

# 3D Printing at Darien Library

John Blyberg & James McNutt

@jblyberg

@jmcnuttcase

[jblyberg@darienlibrary.org](mailto:jblyberg@darienlibrary.org)

[jmcnutt@darienlibrary.org](mailto:jmcnutt@darienlibrary.org)

About Us



# Darien Library

# Darien Library

- 45 minutes north of NYC
- ~20,000 residents
- 1 Branch
- Association library
- New construction (2009)

# Designing, Slicing and Printing

# Cathedral Video

# Computer-Aided Design

- Blender
- SketchUp
- FreeCAD
- OpenSCAD
- Sculptress
- TinkerCAD
- 123D Design
- 123D Sculpt
- 123D Creature
- Cubify Invent

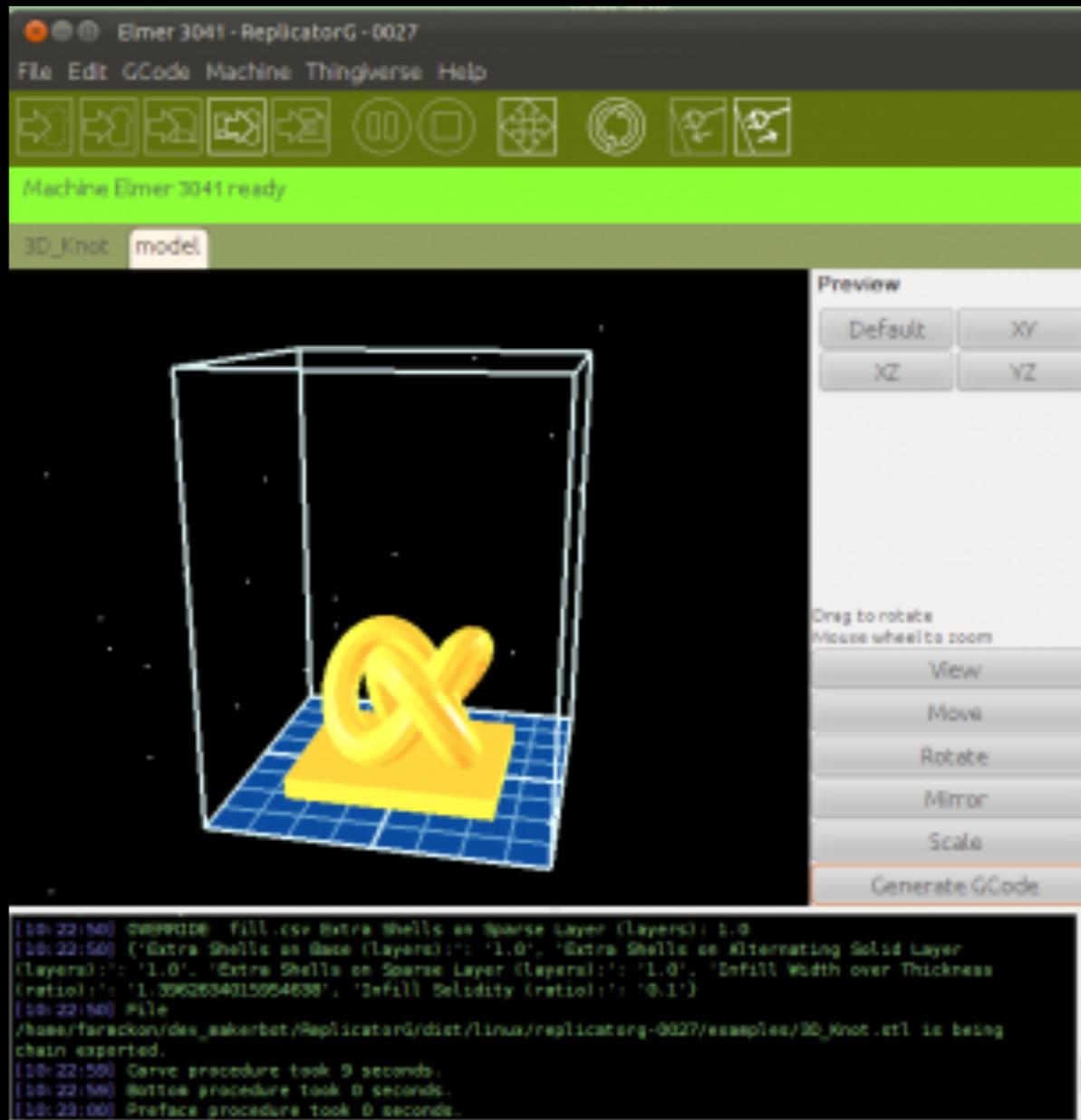
# TinkerCAD Demo

# MeshLab Demo

Thingiverse

# Slicers

- Replicator G
- Slic3r
- MakerWare



