



FI Tech Summer Boost: AM & 3D printing

Practicalities of different
AM technologies

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School of technology and Innovation
University of Vaasa



- **Technobothnia additive manufacturing equipment:**

- FDM machines multi extruders
- SLA
- DLP
- Material jetting
- Powder based



3D Scanning Hardware



(a) Microsoft Kinect v1



(b) Microsoft Kinect v2



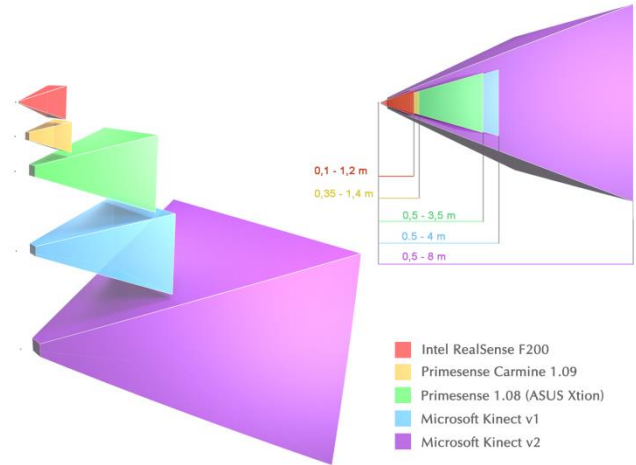
(c) ASUS Xtion (Primesense Carmine)



(d) Intel RealSense 3D camera by

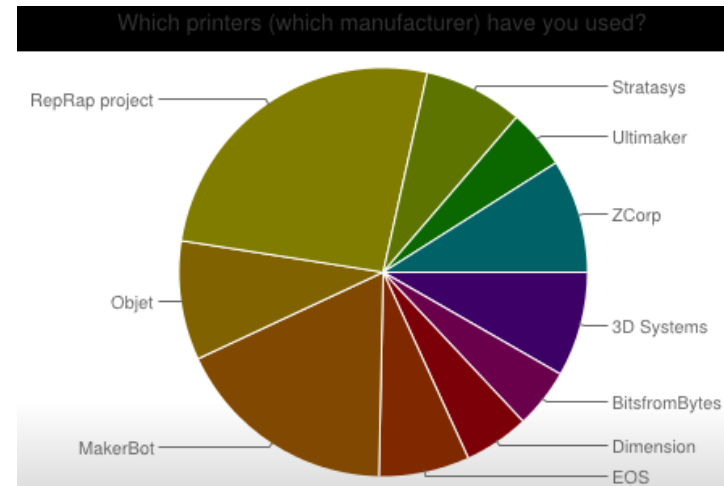


(e) Laptop featuring Intel RealSense



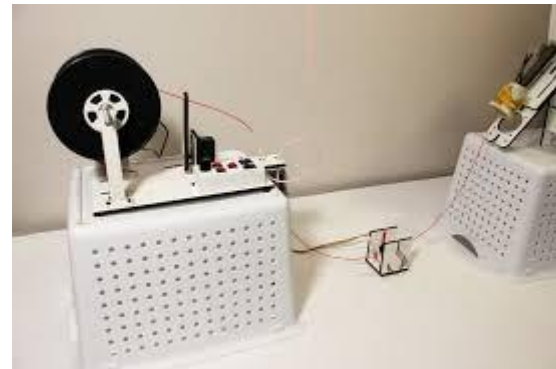
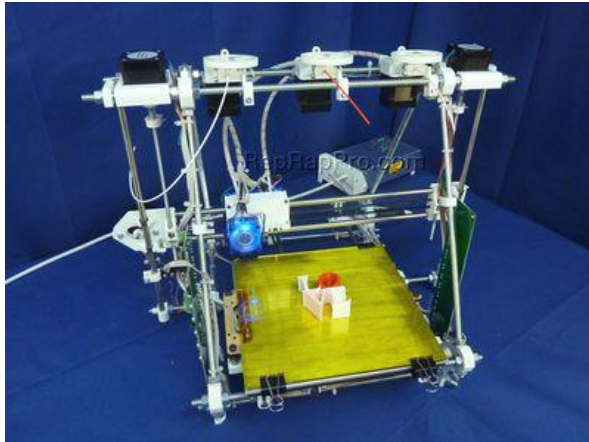
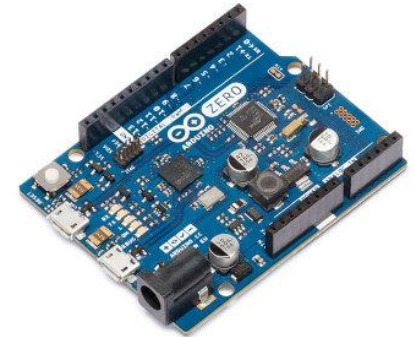
Personal 3D printers

- Open source design
- REPRAP
- FAB at home
- Consumer 3d Printers
- Makerbot
- Ultimaker



Education Open source lab

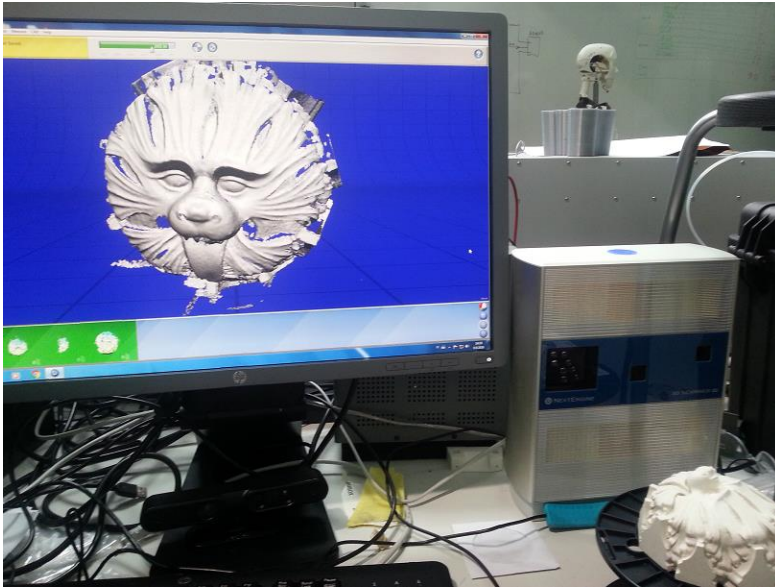
Filastruder +filawinder
Plastic filament from pelets- (price
reduction by fraction of 10)
"One laptop per child"
REPRAP projects
multimaterial printer



