

3D Printers, an introduction.

By Chris Scarlett

The Inventors

- Coined as “Additive Manufacturing”
- Development started in the 1970s and 80s
 - Ross Housholder filed the first patent in 1979 but it was never commercialized.
 - Chuck Hull, who founded the company 3D Systems is credited with the invention of the first commercial 3D printer in 1986
 - The company developed the Stereolithography (SLA) format for printing
 - Carl Deckard, almost concurrently, developed the Selective Laser Sintering (SLS) method for printing in 1986.



The Processes (the more common ones):

- SLA, Stereolithography
 - Uses photopolymers (plastics that change properties (hardens) when exposed to certain wave lengths of light)
- SLS, Selective Laser Sintering
 - Fabricates using thermoplastics, metal and ceramic powders
 - Can make objects in a variety of materials
- FDM, Fused Depositional Modeling
 - Fabricates using thermoplastics and eutectic metals initially molten then harden at room temperature
- LOM, Laminate Object Manufacturing
 - Uses thin layers of materials, laser cuts then fuses the layers together
- Other methods also exist and are frequently developed by various companies



Printers, Manufacturer's and \$\$

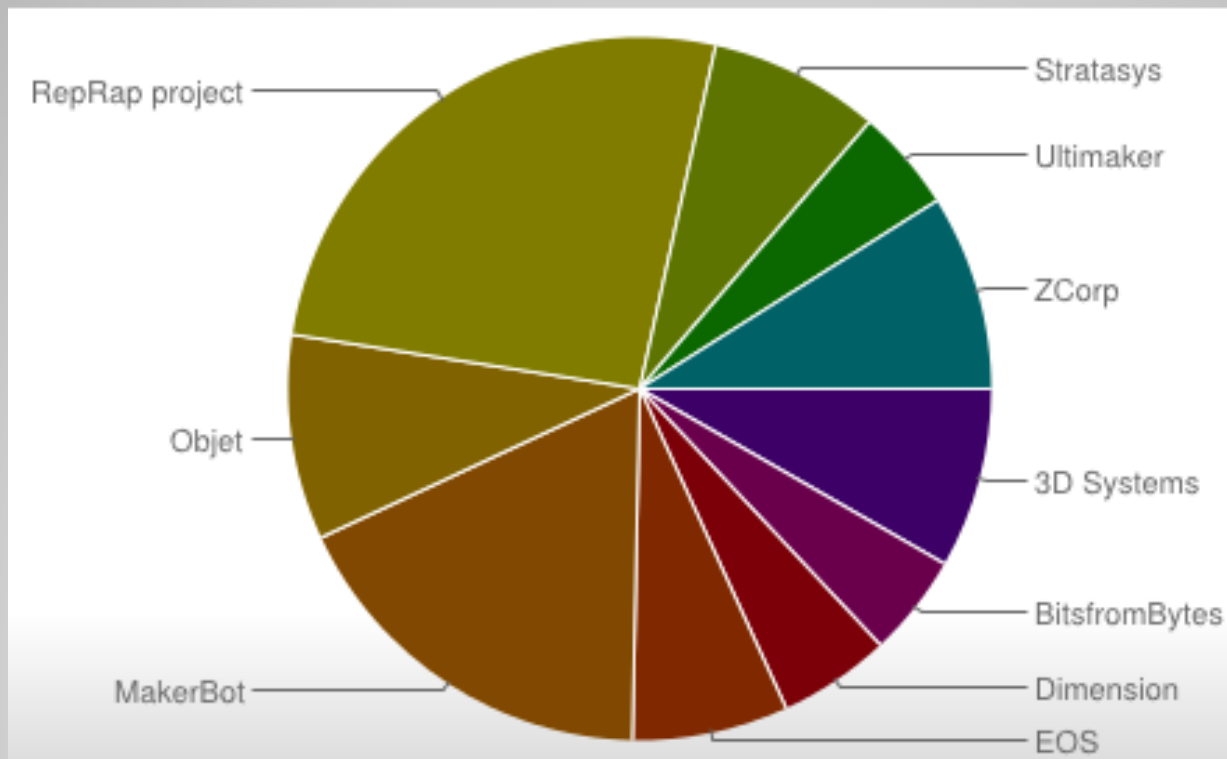
- SLA, Stereolithography
 - Large and small printers, can fit on a desktop, very fine detail
 - Objet Printers starting at ~ \$20,000
- SLS, Selective Laser Sintering
 - Large (small room), low volume, high detail parts, various materials
 - 3D Systems ~ \$100,000 and more?
- LOM, Laminate Object Manufacturing
 - Small printer, can fit on a desktop, moderate detail
 - SolidO ~ \$3,000
- FDM, Fused Depositional Modeling
 - Getting smaller all of the time, can now fit on a desk top, moderate detail but inexpensive, growth area with many manufacturers
 - Dimension ~ \$9-20,000, MakerBot ~ \$1,800, UP Start Plus ~ \$1700, Ulimaker ~ \$1800, RepRap ~ \$500-\$600 (build your own from a kit)