# How to Choose a 3D Printer?

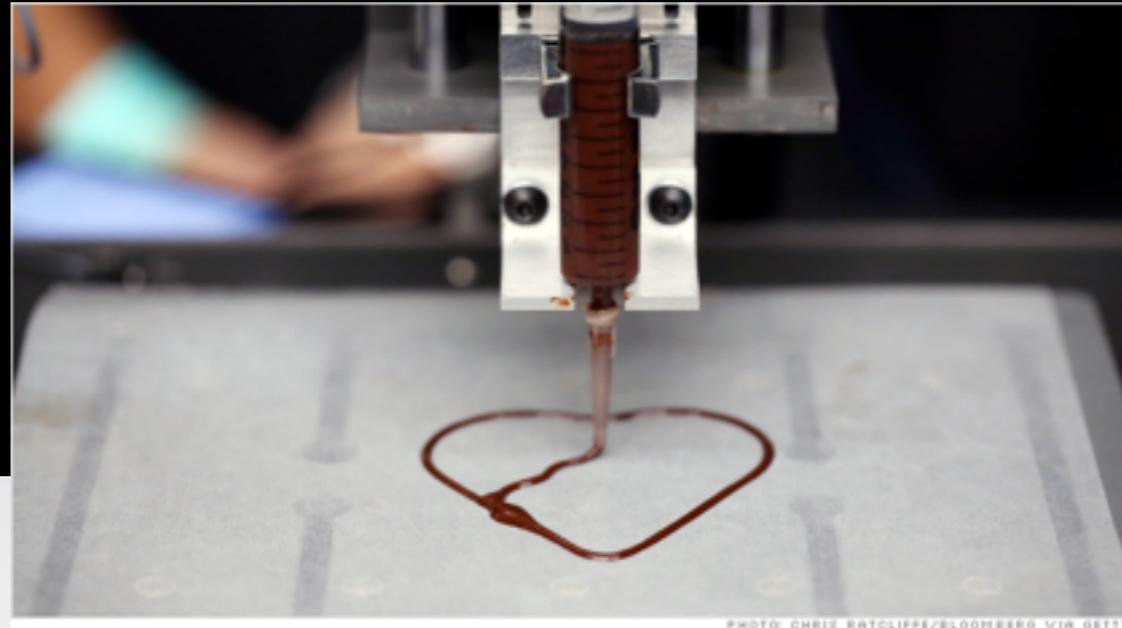
Make just released an article  
comparing 24 printers which  
gives really good  
breakdown

# How to Choose a 3D Printer?

Our experiences

# Materials

- Chocolate
- Sugar
- Polyamide
- Ceramic
- Cement
- Alumide
- Bioplastics
- Cartilage
- Bone
- Gold, Steel, Brass... really just pick a metal



*i.materialise*  
made by 3dsystems

# Consumer Materials

- PLA
- ABS



# Printing Services

# Printing Services

- Shapeways \$19.31
- I.Materialise \$16.59
- Ponoko \$46.45
- Sculpteo \$26.51
- Kraftwurx \$28.96



# History of Personal 3D Printing

- 1986 – First 3D Printing Patent
- 2005 – RepRap (Beginning of personal 3D printing revolution)
- 2009 – MakerBot founded
- 2012 – Fully assembled models