Open Source Lab equipment

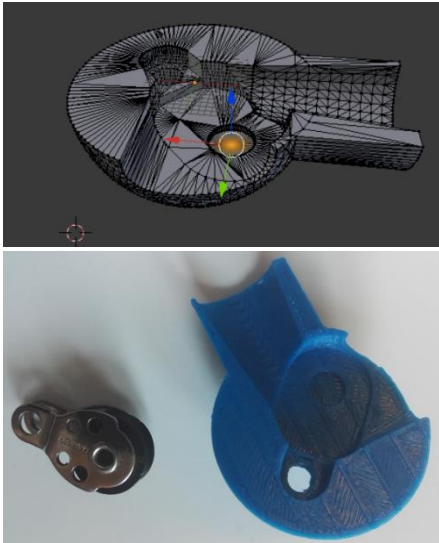


3D scanning & Jewelry



Flat laser line scan and Sterling silver belt buckle cast

Modeling and 3D printing for sailing



ABS plastic and Nylon+Carbon fiber materials tested

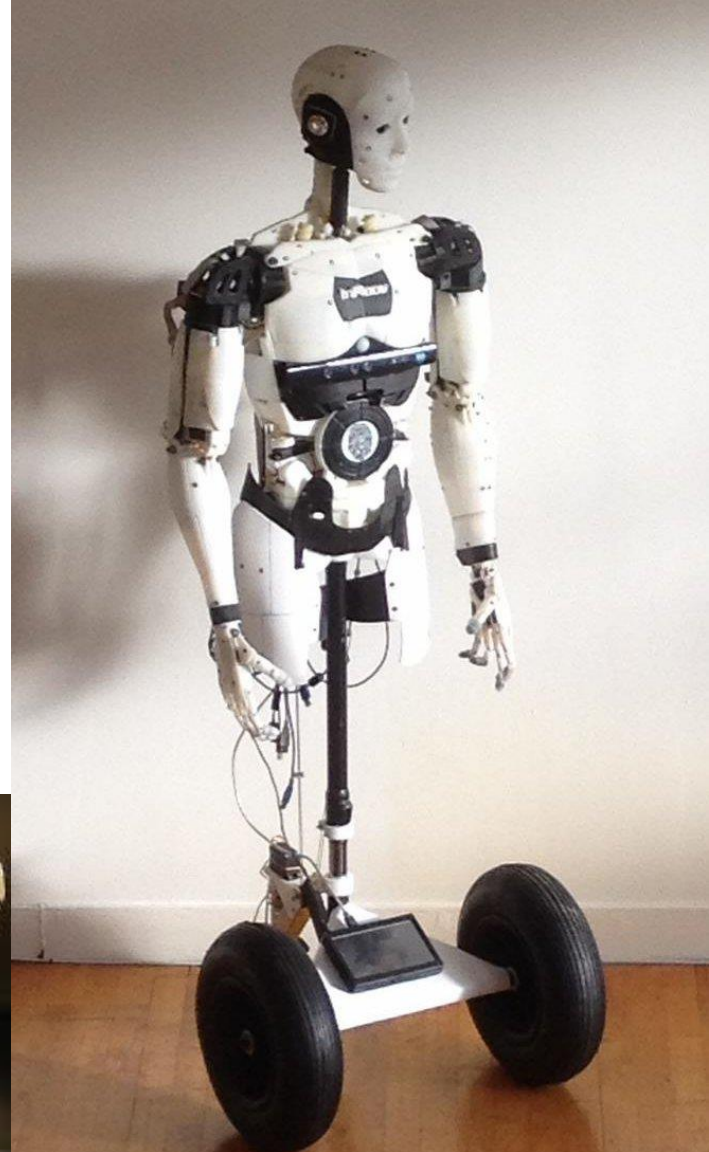
Drones and Robotics



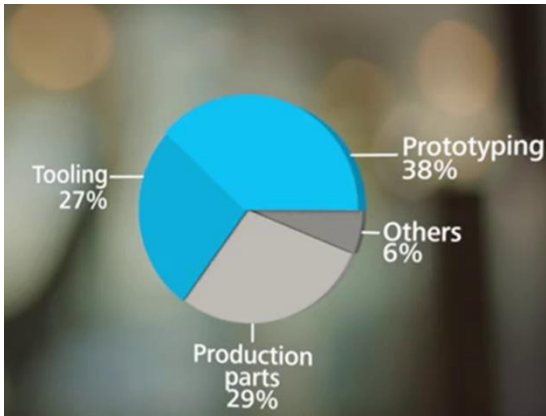
Embedded electronics ,
AI
Quadrotor,
controls and
video link



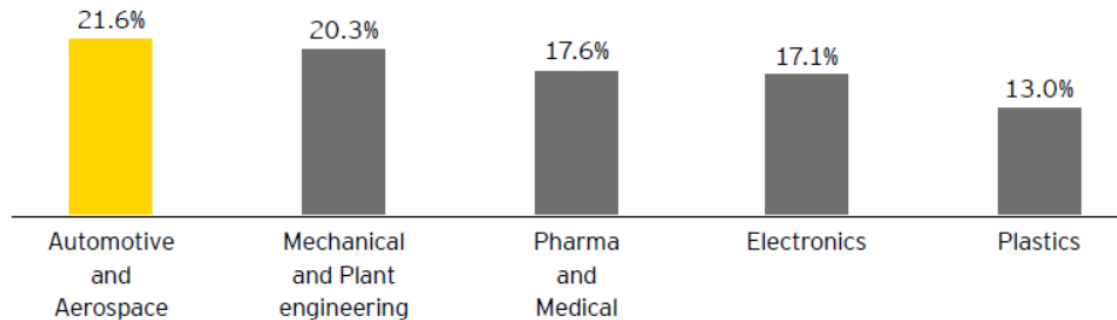
Inmoov real size
humanoid



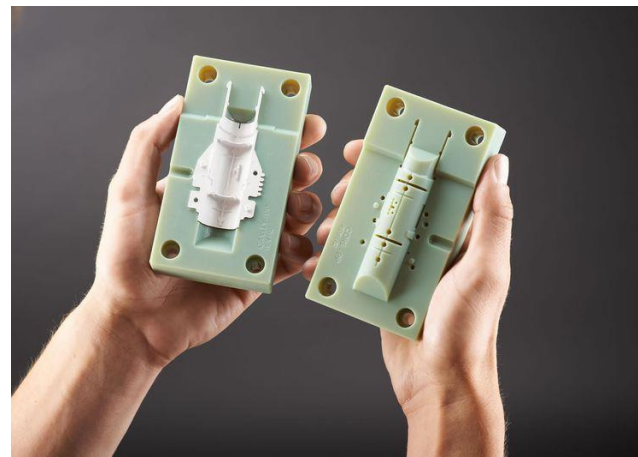
Applications-tool



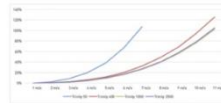
Over 20% of automotive, aerospace and mechanical and plant engineering companies with 3DP experience apply the technology to make tools (%)*



Workstations, Molds, jigs and fixtures



Personal Fabrication-Wind turbines



Portable wind turbine generates up to 50 watts of electricity, may be used for water pumping etc.

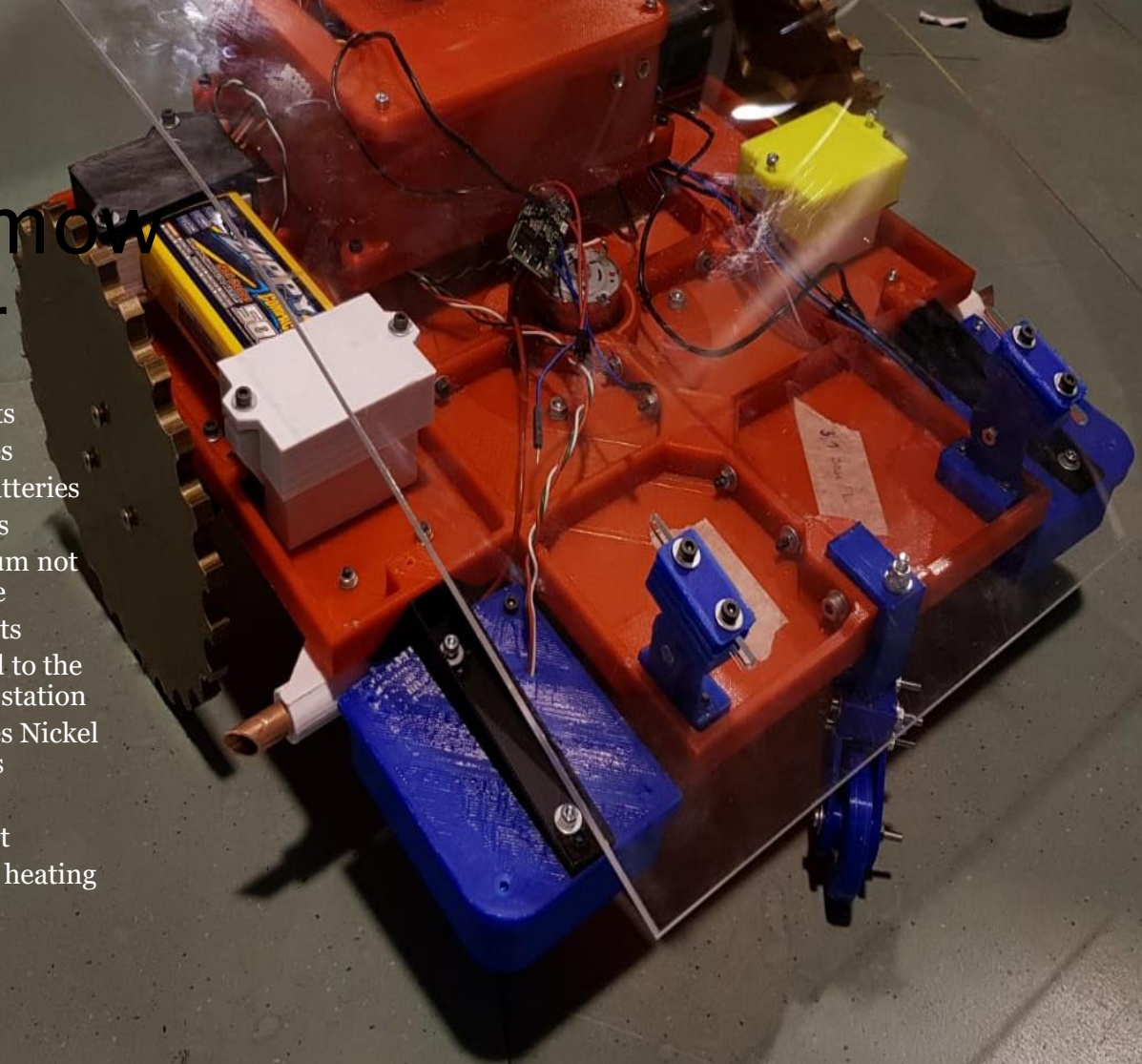
<http://www.reprap-windturbine.com/index.php?id=10&L=1>

