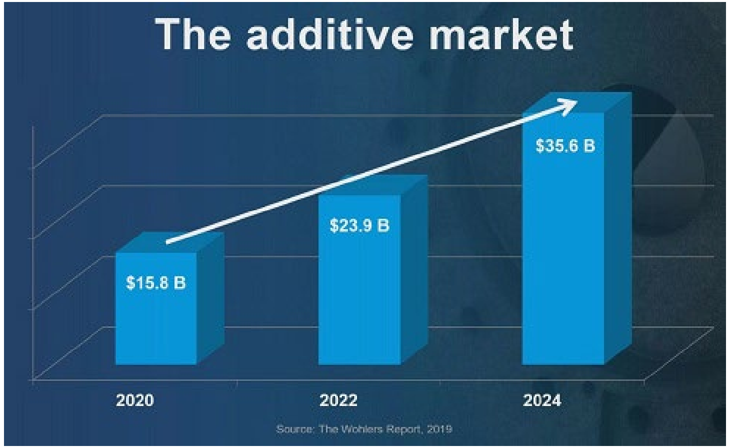
Skills for a future strong workforce & Dual Enrollment

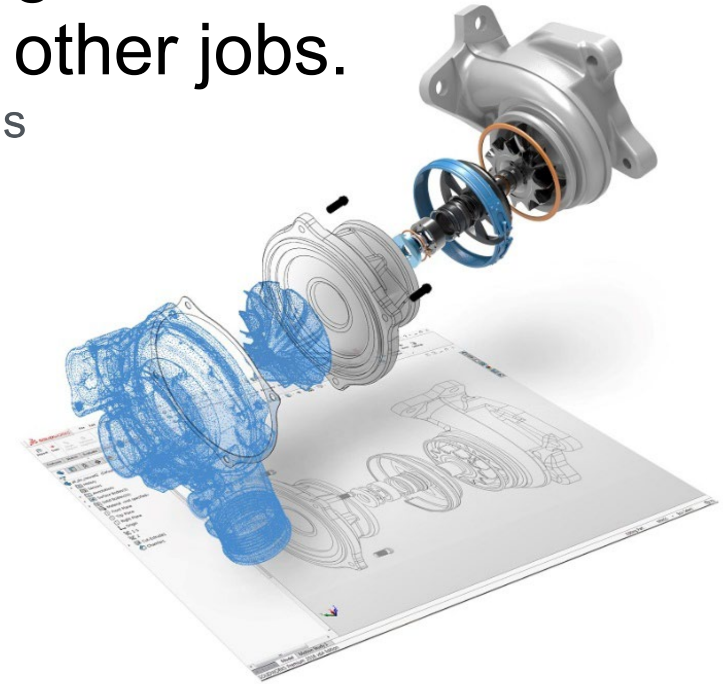




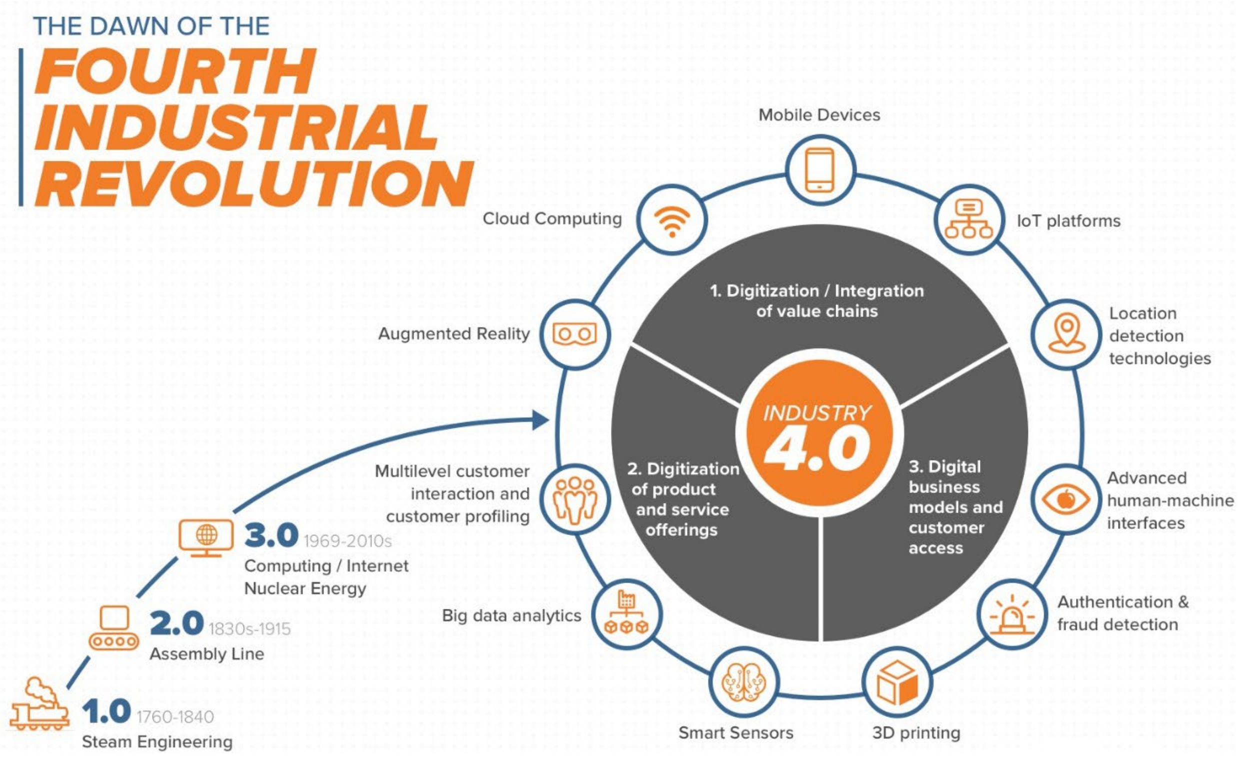

DMT - Skills for the future

- Critical skills for Mechanical Engineers and Industrial Designers and many other jobs.
  - CAD - Parametric Mechanical Design tools
  - 3D Printing / Additive Manufacturing “AM”
  - Traditional Manufacturing, CNC & CAM





Charting your own pathway to professional success in the 4th Industrial Revolution



Engineering pathways in the Design & Manufacturing Technologies Department at De Anza College

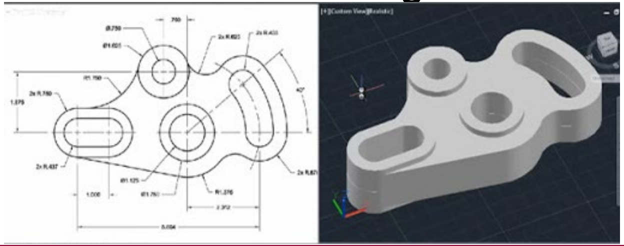
- DMT 55

Course Description – Fall 2025

This survey course is designed to introduce students to both design, manufacturing and modern fabrication, by means of demonstrations, with the following areas of emphasis: 3D Engineering CAD systems, (3D Printing), manufacturing processes, equipment and systems, design for manufacturing, measurement tools, blueprint reading, rapid prototyping CNC machine set-up, CNC machine programming (lathe and mill) and CAM. This hands on, team based course is designed to provide students with instruction & skills through applied real world experience to enable insight as to how products are designed and fabricated.

Engineering pathways in the Design & Manufacturing Technologies Department at De Anza College

- DMT 55
  - 4 weeks of rudimentary parametric solid modeling "CAD", projects and best practices of engineering software.
  - 4 weeks of hands on Mill, Lathe, how to read a drawing and basic measurement tools usage
  - 4 weeks of 3D Printing, current industry technology, fixing & editing STL files, slicing software and basic Design for Additive Manufacturing "DfAM"



DESIGN & MANUFACTURING TECHNOLOGIES
De Anza College

Engineering pathways in the Design & Manufacturing Technologies Department at De Anza College

- DMT 53

Course Description – Winter 2026

The objective of this course is to present a comprehensive overview of 3D Printing, spanning from fundamentals to applications and technology trends. Participants will learn the fundamentals of (AM) Additive Manufacturing/3D Printing of polymers, metals, composites, and biomaterials, and will realize how process capabilities (rate, cost, quality) are determined by the material characteristics, process parameters, and machine designs.

- High School Dual Enrolment class

DMT DESIGN & MANUFACTURING TECHNOLOGIES DeAnza College

- DMT 53

Course Review – Winter 2026

- Recent high school student comment

"I also just wanted to thank you for being a great professor during the quarter. You and Max both did a wonderful job at instructing a fun *and* efficient course to get people familiar with additive manufacturing and I am very grateful to have been a part of it. I have learned a lot through DMT 53 (and also DMT 55), and will definitely retain this knowledge not only through the parts we've printed and created but also through the entire industry to which I have been newly exposed to.