# Additive Manufacturing

1986

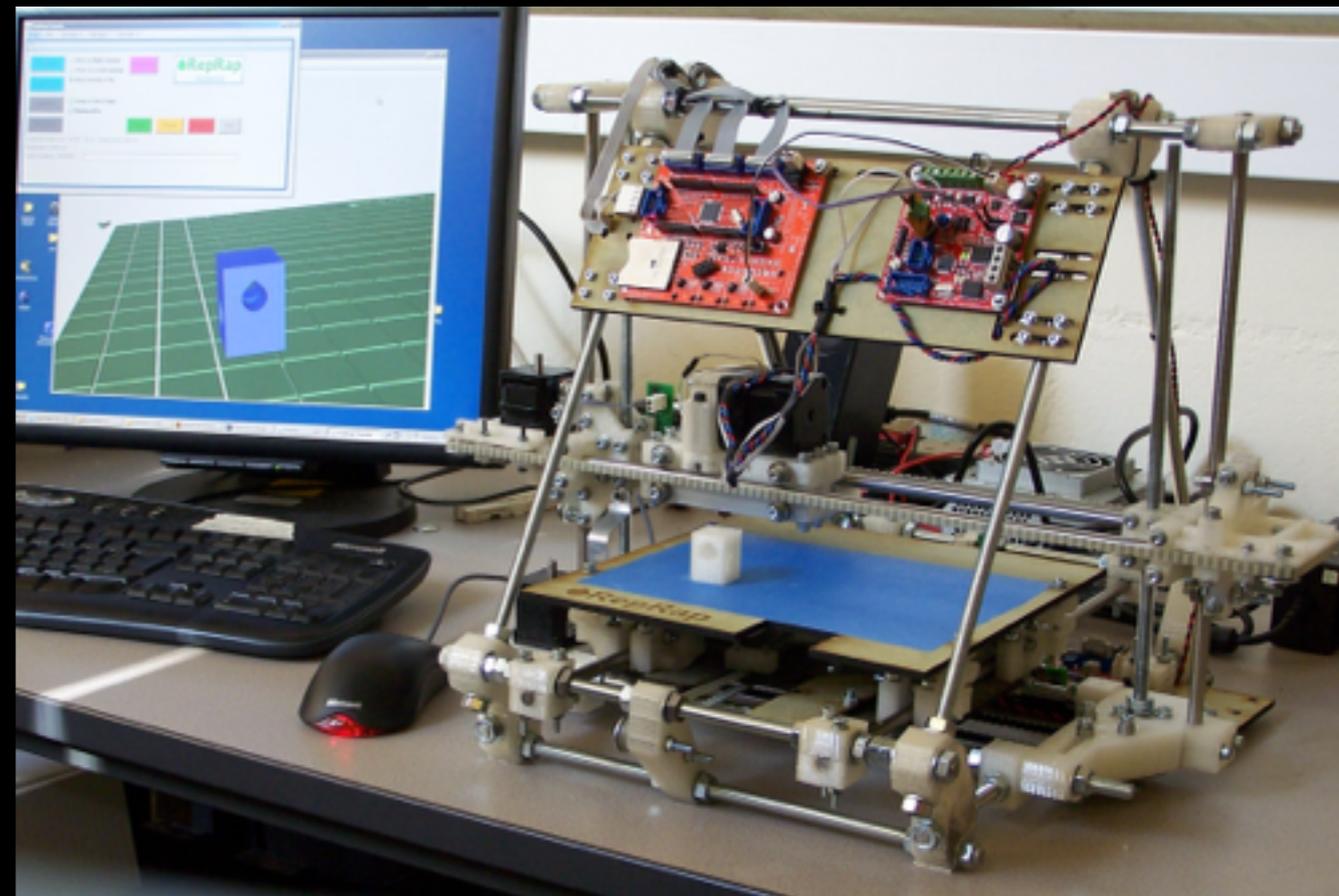
Charles Hull  
founds 3D Systems



# RepRap

2005

The goal was to create a machine that could replicate itself.



# MakerBot Cupcake

2009

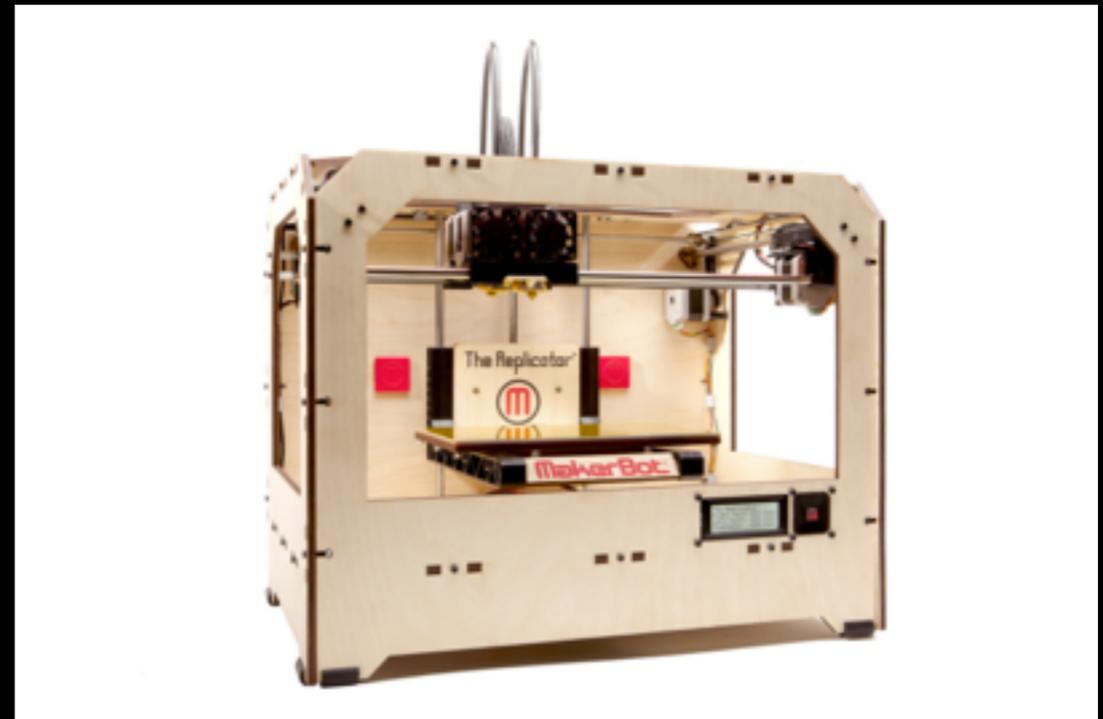
MakerBot Cupcake came in  
a kit that could be  
assembled in a few hours.