3D printed Wind turbines

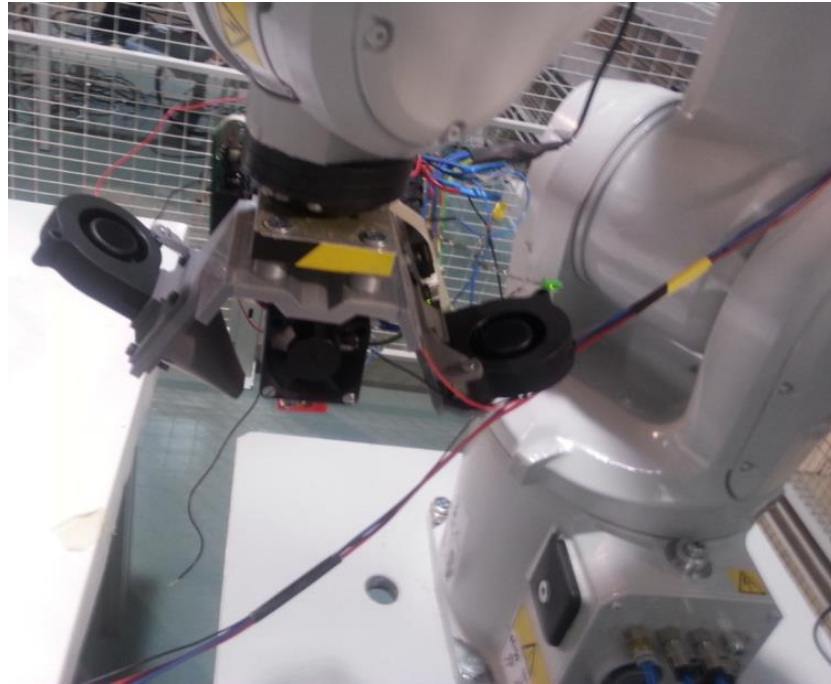


Lawnmower

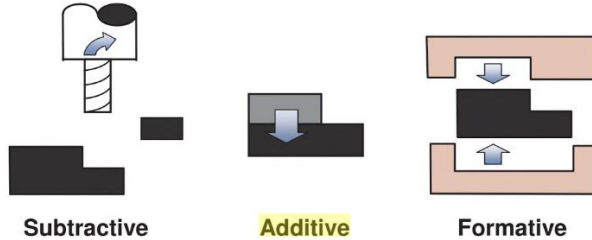
- Battery mounts
 - Old holes
 - Fixed batteries
- Sensor mounts
 - Aluminum not available
- Charging points
 - Matched to the docking station
 - Old holes Nickel batteries
- Cover
 - Laser cut
 - Bend by heating



Robots and 3D printing big scale:



Hybrid manufacturing



- CNC
- Vacuum casting
- Heat sintering
- Polishing, coating



Digital manufacturing advances



Manage Files and Projects - Cloud storage



Share job files between users and machines



Virtual Factory allows to manage the workload and monitor different interconnected machines



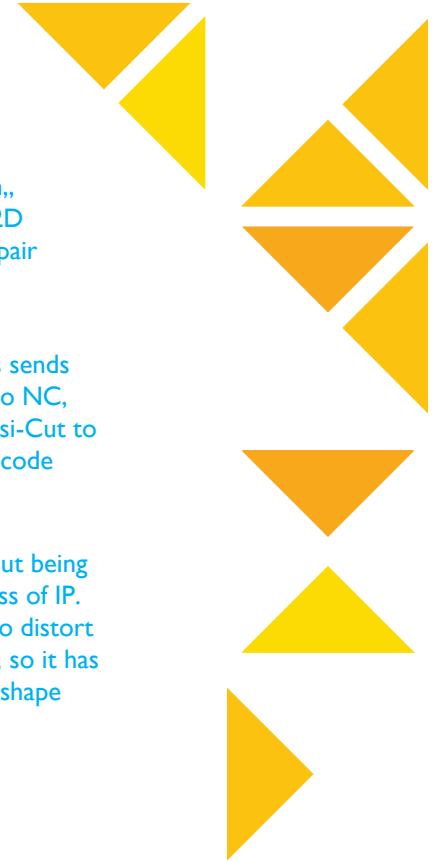
Prepare design,, unfold 3D to 2D analyse and repair



Cloud slices sends 2D modes to NC, Kirmoto, Visi-Cut to generate G-code



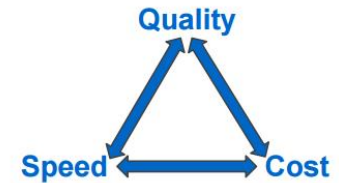
Share without being afraid for loss of IP. Use Tools to distort your object, so it has the original shape but altered geometry.



Additive manufacturing value proposition

- **Considerations**

- Application / Material Properties
- Part Quality
- Lead Time
- Production Volume / Quantity
- Part Cost
- Tooling Cost