Thank you for being you, it was an awesome quarter."

DMT Dept' offers professional Engineering pathway skills

- CAD

CAD designers use specialized computer software to generate drawings, blueprints, plans, and other design documents for use across a wide variety of fields (mechanical design, architecture, construction, engineering, etc.

Design Your Future in CAD

www.deanza.edu/dmt/

- 3D Printing "AM"

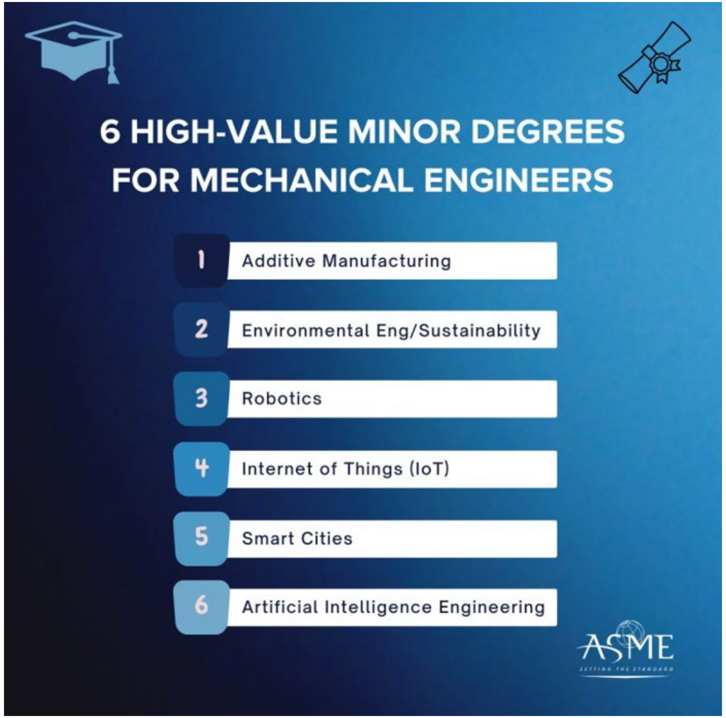
Additive Manufacturing is rewriting the rules for how we design, build, and create in every major industry. From consumer product and industrial design, automotive, medical to Aerospace industries, the landscape is changing fast and we are here to train the future workforce.

Local companies that use CAD to design products

CAD at De Anza College

- Creo Parametric
- Autodesk Inventor
- SolidWorks
- Siemens NX

Nearly every industries uses CAD & Many use 3D Printing



The Aerospace industry

All of the major aerospace companies embrace Additive Manufacturing

GKN AEROSPACE

AIRBUS

CAD TO METAL Arcam AB

Honeywell

Avio Aero A GE Aviation Business

Rolls-Royce

SAFRAN AEROSPACE · DEFENCE · SECURITY

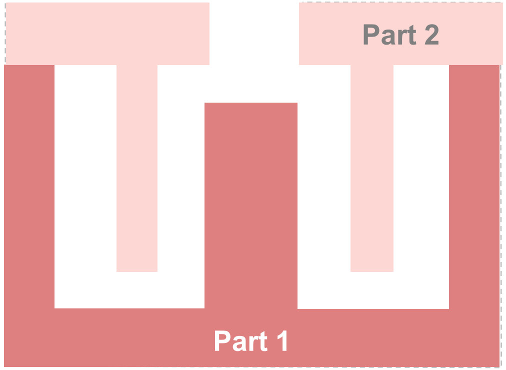
Pratt & Whitney A United Technologies Company

https://youtu.be/7Ie2EoJ8b8Q
https://jobs.gecareers.com/global/en/ge-additive-careers

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

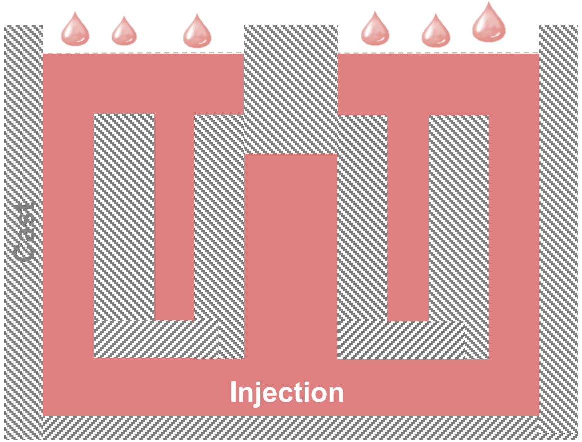
Why and When to use AM: *Where does it fit in?*

Subtractive
(e.g. Machining)



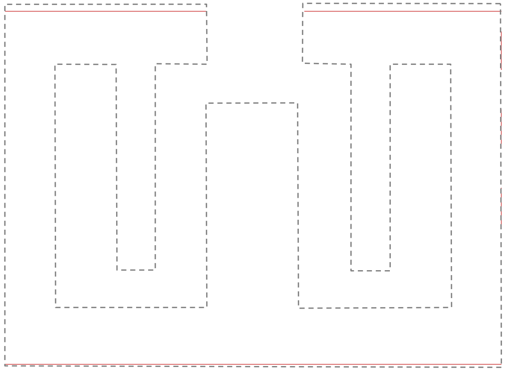
- *Complexity limited by tooling and assembly steps*
- *High initial investment for tooling*
- *Material waste*
- *Strong, precise parts*

Formative
(e.g. Injection Molding)



- *Molding design & fabrication required = Even higher initial investment*
- *Cast removal (post-processing)*
- *Injection uniformity concerns*
- *Near shape parts*

Additive
(e.g. 3D Printing)



- *Quasi-single step process*
- *Minimum material waste*
- *Near to final shape parts*
- *Post-processing*

Additive Manufacturing alone is NOT the solution. The key is to find how to use its strength, combined with other manufacturing techniques to get best/better parts

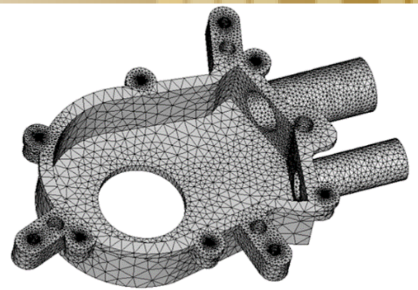
De Anza College training technology for your success

Equipment Investment

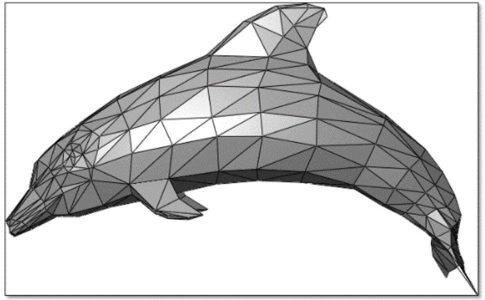
- HP Multi Jet Fusion 3D Printer
- Stratasys F370 & Fortus 250
- Creaform 3D Laser Scanner
- 3D Systems Figure 4 - DLP
- Stratasys Objet30 Pro - PolyJet
- Markforged Carbon fiber 3D Printer

You can make almost any form with 3D Printing
- Volume or mass is expensive but complexity is free

Universal aspects of all 3D printing

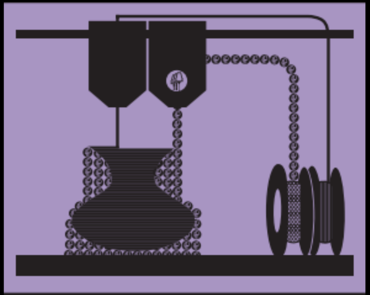


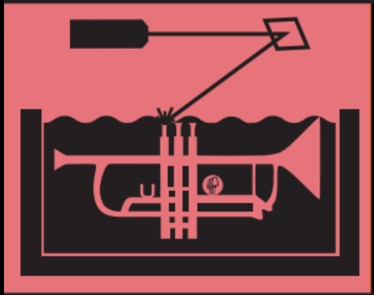
- Prats are built Layer by Layer
  - 3D Geometry is converted to 2D slices, then recompiled during printing
- CAD to Print File
  - Software translates between your CAD geometry & 3D Printing process (slicing software)
  - STL "stereolithography“ file