# MakerBot

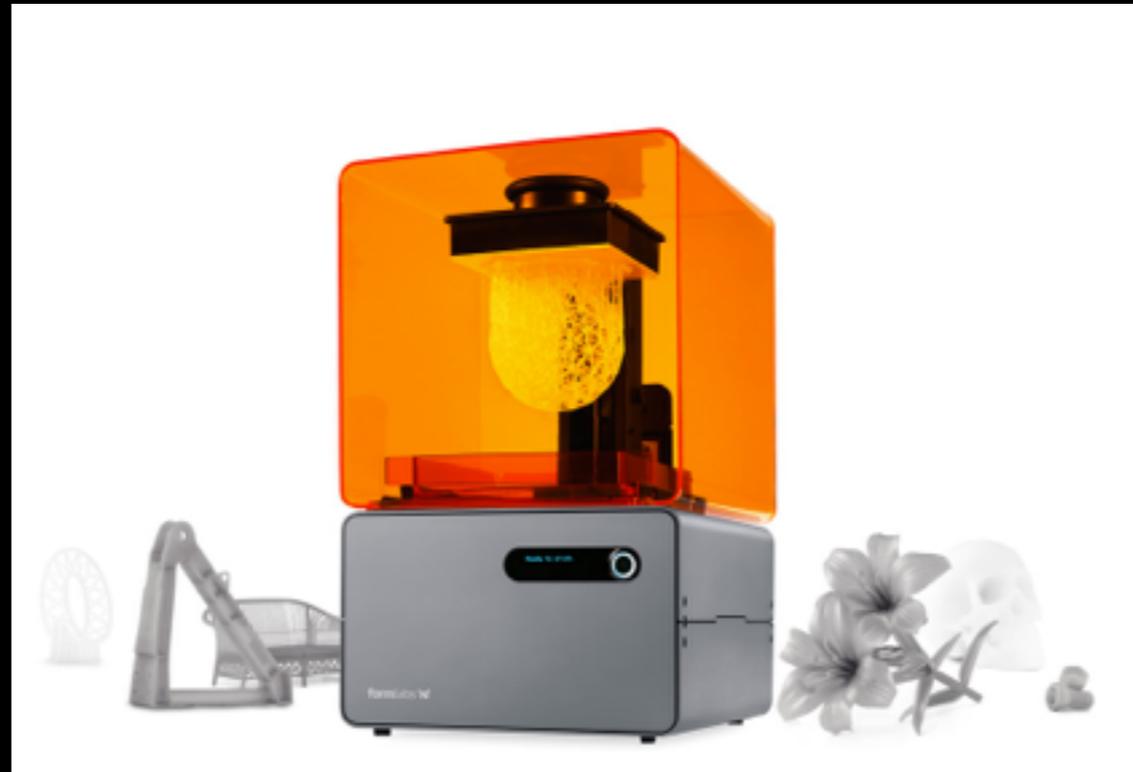
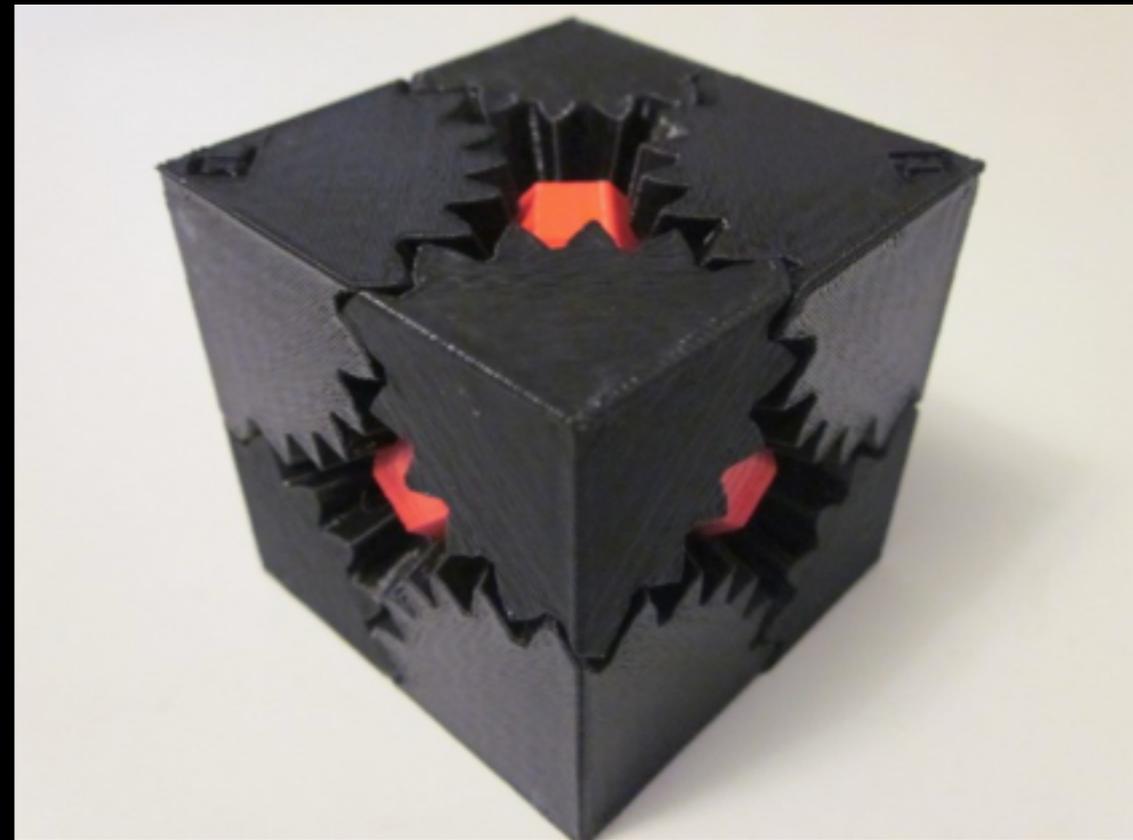
2012