The Printers, Companies and \$s

- Various companies and their market share

Which printers (which manufacturer) have you used?



The Printers, Companies and \$\$

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Watch a video of how the Laser Sintering Process works

Watch a video of the sPro™ SLS 3D Printer

Images (click on thumbnail to view a larger image):

Log in / create account

PRINTERS

- Stereolithography (SLA®)
 - ProJet™ SD 7000
 - ProJet™ HD 7000
 - ProJet™ MP 7000
 - ProJet™ SD 6000
 - ProJet™ HD 6000
 - ProJet™ MP 6000
 - iPro™ 9000
 - iPro™ 9000 MP
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This category contains Ultimaker kits that you can assemble yourself.

2 Item(s) Show 9 per page

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Community Poll
What is the best property of a perfect 3D printer?

- It's fast and accurate!
- It's open source!
- It's affordable!
- Large build volume!
- Easy to use!
- Reliable, low-maintenance operation!

cturing machine.
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unity portal and New
Use the links below
translated into other

Project started the
sed 3D printer among

used?

- Stratasys
- Ultimaker
- ZCorp

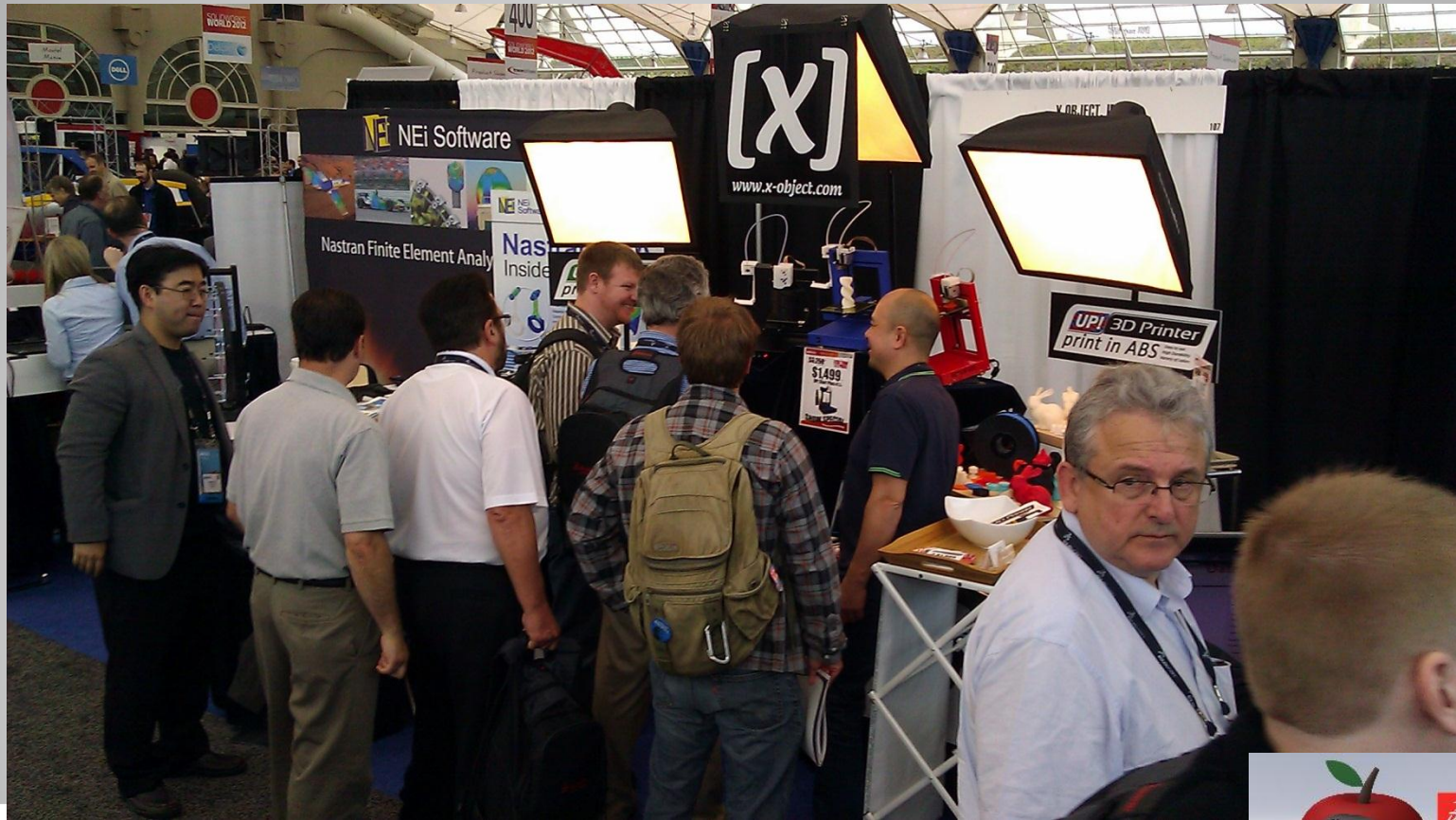
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Upon completion of your purchase through PayPal, you will receive a confirmation email from the UPI USA Store (1-2 days). This confirms that your order has been received. Once your order ships, depending on lead times, you will receive a delivery confirmation and tracking number for your order from either UPS or USPS.

The Printers, Companies and \$s

- The Up Start Plus at SWW 2012



The MakerBot vs Dimension

- Inexpensive
 - 88% less, filament material is about half price
- Smaller machine
 - 20 pounds versus about 200 plus pounds, 30% of the volume, open printer rather than an enclosed oven
- Printing Processes
 - Once printed no need to dissolve support material
 - Similar resolution although without the dissolvable material it can be inconsistent especially when it starts
- This new direction causes some headaches
 - Without the enclosure large parts some times begin to separate
 - Breakaway support material is hard to remove
 - Resolution suffers without the support material
 - Molten plastic is hard to control