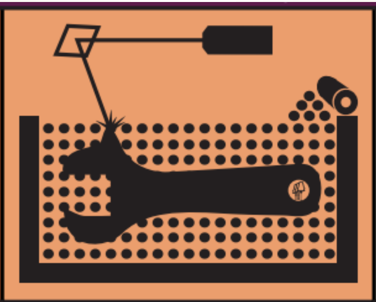


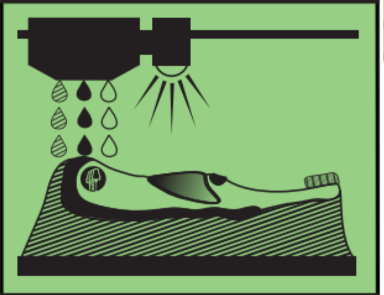
Basics of 3D Printing Technology

- 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



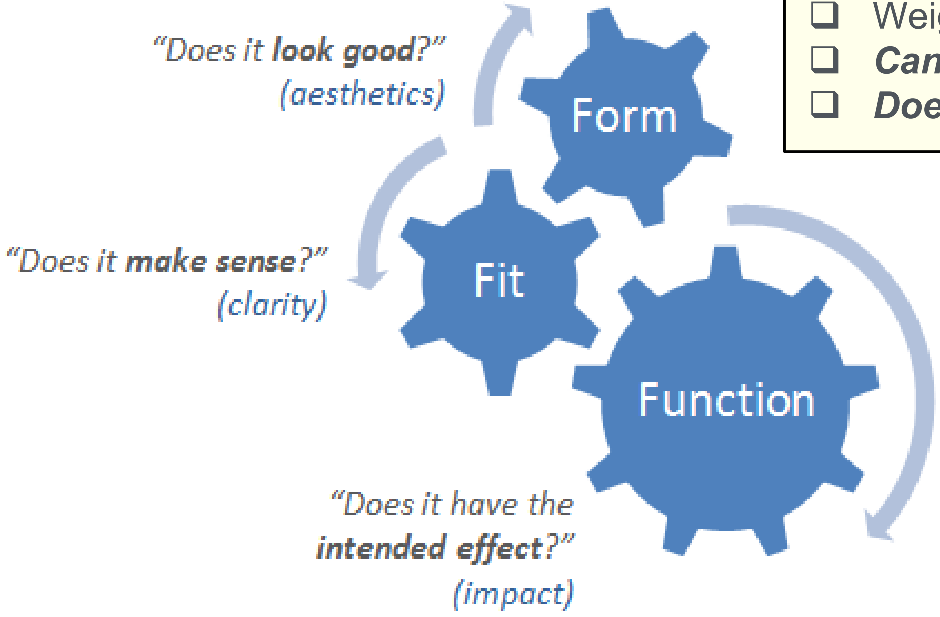






Material Extrusion	VAT Photopolymerization	Powder Bed Fusion (PBF)	Binder Jetting	Material Jetting
Alternative Names: FFF - Fused Filament Fabrication FDM™ - Fused Deposition Modeling	**Alternative Names:** SLA™ - Stereolithography Apparatus DLP™ - Digital Light Processing 3SP™ - Scan, Spin, and Selectively Photocure CLIP™ – Continuous Liquid Interface Production	**Alternative Names:** SLS™ - Selective Laser Sintering; DMLS™ - Direct Metal Laser Sintering; SLM™ - Selective Laser Melting: EBM™ - Electron Beam Melting; SHS™ - Selective Heat Sintering; MJF™ - Multi-Jet Fusion	**Alternative Names:** 3DP™ - 3D Printing ExOne Voxeljet	**Alternative Names:** Polyjet™ SCP™ - Smooth Curvatures Printing MJM - Multi-Jet Modeling Projet™
Description: Material is extruded through a nozzle or orifice in tracks or beads, which are then combined into multi-layer models. Common varieties include heated thermoplastic extrusion (similar to a hot glue gun) and syringe dispensing.	**Description:** A vat of liquid photopolymer resin is cured through selective exposure to light (via a laser or projector) which then initiates polymerization and converts the exposed areas to a solid part.	**Description:** Powdered materials is selectively consolidated by melting it together using a heat source such as a laser or electron beam. The powder surrounding the consolidated part acts assupport material for overhanging features.	**Description:** Liquid bonding agents are selectively applied onto thin layers of powdered material to build up parts layer by layer. The binders include organic and inorganic materials. Metal or ceramic powdered parts are typically fired in a furnace after they are printed.	**Description:** Droplets of material are deposited layer by layer to make parts. Common varieties include jetting a photocurable resin and curing it with UV light, as well as jetting thermally molten materials that then solidify in ambient temperatures.
Strengths: • Inexpensive and economical • Allows for multiple colors • Can be used in an office environment • Parts have good structural properties	**Strengths:** • High level of accuracy and complexity • Smooth surface finish • Accommodates large build areas	**Strengths:** • High level of complexity • Powder acts as support material • Wide range of materials	**Strengths:** • Allows for full color printing • High productivity • Uses a wide range of materials	**Strengths:** • High level of accuracy • Allows for full color parts • Enables multiple materials in a single part
Typical Materials Thermoplastic Filaments and Pellets (FFF); Liquids, and Slurries (Syringe Types)	**Typical Materials** UV-Curable Photopolymer Resins	**Typical Materials** Plastics, Metal and Ceramic Powders, and Sand	**Typical Materials** Powdered Plastic, Metal, Ceramics, Glass, and Sand.	**Typical Materials** Photopolymers, Polymers, Waxes

AM Technology Selection



FORM

- ❑ Weight, size, visual appearance / aesthetic choices
- ❑ ***Can printing technology reach required resolution?***
- ❑ ***Does the printing technology offer color?***

FIT

- ❑ **Does the part** connect, join, or fit?
- ❑ ***Can the printing technology meet tolerances?***
- ❑ ***Can part fit into the available printer(s)?***

FUNCTION

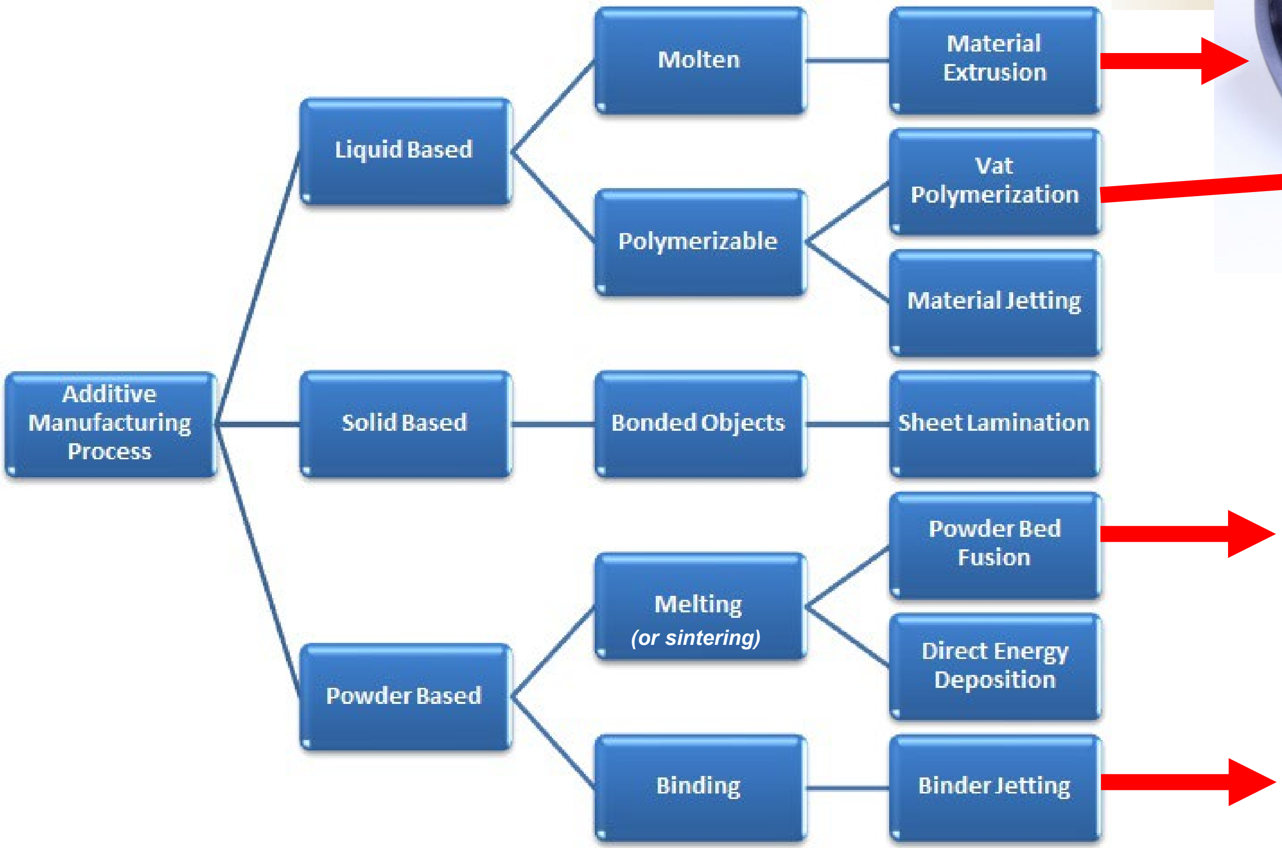
- ❑ **Does the** part perform its stated purpose effectively and reliably?
- ❑ ***Can printed material support the function (strength, weight, texture, etc.)?***