Fully assembled 3D printers  
...and lots of them.



# Now

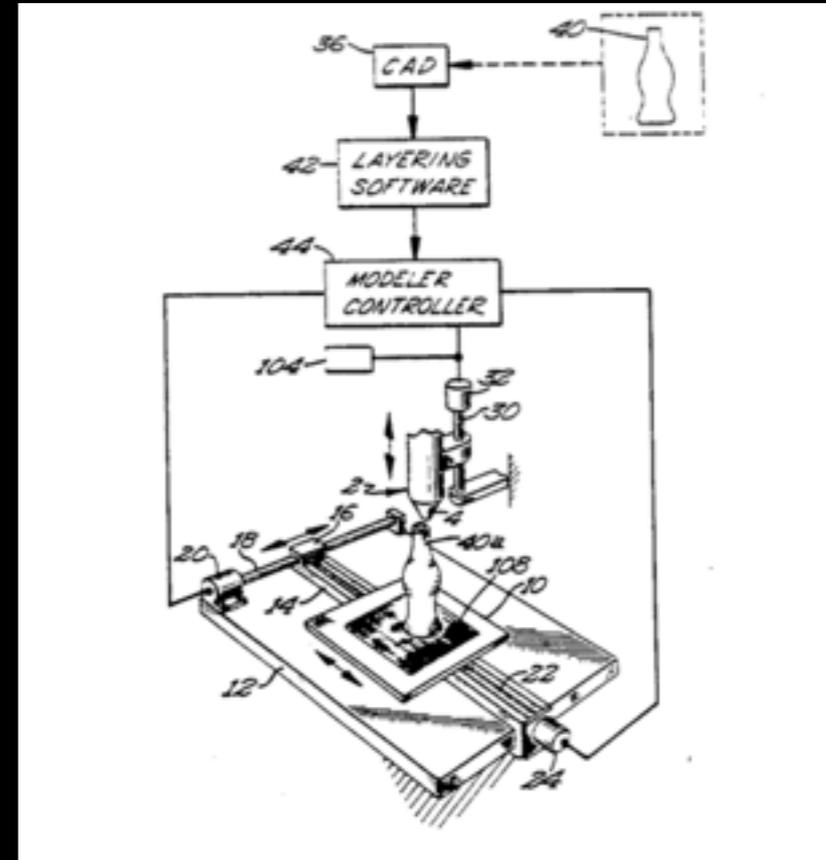
3D Printing still favors the enthusiast who has time to figure out the quirks of her machine