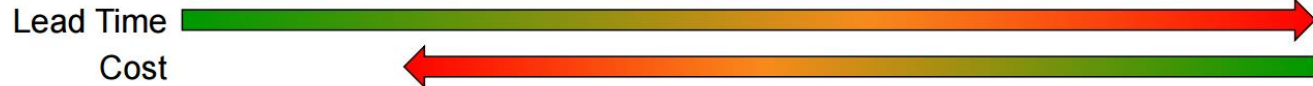
FDM
Lead Time - 8 hours
Cost - \$50

SLS
Lead Time - 3 Days
Cost - \$2500

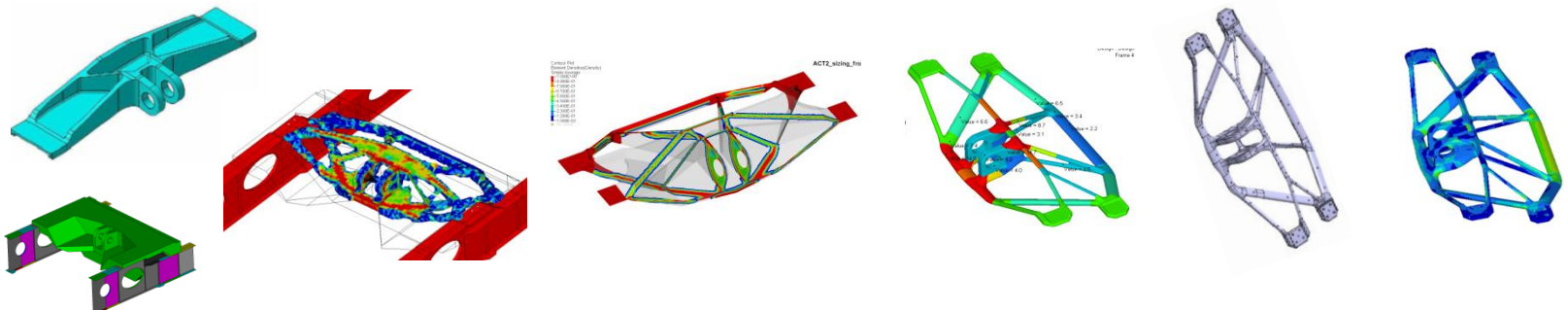
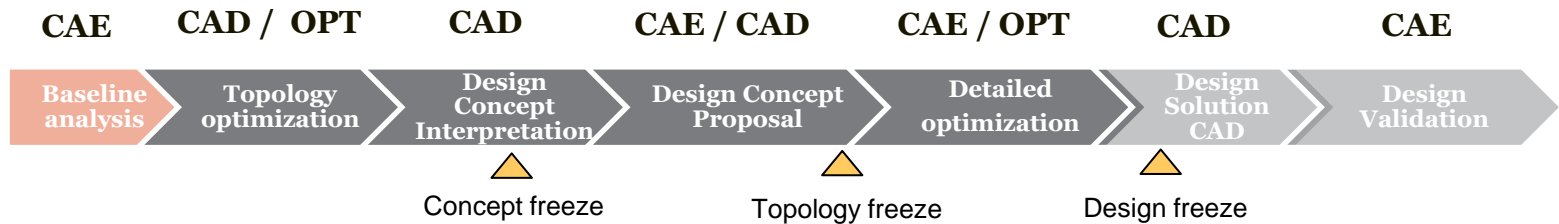
Rapid Cast
Lead Time - 4 weeks
Cost - \$2000

Billet
Lead Time - 4 weeks
Cost - \$1500

Production Cast
Lead Time - 2 Months
Cost - \$5



Optimization Driven Design

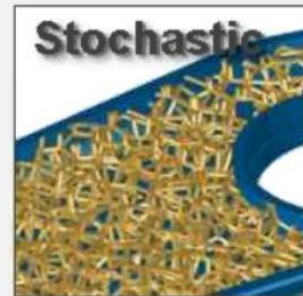
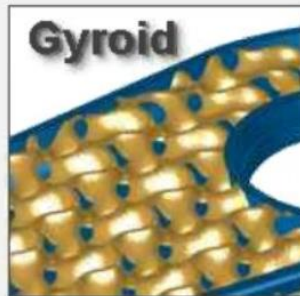
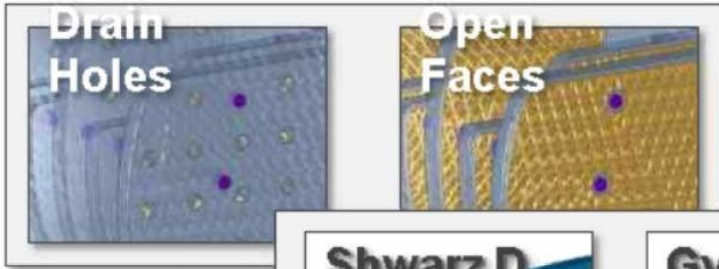


Design guidelines for AM

Lattice-based Structure Optimization

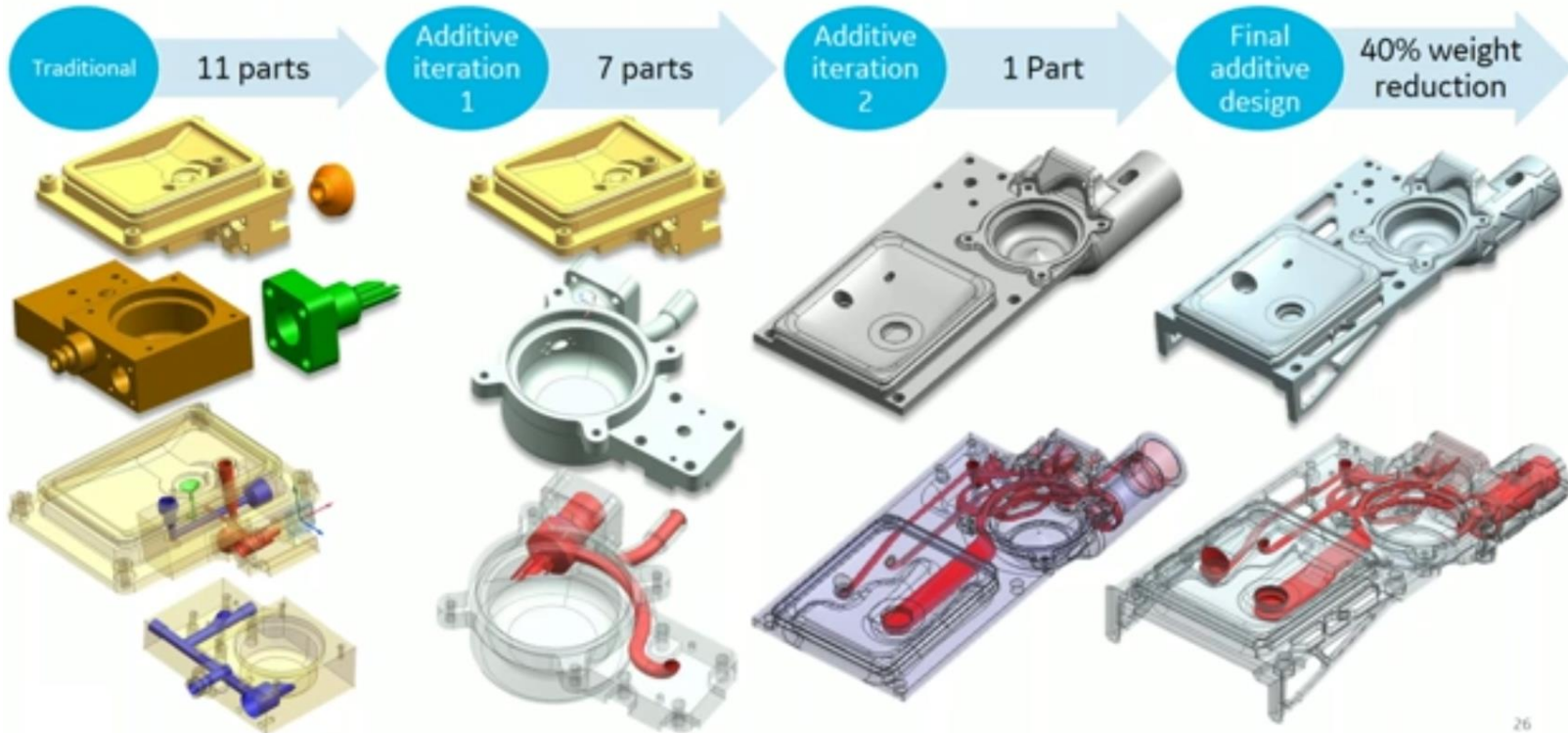
Minimize Weight & Material Usage

- **Versatile** – various types:
template based, configurable thickness & density, user-defined