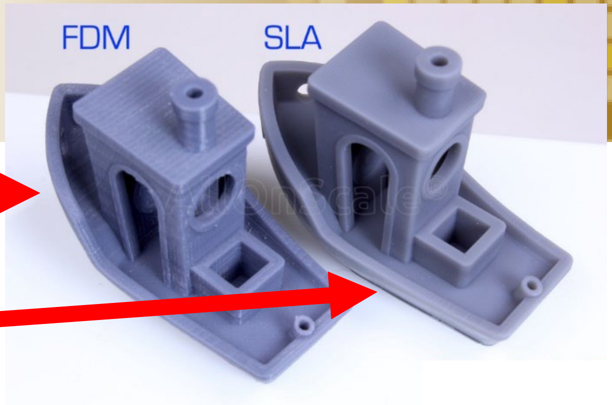
3D PRINTING = MASS IS EXPENSIVE BUT… COMPLEXITY IS ~FREE

Overview of 3D Printing/Additive Manufacturing processes

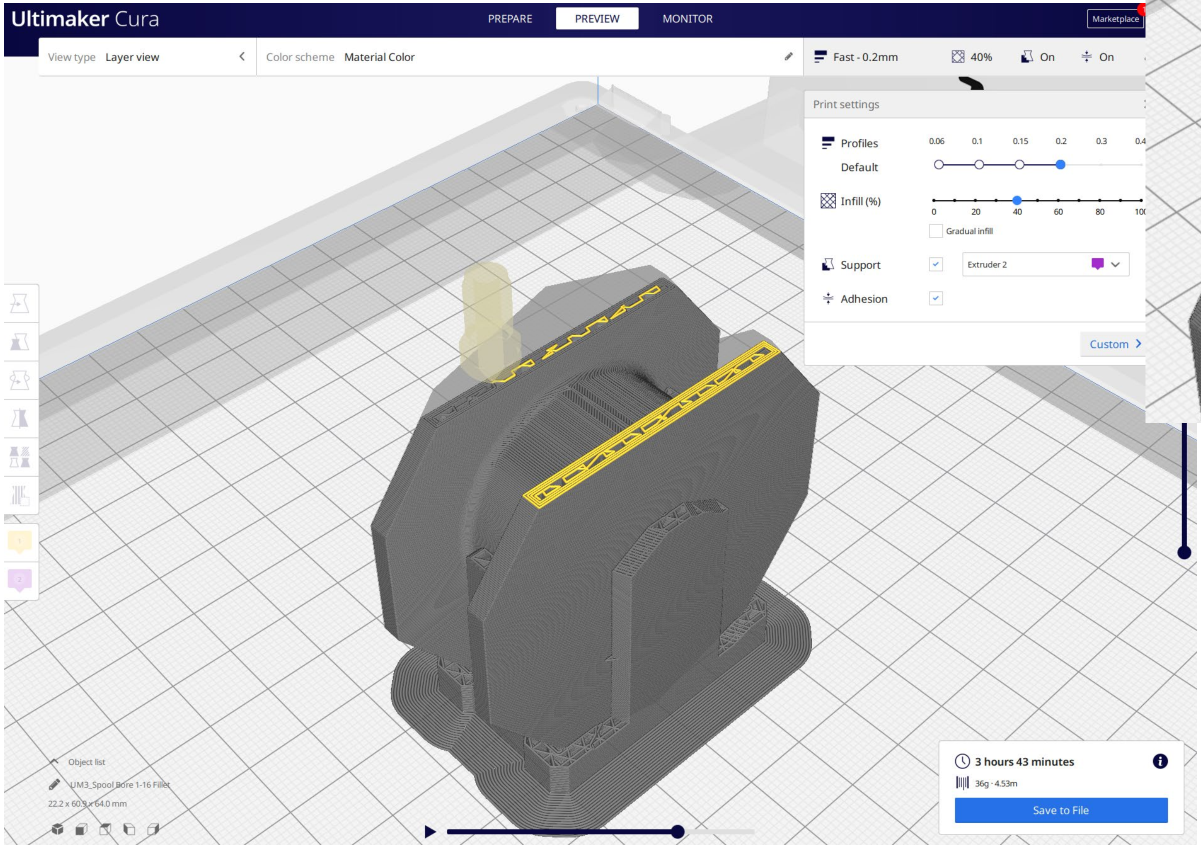
ASTM Category	VAT Photopoly-merization	Material Extrusion	Powder Bed Fusion	Binder Jetting	Material Jetting	Sheet Lamination	Directed Energy Deposition
PROCESS	3D object grown layer by layer from a VAT of liquid UV curable resins	3D object grown line by line, layer by layer from molten filaments	3D object grown from layers of selectively molten powder using energy beam	3D object grown from layers of bonded powder using selective adhesive jetting	3D object grown layer by layer by selectively jetting UV curable resins	3D object grown by bonding selectively cut laminate sheets	3D object grown by melting material as it is being deposited
MATERIALS	• Photopolymers • UV curable • Metal/Ceramic + polymers paste	• ABS/PLA/PA12/PC • Fiber-infused, Metal-infused filaments	POWDERS • Nylons, PEEK, TPU • Metals	POWDERS • Sand • Metal • Ceramics • Plaster/Plastics	• UV cured resins (rubber-like, rigid, biocompatible, high temp)	• Paper + adhesive • Metal + adhesive	POWDER & WIRE • Metals
TERMS & BRANDED PROCESS	SLA DLP CLIP	FDM/ FFF	MJF SLS DMLS/ SLM EBM	CJP BJT SPJ	MJP PJT NPJ	LOM UAM SDL	LMD/ DMD LENS EBAM LDT