# Types of 3D Printers

# Fused Deposition Modeling

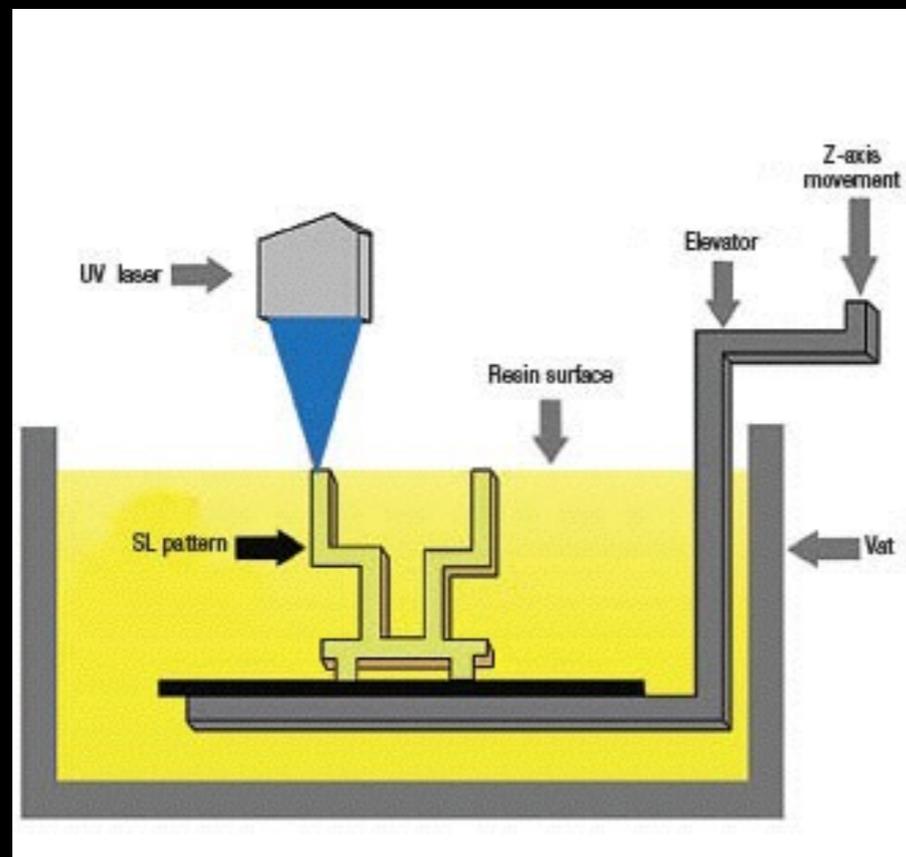
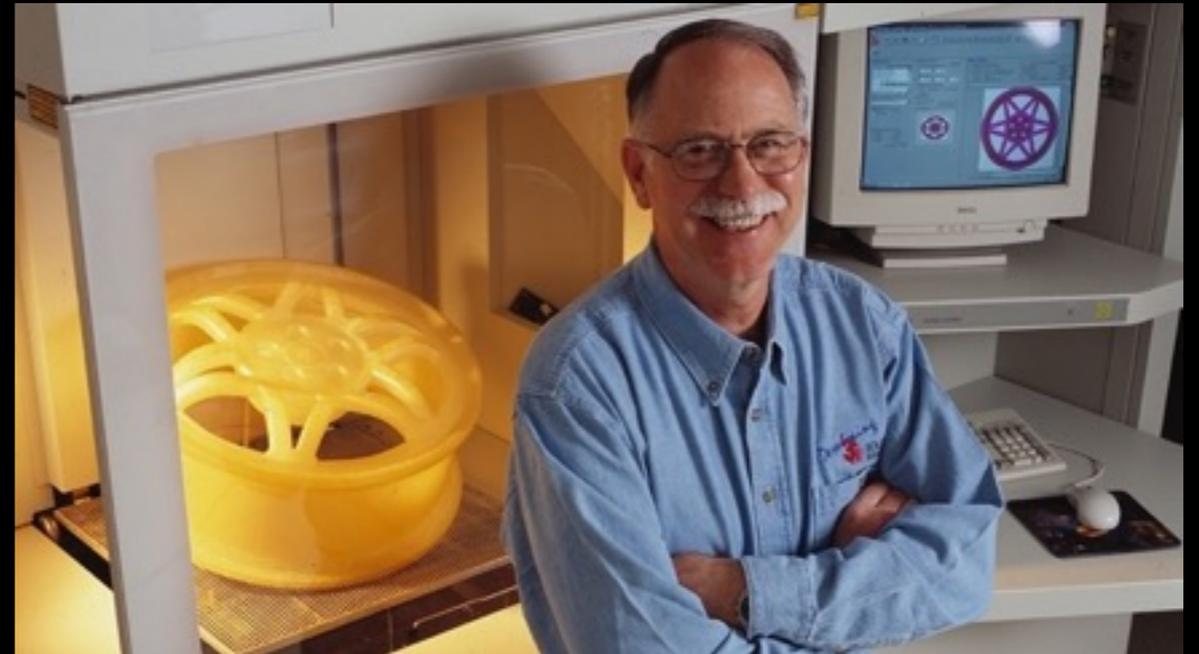
The printing method more commonly referred to as Extrusion Deposition was patented by S. Scott Crump in the early 1990s.