The MakerBot Printing

- The Stitz Stool Part

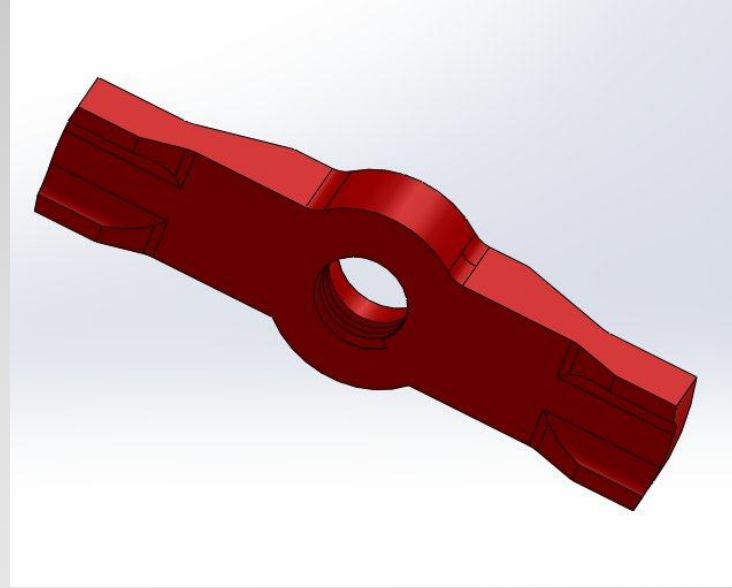
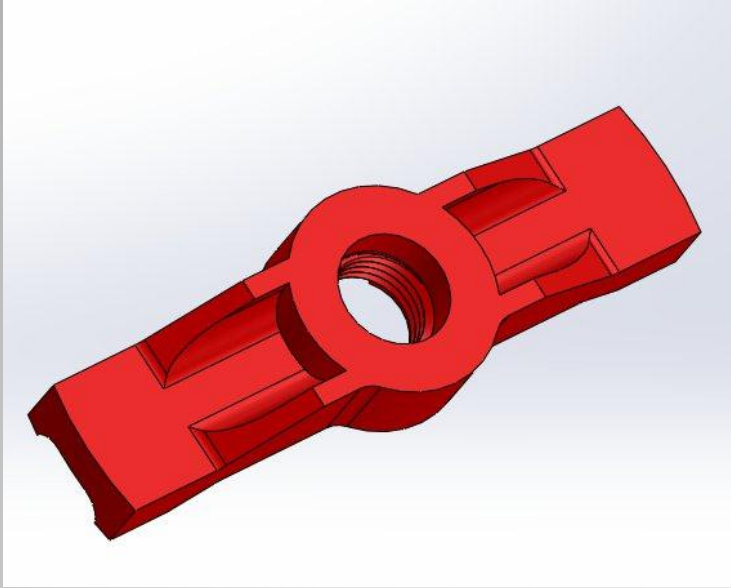


A screenshot of an Amazon product page for the Wilkhahn - Stitz Stool. The page shows the product name, price (\$819.00), and a 'Visit this Site' button. It also features a 'Product Ads from external websites' section with two other stool products: ZuoMod Escape Counter Stool and Hausmann Hand Controlled Air-Lift Stool. The page includes the Amazon logo, search bar, and navigation links.



The MakerBot Printing

- The Stitz Stool Part



The MakerBot Printing

- The Stitz Stool Part

The screenshot shows a web browser window displaying the 2modern website. The URL is www.2modern.com/designer/Wilkhahn/Wilkhahn-Velas-Stool. The page features the 2modern logo and navigation menu. A banner for a Labor Day Sale is visible. The main product is the Wilkhahn - Velas Stool, priced at \$1,049.00. The page includes a product image, a 'Zoom' button, and social media sharing options. The right side of the page shows the price, a 'Fabric Color' dropdown menu, a quantity selector, and an 'Add to Cart' button. Shipping and availability information is also provided.

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Wilkhahn

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*Fabric Color

Qty: **Add to Cart**

Shipping: FREE SHIPPING! Add to 2Modern Registry

Availability: This item ships in approximately 8-10 weeks.

feedback
save 5%



Helpful Links:

- [Robert's Blog on the invention of 3D printing](#)
- [Wikipedia on 3D printing](#)
- [US patent on Charles W. Hulls SLA printer](#)
- [US patent on Carl R. Deckard SLS printer](#)
- [3DSYSTEMS Printers SLA, SLS](#)
- [Objet Printers](#)
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