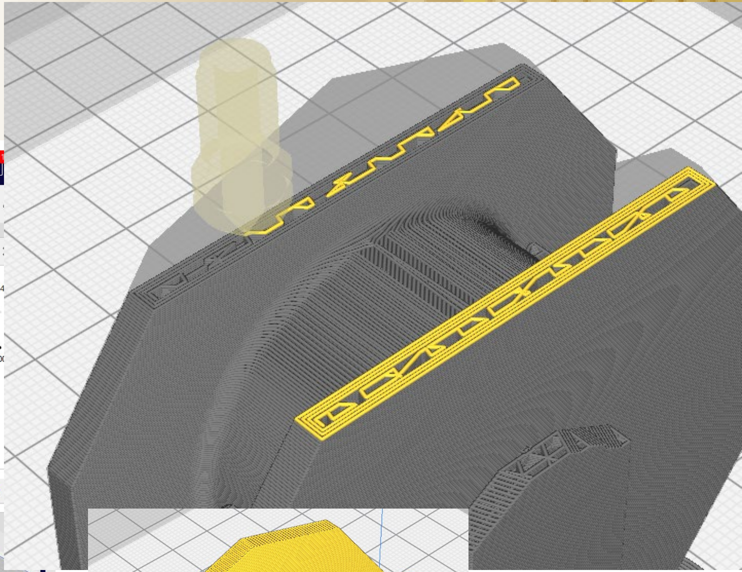
AM Technologies

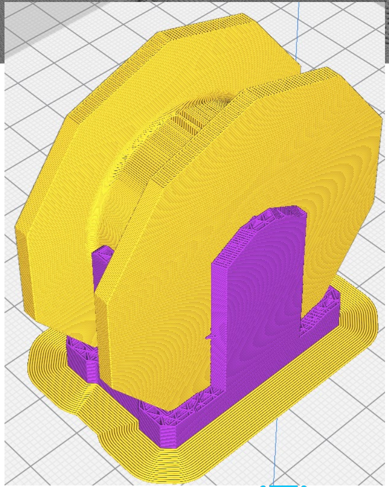




FDM slicing with support structure



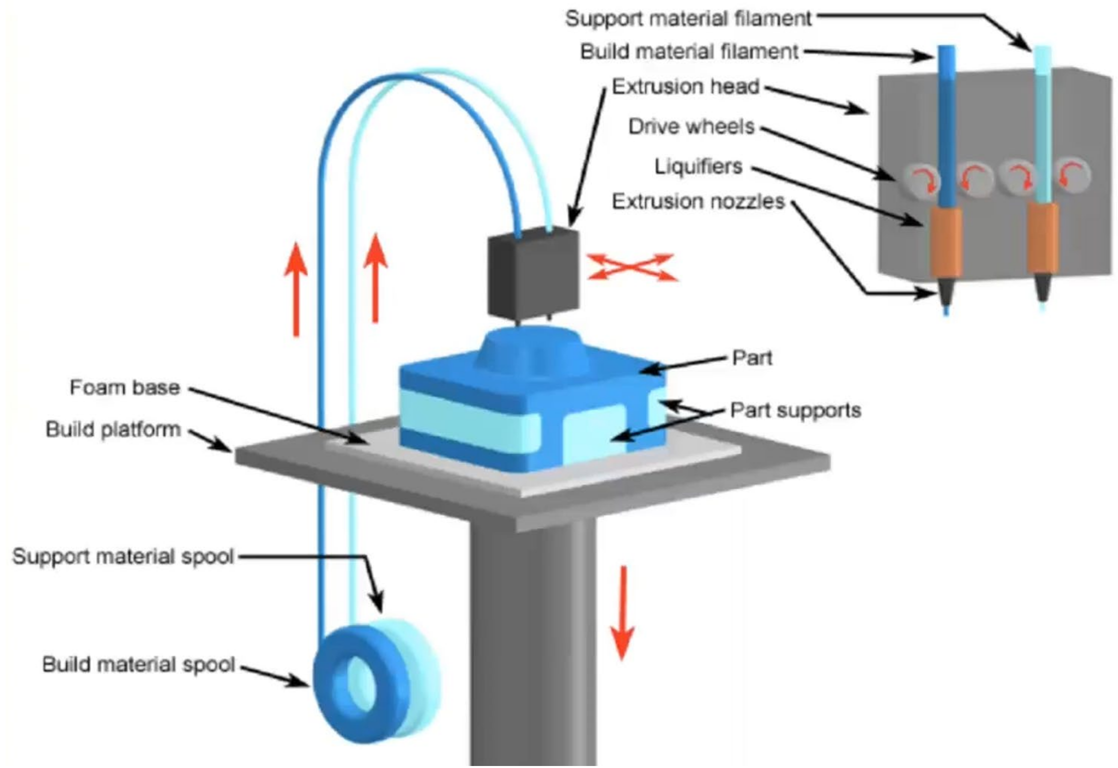




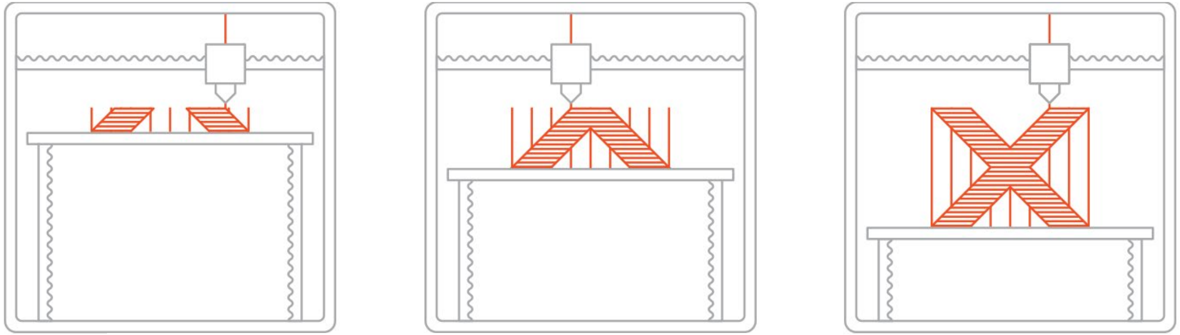
Considerations when picking print technology

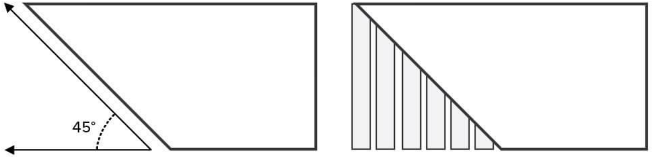
- Print Process Mechanism
  - How it Works
  - Advantages
  - Design considerations
- FDM / FFF
  - Fused Deposition Modeling / Fused Filament Fabrication

Fused Deposition Modeling / Fused Filament Fabrication
FDM / FFF



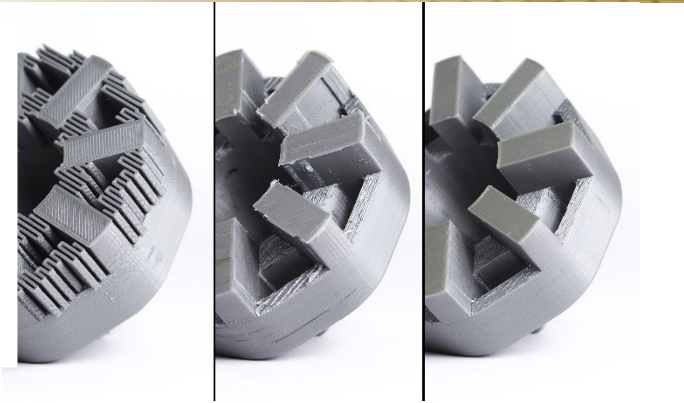
FDM Print Often Requires Support Structures





Overhang of less than 45 degrees
No support is needed

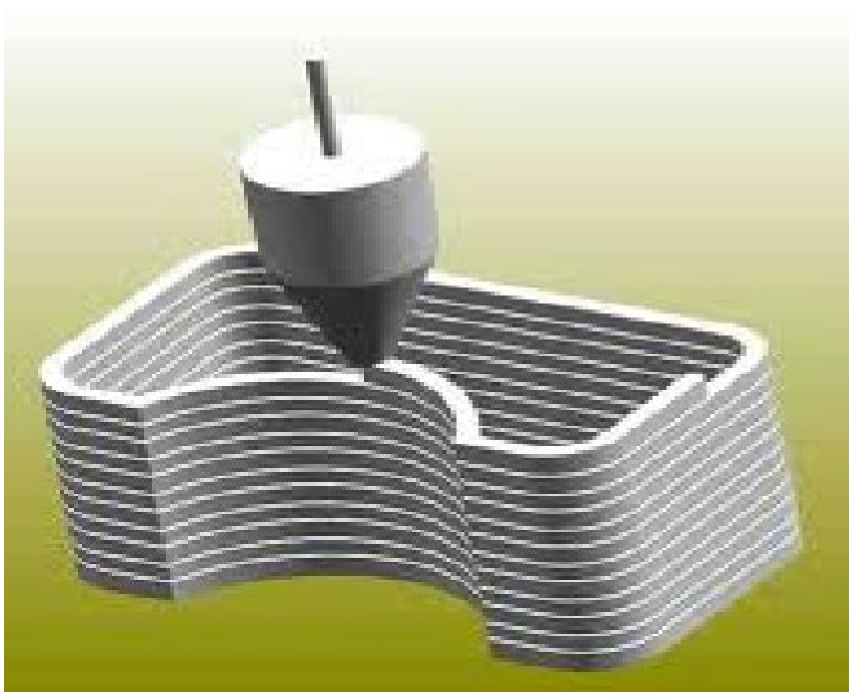
Overhang of more than 45 degrees
Support is needed



FDM is not solid like other processes
"Infill & Shell Thickness"

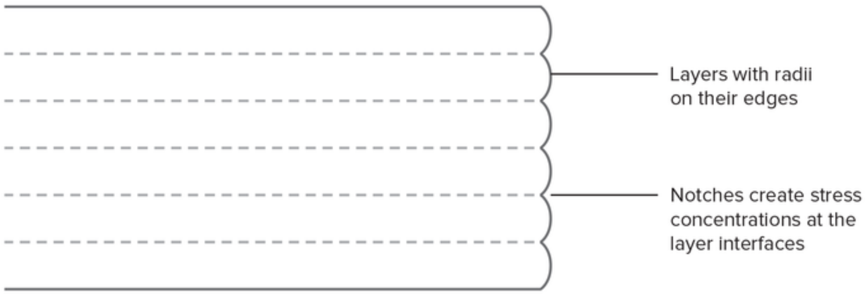
FDM parts are usually not printed solid to reduce the print time and save material. Instead, the outer perimeter is traced using several passes, called the shell, and the interior is filled with an internal, low-density structure, called the infill.