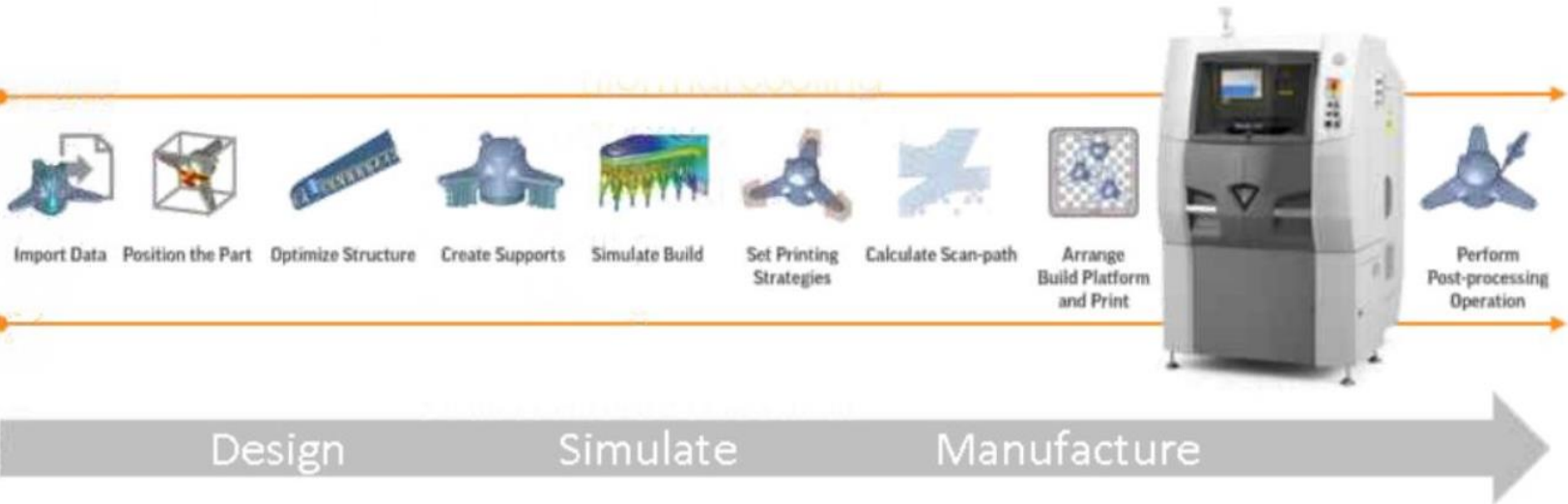


Part Count Reduction PCR

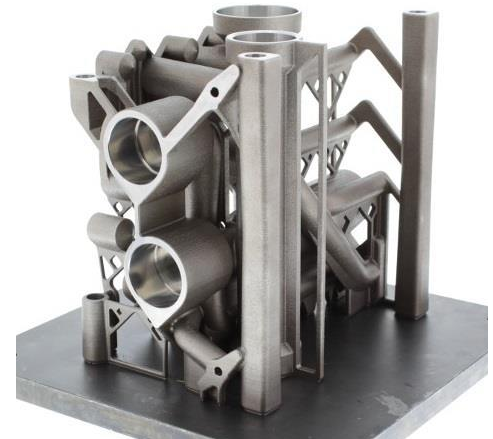
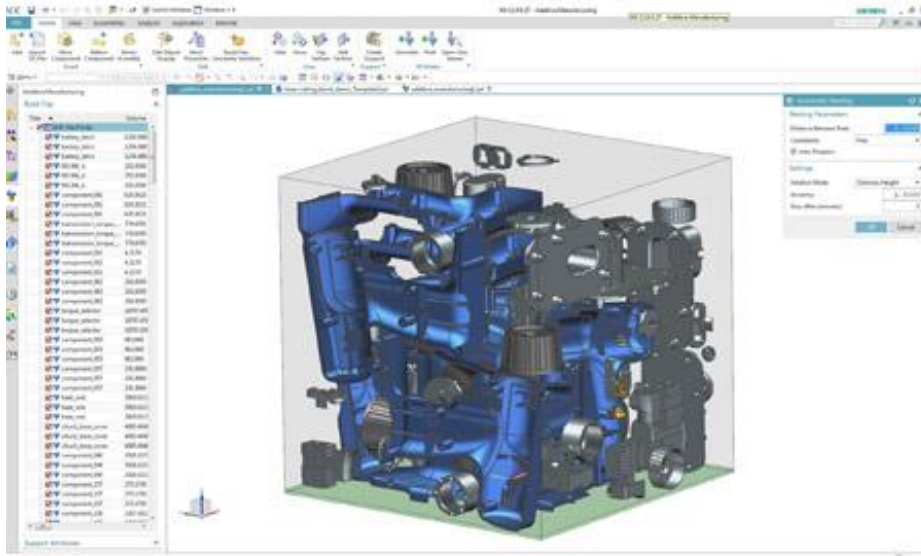
Additive design journey... distribution manifold