Fused Deposition Modeling's (FDM) simplicity of design and relatively low materials-cost, in conjunction with RepRap's open-source and collaborative effort begun in 2005, help explain both the recent 3-D printing boom and the availability of desktop models at your local public library.

# Stereolithography

Patented by Charles Hull in 1986, stereolithography (or SLA) creates a 3D object through a photopolymerization process – essentially, curing a liquid resin with a UV laser.

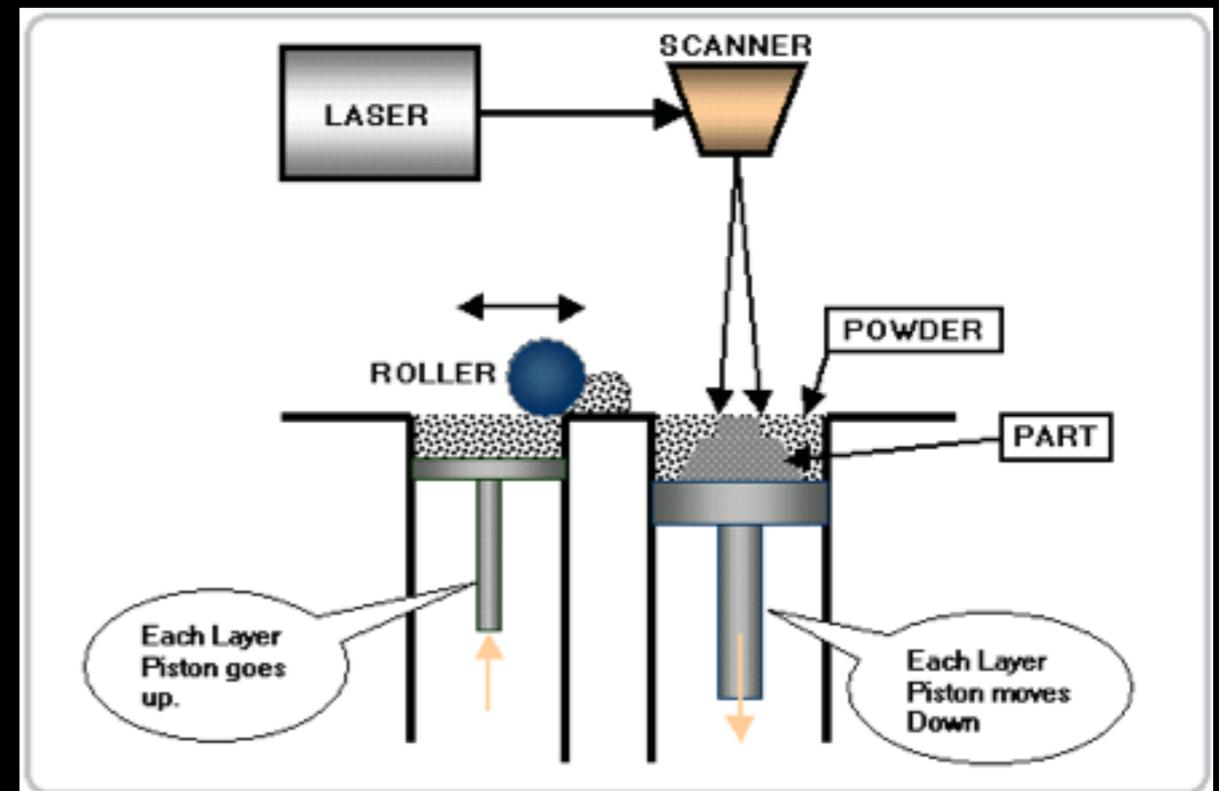


An advantage of stereolithography, as with many additive manufacturing processes, is its speed. The high cost of the machines themselves, as well as of the resin, make it a somewhat impractical method, however.