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



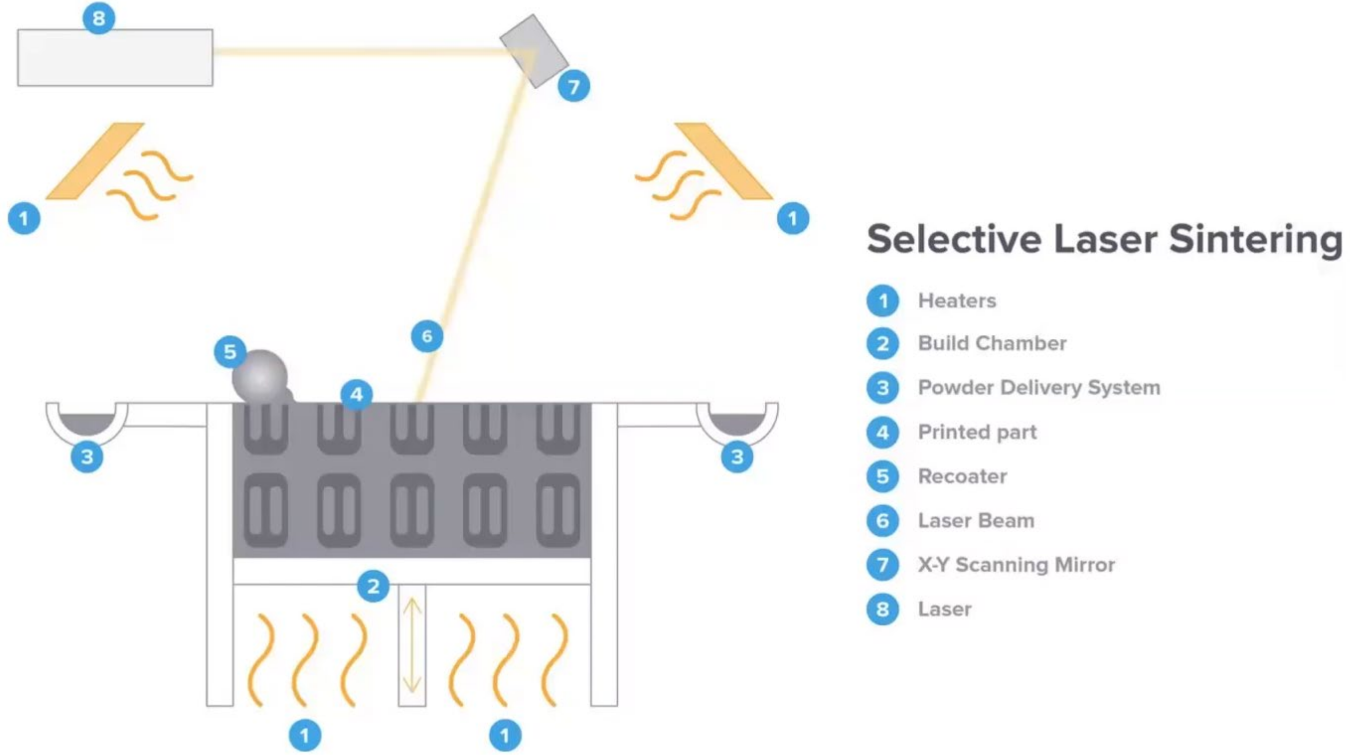
It may be difficult to produce parts with fine features, textures or very thin walls

FDM Parts are generally not watertight or airtight



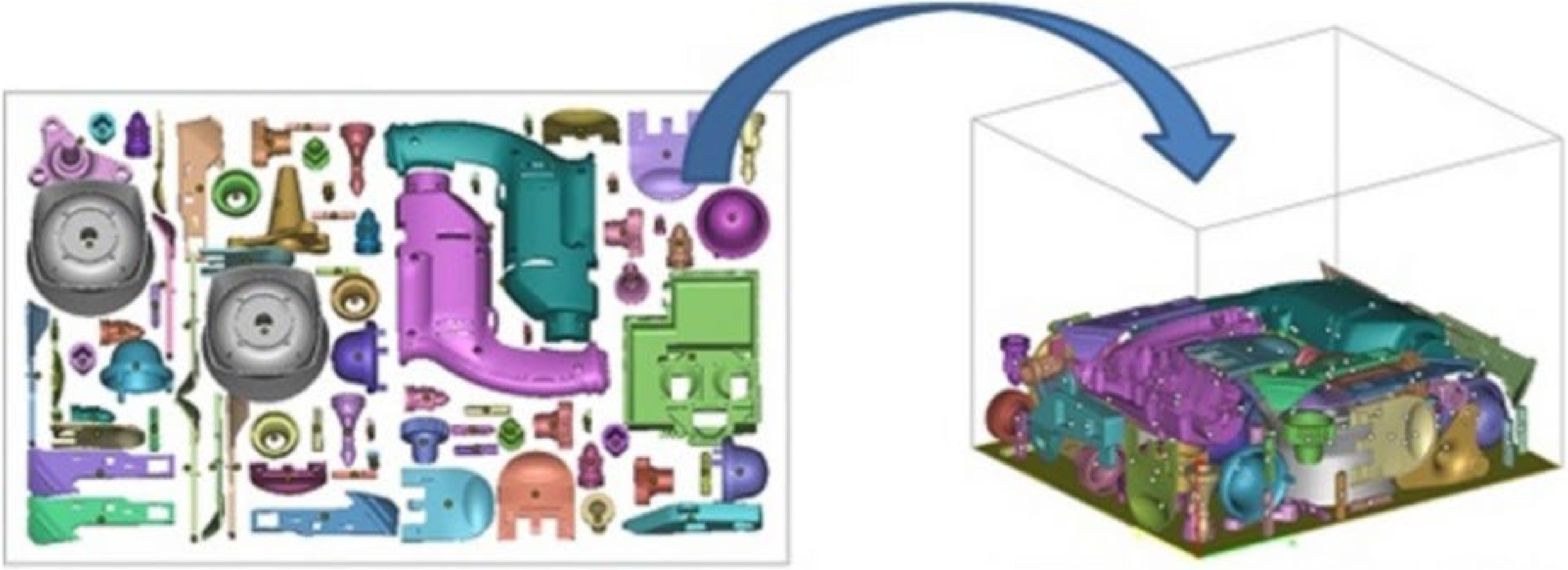
This issue can be mitigated with post processing but will add time and labor to part

SLS: Selective Laser Sintering



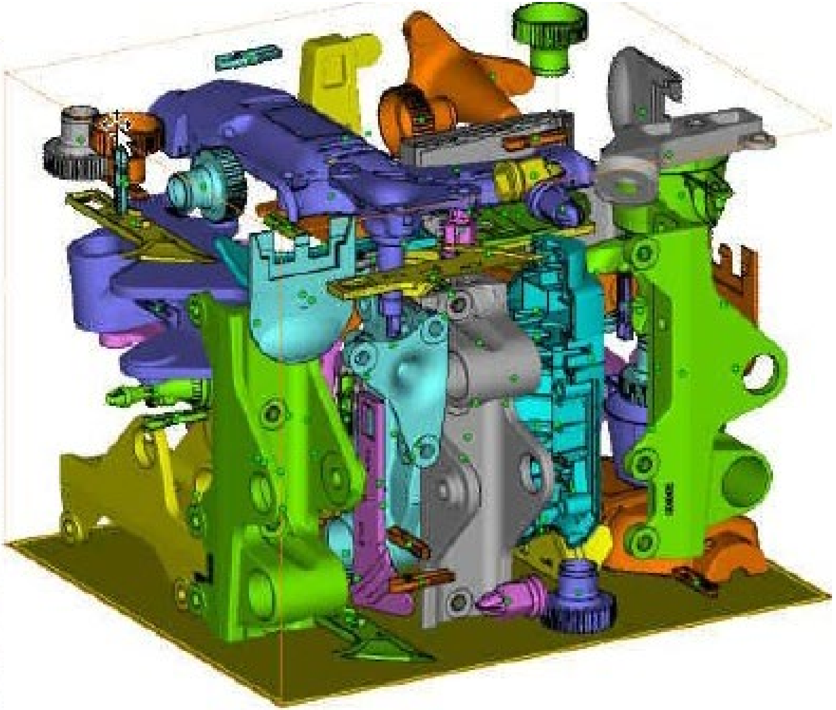
SLS has becoming more popular and does not require support structures

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



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

3D Nesting in SLS powder bed fusion "cake"