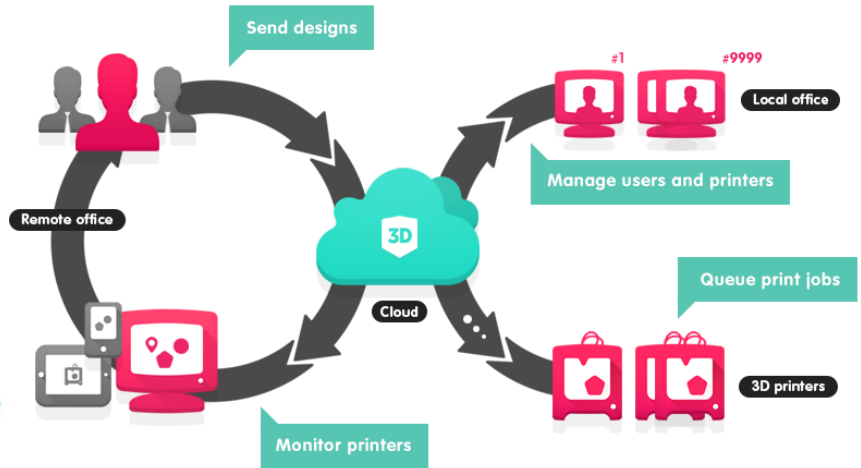
From Design to Additive Manufacturing



Nesting for AM



Cloud Manufacturing for AM

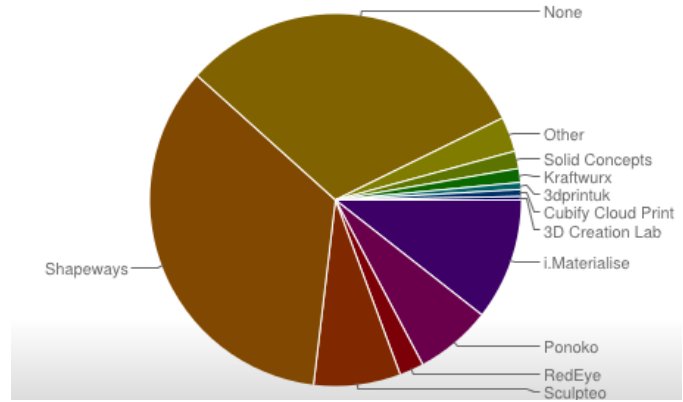


Computer 11 ID: 0x8c9a5491092L win32	3DPrinterOS Cloud 3D Printer Management	Microsoft Azure																														
<p>Active Printers LiveView Wall Inactive Printers</p> <p>Deactivate offline Add Workgroup Printers INSTALL</p> <p>Finished jobs stay here for 24 hours only, go to dashboard to see full history</p>																																
<p>U2-1 Ultimaker 2</p> <table border="1"> <thead> <tr> <th>Date / Time</th> <th>Filename</th> <th>Printed by</th> <th>Filament</th> <th>Estimated real print time</th> <th>Status</th> <th>Logback to send</th> <th>LIVE VIEW</th> <th>APPS</th> <th>✓</th> </tr> </thead> <tbody> <tr> <td>06.08.2015 12:43</td> <td>model_park1.gcode</td> <td>nikolai@3dprinters.com</td> <td>3.07g</td> <td>00:20 / -</td> <td>Offline</td> <td>Job ID: 23276, Printer</td> <td></td> <td></td> <td>CANCEL</td> </tr> <tr> <td>07.08.2015 09:30</td> <td>Qawhox_keychain.gcode</td> <td>koobloov@jpmc.com</td> <td>9.58g</td> <td>00:33 / 00:37</td> <td>Finished</td> <td>Job ID: 23227, Printer</td> <td></td> <td></td> <td>RESTART</td> </tr> </tbody> </table>			Date / Time	Filename	Printed by	Filament	Estimated real print time	Status	Logback to send	LIVE VIEW	APPS	✓	06.08.2015 12:43	model_park1.gcode	nikolai@3dprinters.com	3.07g	00:20 / -	Offline	Job ID: 23276, Printer			CANCEL	07.08.2015 09:30	Qawhox_keychain.gcode	koobloov@jpmc.com	9.58g	00:33 / 00:37	Finished	Job ID: 23227, Printer			RESTART
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<p>Computer 21 ID: 0x8c9a541643a3L win32</p> <p>Makerbot Replicator ZX TLL AirPrint Makerbot Replicator ZX</p> <p>Logs LIVE VIEW APPS SHARE ✓</p> <table border="1"> <thead> <tr> <th>Date / Time</th> <th>Filename</th> <th>Printed by</th> <th>Filament</th> <th>Estimated real print time</th> <th>Status</th> <th>Logback to send</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Date / Time	Filename	Printed by	Filament	Estimated real print time	Status	Logback to send																							
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3D community

- Thingiverse.com
- Kraftwurx
- Shapeways
- Sculpteo
- i.materialize



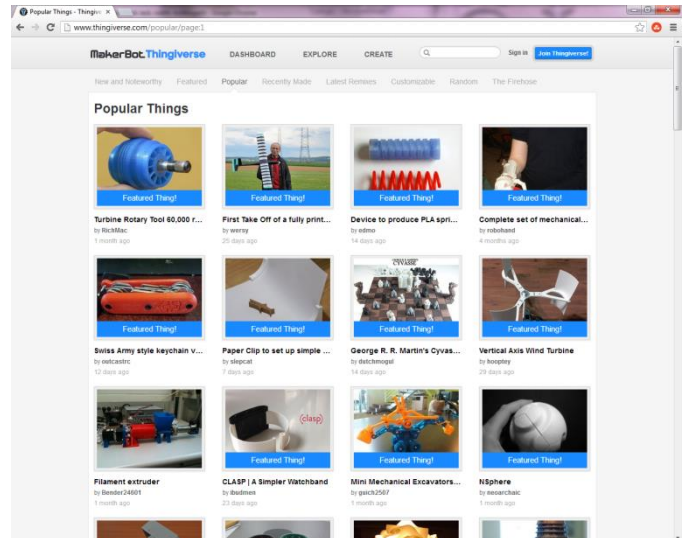
<http://www.instructables.com/id/9-12-Projects-High-School/>

<https://www.thingiverse.com/education>

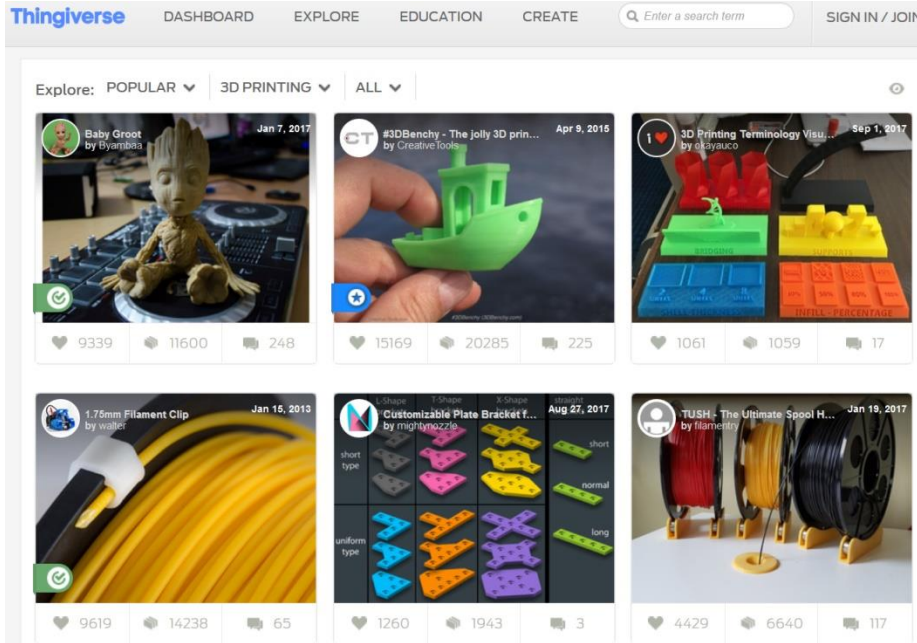
<https://www.thingiverse.com/challenges>



<https://www.tinkercad.com/learn/>

<http://www.reprap-windturbine.com/>



Models repositories



Repository	Registration required	Price	File Formats
Sponsored link: 	Yes	Free & premium	*.stl, *.obj
Sponsored link: 	Yes	Free & premium	*.stl
123D Catch Models	Yes	Free & premium	*.stl, *.obj, *.3dp
3D File Market	No	Free & premium	*.stl
3DShook	Yes	Free & premium	*.stl
CGTrader	Yes	Free & premium	*.stl, *.vrmf, *.max, *.obj, *.fbx, *.dxf, *.blend, *.3ds
Cubehero	No	Free	*.stl
Cults	Yes	Free & premium	*.stl, *.obj

Special filaments



BROWSE BY CATEGORY

3D Printers

- Assembly Required
- BCN3D 3D Printers
- Built to Order
- CraftBot 3D Printers
- Crealitty 3D Printers
- Dremel 3D Printers
- FlashForge 3D Printers
- Fully Assembled 3D Printers
- High Temperature 3D Printers
- Intamsys 3D Printers
- Kodak 3D Printers
- Laser Cutters & Engravers
- LulzBot 3D Printers
- MAKEiT 3D Printers
- MakerGear 3D Printers
- Peopoly 3D Printers
- Pulse Custom 3D Printers
- Raise3D 3D Printers
- Refurbished 3D Printers
- Robo 3D Printers
- SLA/DLP/LCD Resin 3D



Home / Store / 3D Printer Filament / Specialty Filament / 1.75mm Specialty Filament

1.75mm Specialty Filament

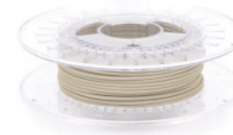
Finding the right 3D printing filament for every project can be a task. Luckily, here at MatterHackers, we take pride in offering the largest selection of 3D printing filament available. From our affordable MH Build Series filament, to our professional-grade PRO Series filament, you can find any material, like PLA, ABS, NylonX, PETG, TPU, TPE, Flexibles, Polycarbonate, and more! Along with our industry-proven brand of filament, we also carry other top-notch materials from ColorFabb, Taulman3D, NinjaTek, Ultimaker, 3DFuel, and more.



NylonX Carbon Fiber Filament - 1.75mm (0.5kg)



Carbon Fiber PRO Series PETG Filament - 1.75mm (1kg)



ColorFabb bronzeFill Metal Filament - 1.75mm (0.75kg)



ColorFabb Woodfill Fine Filament - 1.75mm (0.6kg)

Profile

Verification

[Printers & Pricing](#)

Pickup & Shipping

Pictures

Payout info

Printers & Pricing










Set up your 3D Printers. Add the pricing details to start taking orders from paying customers.