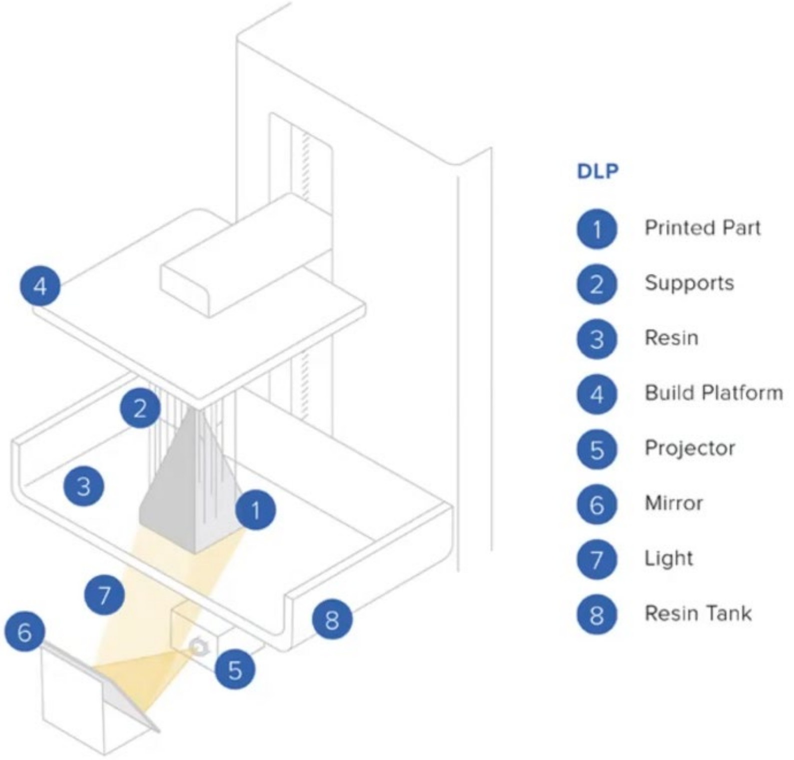
The unused Nylon power can be recycled for future prints

SLS: Nylon is ideal for a range of functional applications, from engineering consumer products to healthcare.

SLS 3D Printing Materials
The most common material for selective laser sintering is nylon, a popular engineering thermoplastic beloved for its lightweight, strong, and flexible properties. Nylon is stable against impact, chemicals, heat, UV light, water, and dirt, making it ideal for both rapid prototyping and production.

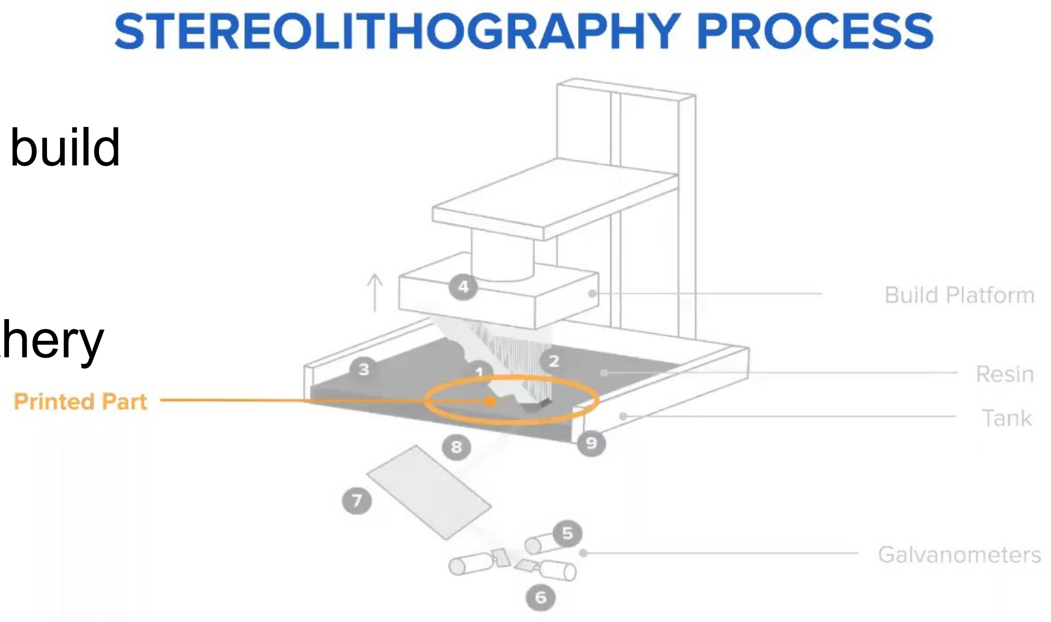
SLA & DLP

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



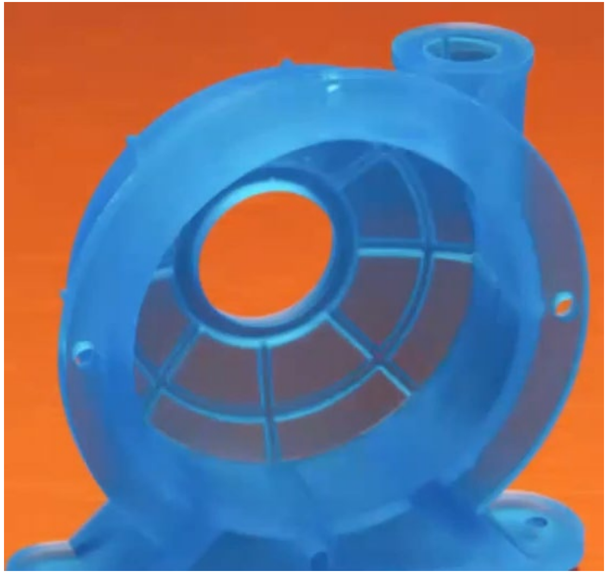
SLA

- 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

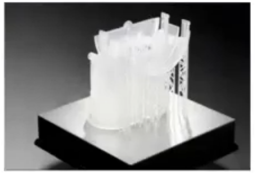
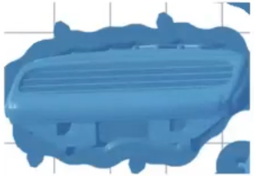


SLA – super fine resolution

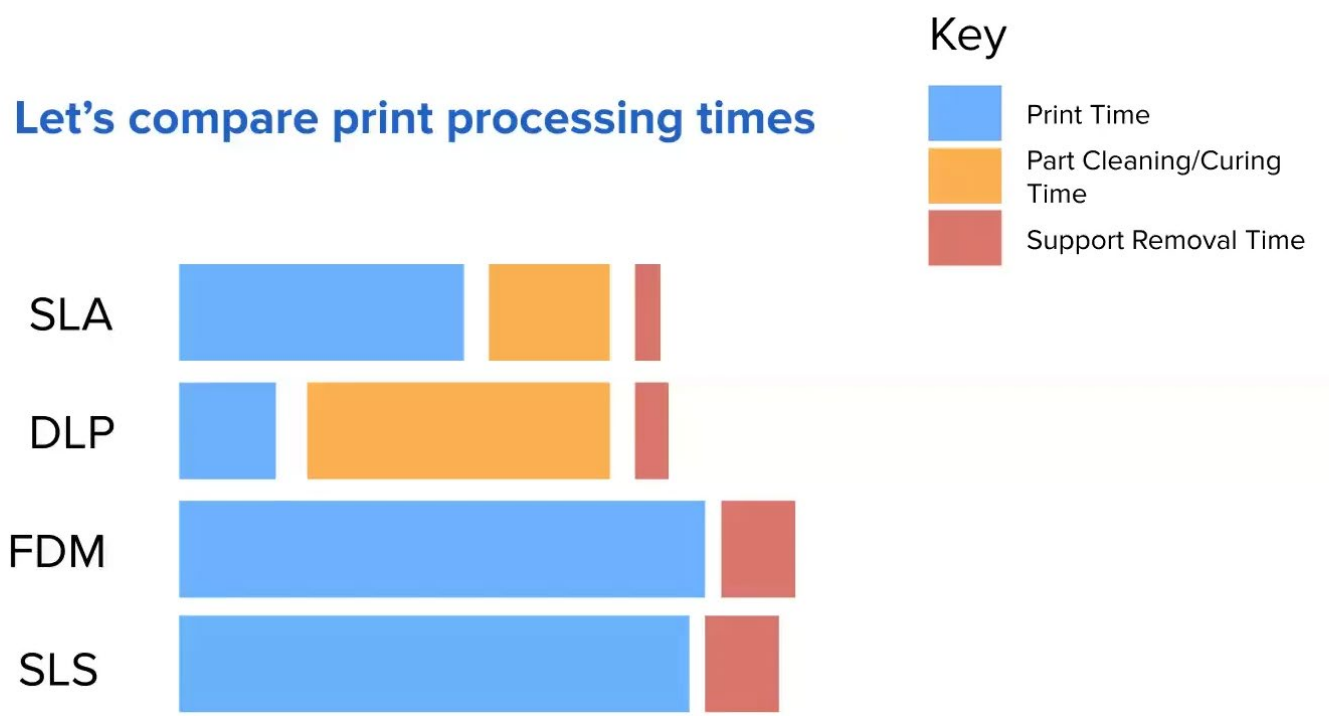
- Can produce highly detailed & translucent parts