[Learn more about how to set up your printer](#)

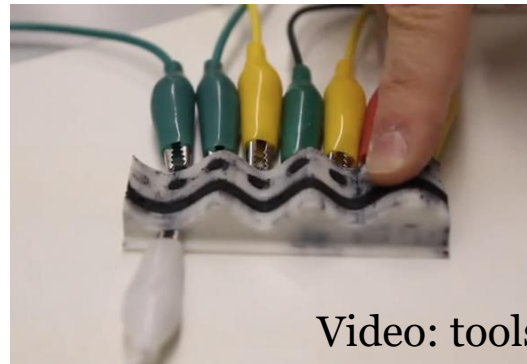
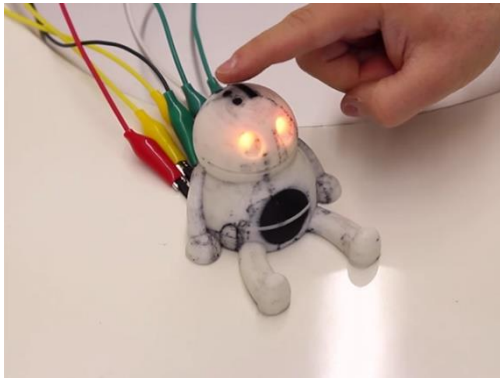
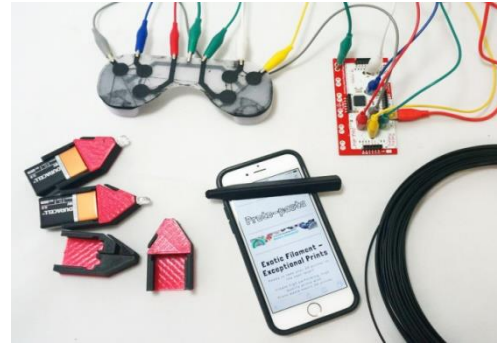
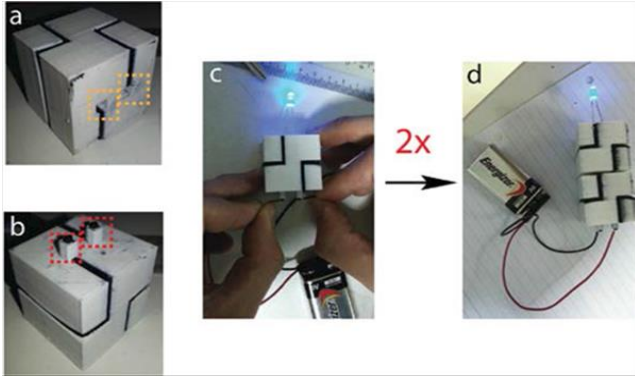
New material color structure

Recently we have completed a migration to a new set of material colors. Printers containing materials without a matching color options had to be taken offline. Please make sure all your materials have at least one color option so all your stations appear properly in the checkout.

[Go to printer settings](#)[Dismiss](#)[Take all printers offline](#)

 Mendel Mono	Offline <input type="checkbox"/>
 Dimension	Offline <input type="checkbox"/>
 Objet30	Offline <input type="checkbox"/>
 Makerbot Replicator 2	Offline <input type="checkbox"/>
 Wanhao - Wanhao S5	Offline <input type="checkbox"/>
 miniFactory	Offline <input type="checkbox"/>
 B9 Creator	Offline <input type="checkbox"/>
 Form 1+	Offline <input type="checkbox"/>
 Markforged Mark One	Offline <input type="checkbox"/>

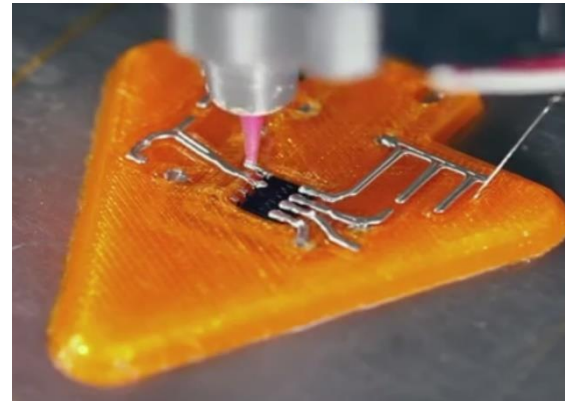
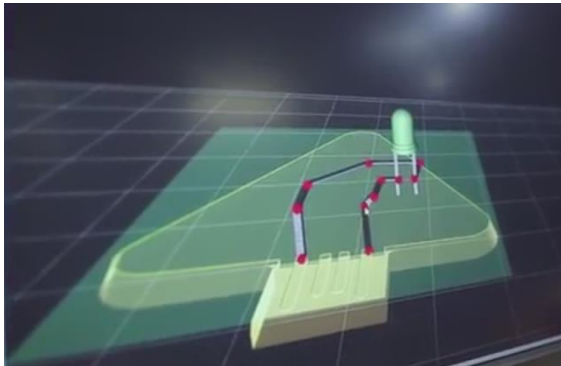
Conductive Termoplastik Filament



Video: tools Volkswagen

Multi-material printing, tools

- Design change to enable Multi-material printing



Strengthening 3D prints with carbon nanotubes and microwaves, continuous carbon fibre

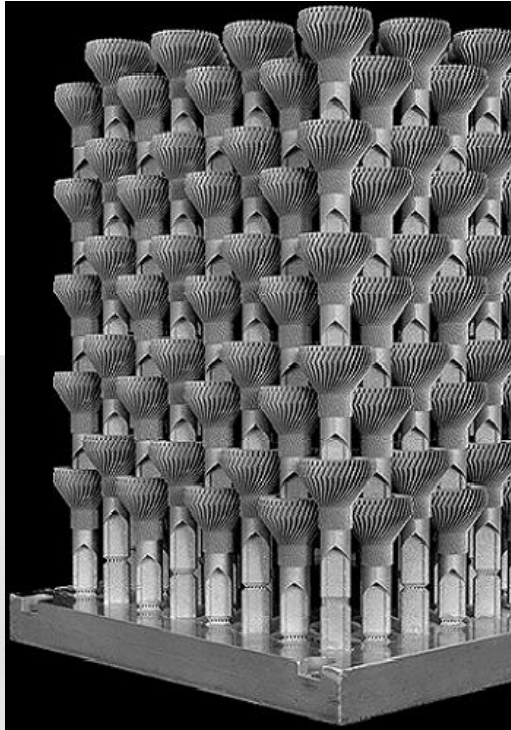


ULTEM and PEEK semi-crystalline plastics, PAEK, alternative polyetherimide (PEI)

- Up coming FDM printers build for special filaments (Hot chamber, vacuum and filters)



Mass-production



Jewelry - Mass customization



Loss wax casting with
DLP 3D printing



Automotive mass production

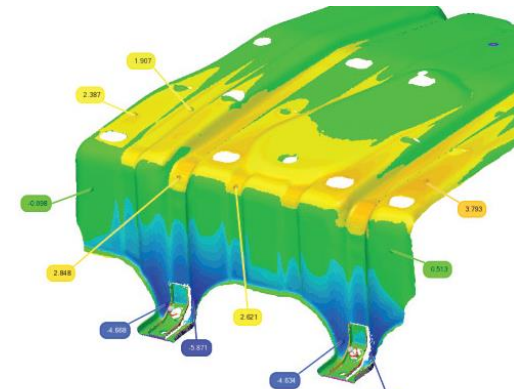
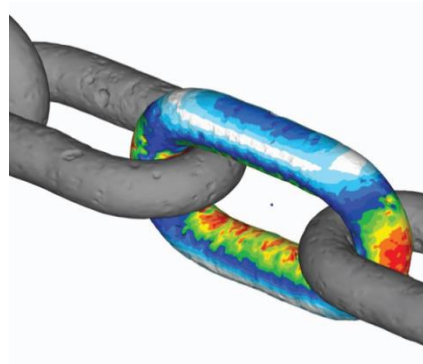
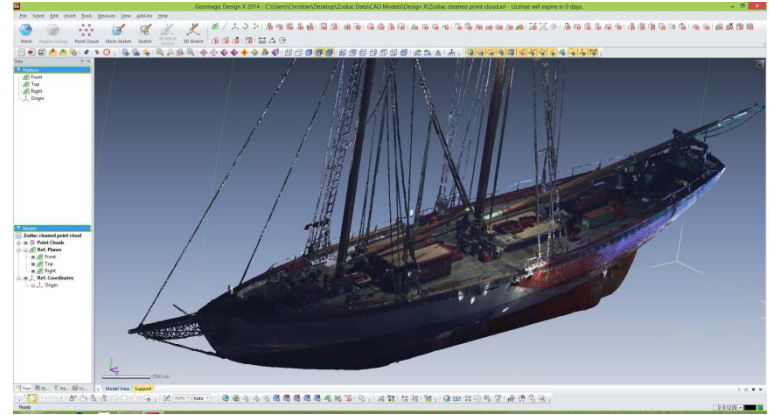


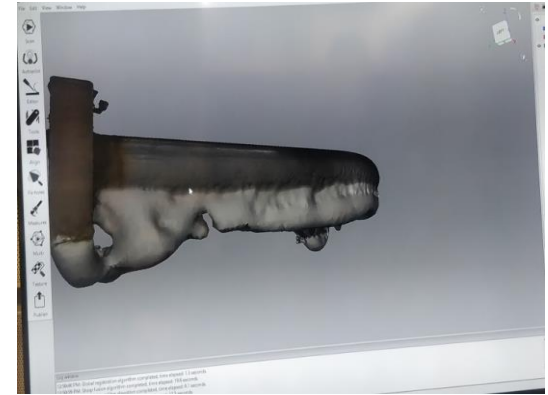
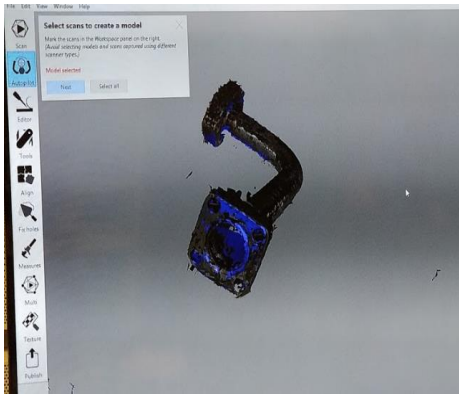
Pop up factory



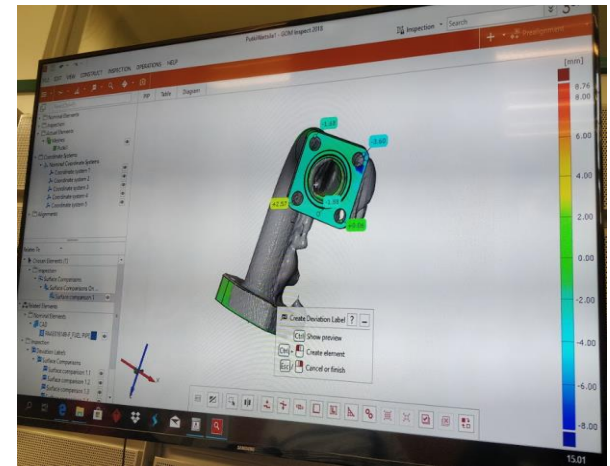
3D Scanning Service and Applications

- Prototyping
- Simulation
- Manufacturing
- Quality assurance and industrial metrology
- Quality control/inspection
Inspecting parts and mechanical assemblies
- As-is condition analysis for marine equipment
corrosion, buoyancy study
- Robotic Control
- Styling, design and reverse engineering
- Design for aftermarket

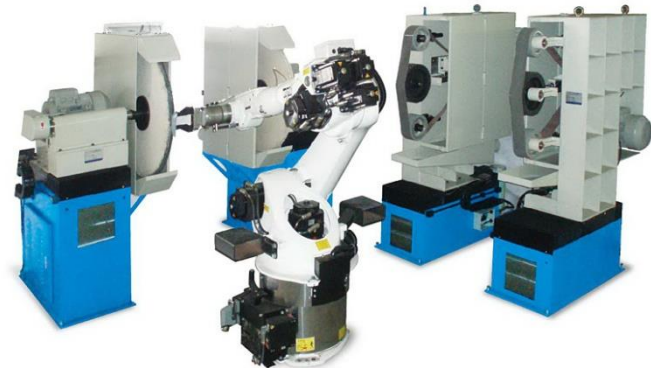
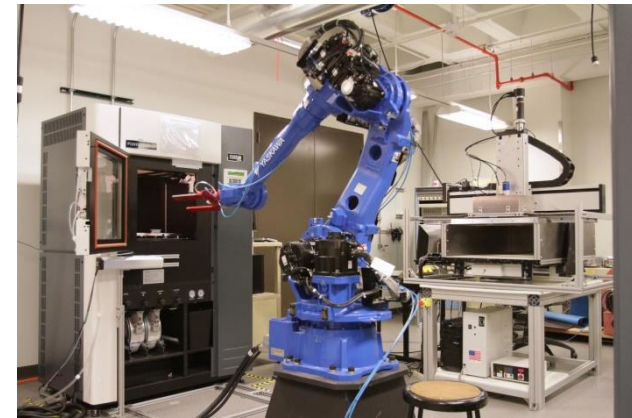




- Multiple scans need to be combined and edited to create perfect 3D-model of a pipe.
- Scanners software can be used for editing and measuring.
- Scanners software can't be used to compare 3D-models.

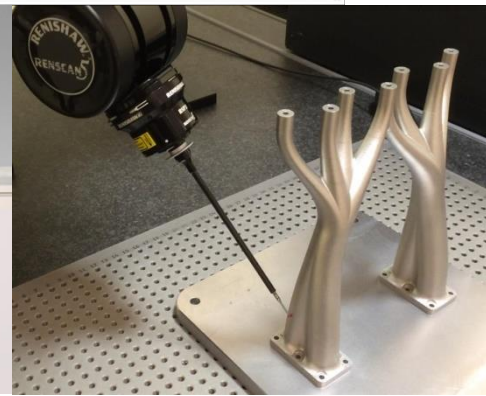
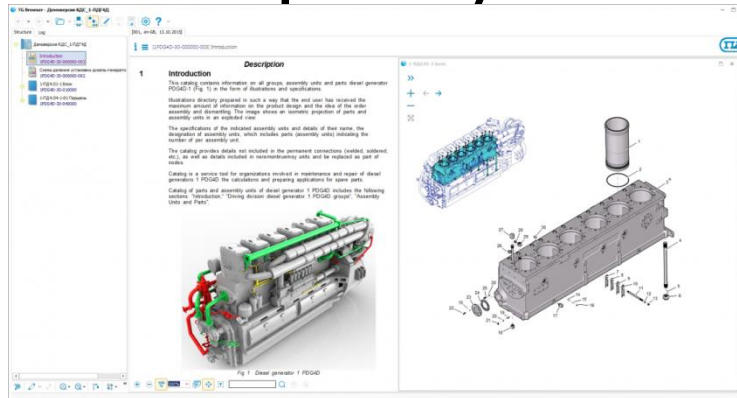


Automated machine tending, machine cleaning and post-processing



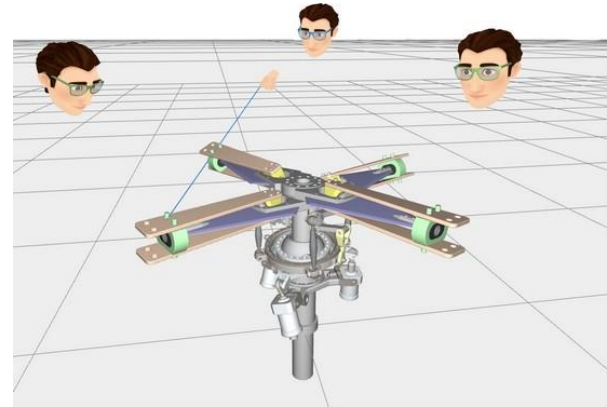
Digital Parts Catalogue

3D scanning, dimension measurement and quality control



Virtual Reality Future of Collaborative Design

- Designing for Metal AM needs collaboration between many stakeholders, R&D, Maintenance, Assembly etc. hence new VR/AR tools
- NVIDIA Holodeck
- IMPROOV - VR Teleconferencing Software for CAD teams





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