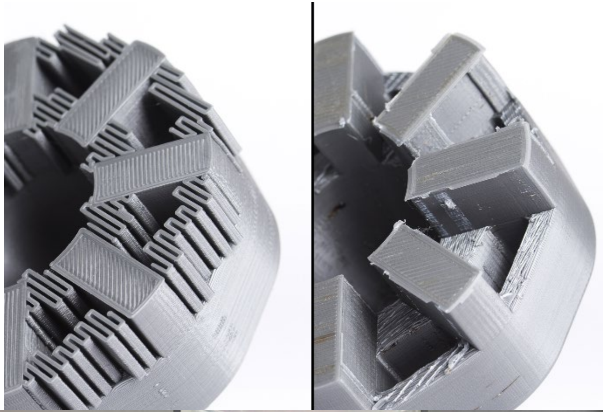
Print Speed comparison

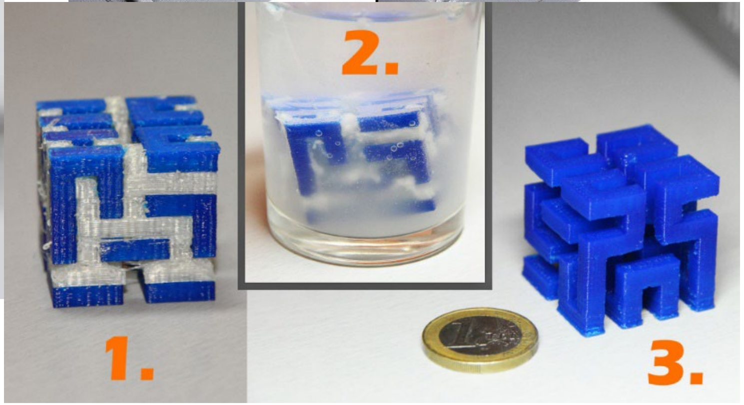
	FDM	SLA	SLS
	150 - 340 minutes	75 - 350 minutes	120-200 minutes
	420 - 1275 minutes	150 - 660 minutes	660 minutes
	21 parts 690 - 1710 minutes 33 - 81 minutes per part	12 parts 90-420 minutes 7,5-35 minute per part	300 parts 2400 minutes (40 hours) 8 minutes per part

Post Processing considerations

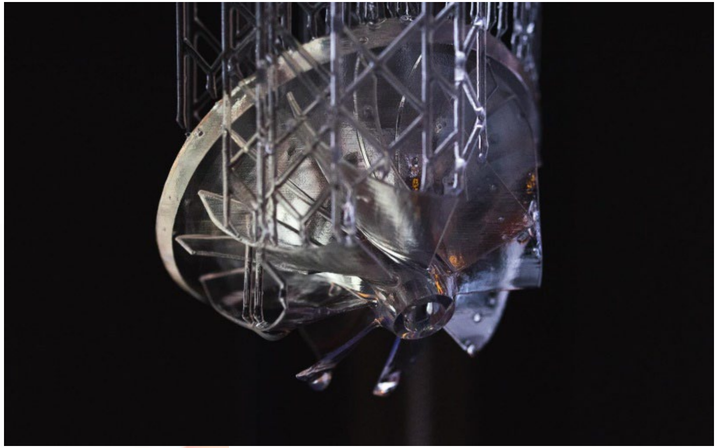


Support removal – FDM – dissolvable or break away



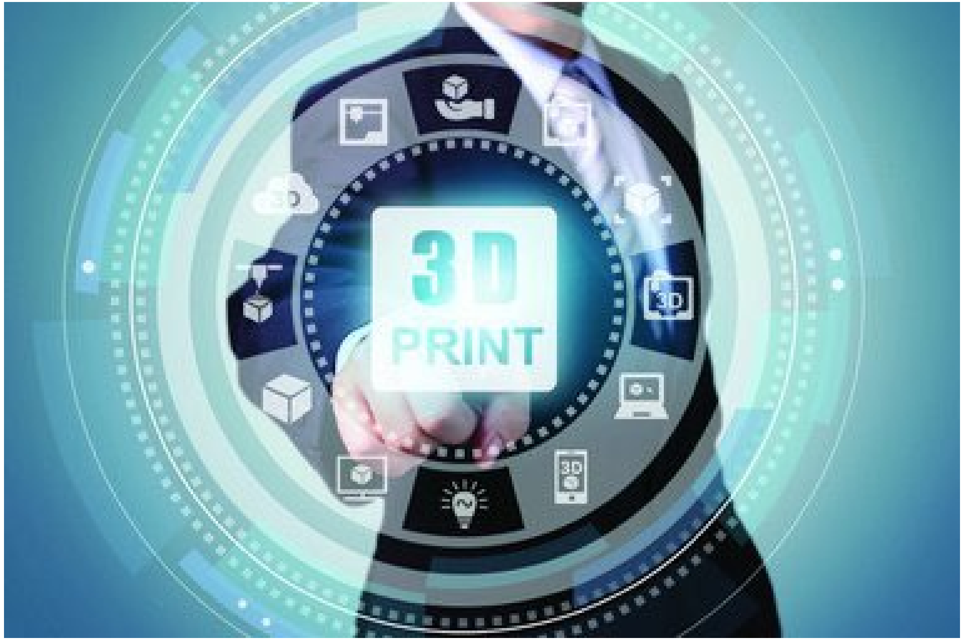


Support removal – SLA – break away



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

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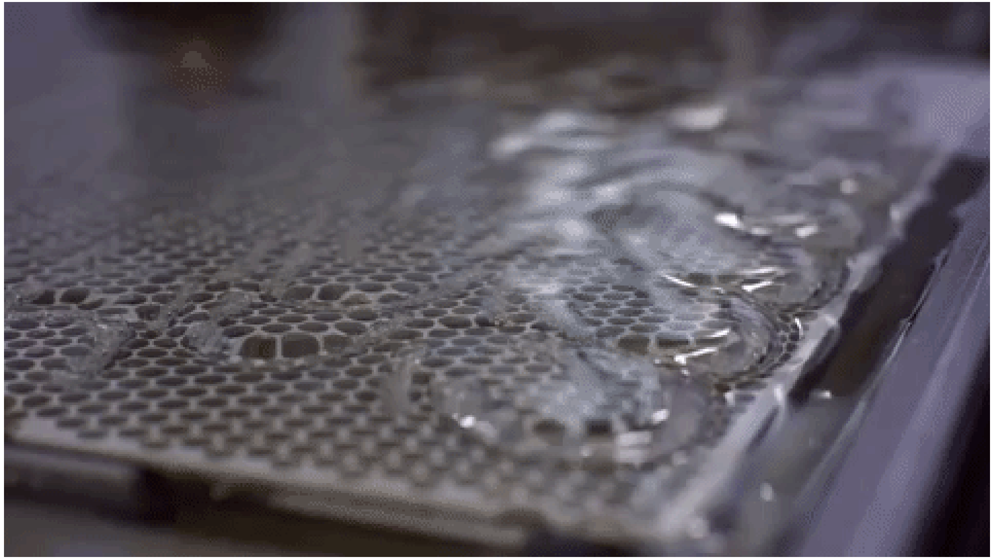

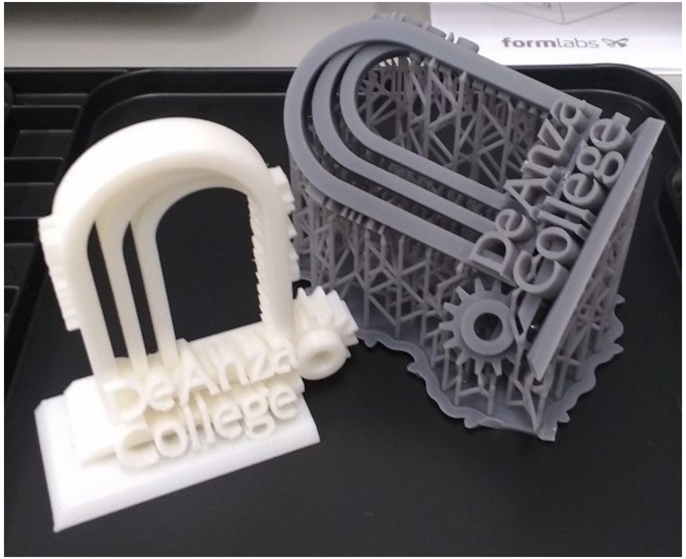

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