# Granular Materials Binding

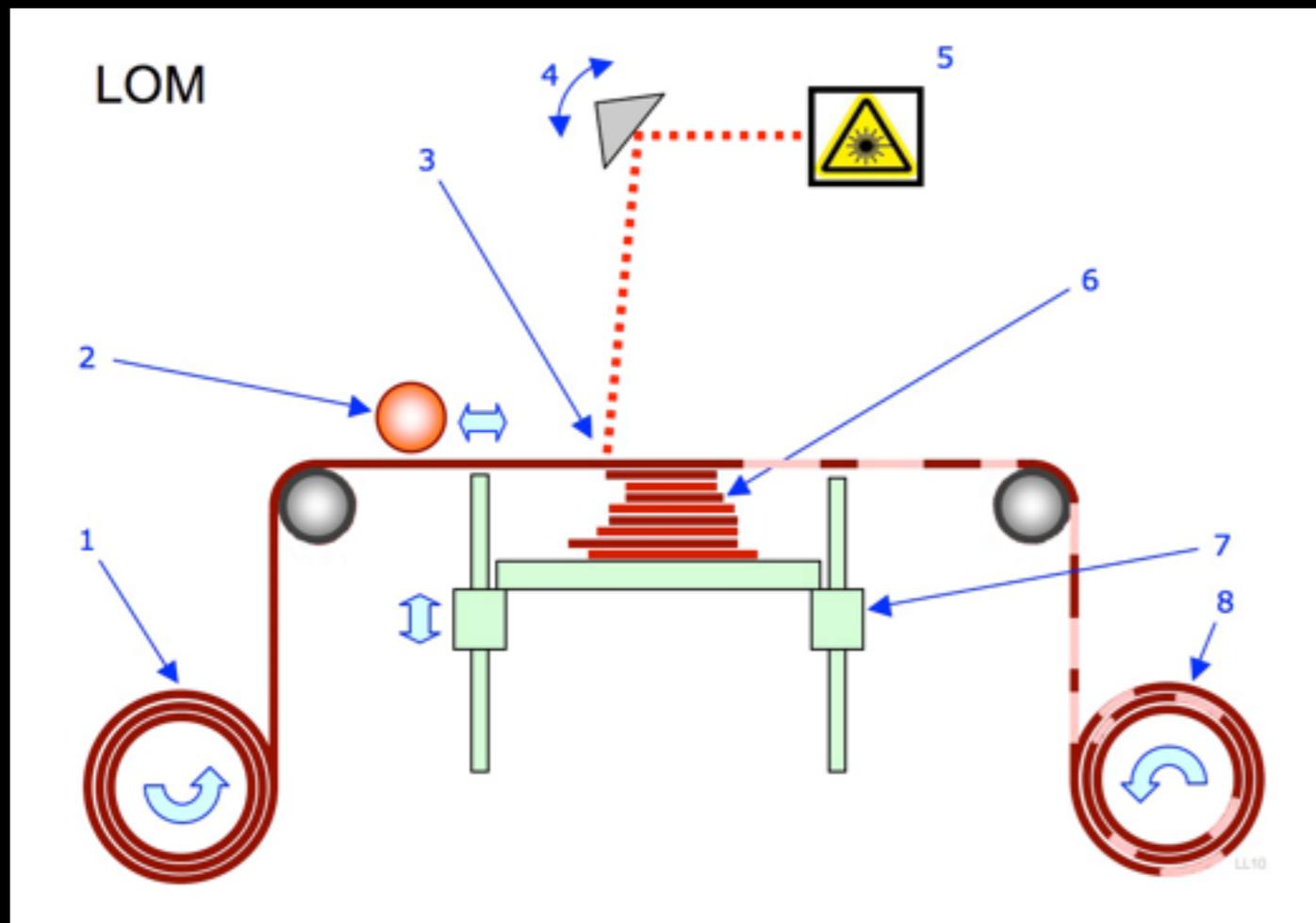
Selective Laser Sintering (SLS), Selective Laser Melting (SLM) and Electron Beam Melting (EBM)

Selective Laser Sintering was first developed and patented by scientists at the University of Texas-Austin in late the 1980s. SLS is capable of printing in a variety of materials, including metal alloys, ceramics and polymers like nylon, and does not require the support structures most other methods do.



Selective Laser and Electron Beam Melting, unlike sintering, fully melt the granules during binding, creating a denser final product; though the technology is more recent, EBM in particular has found a place in the medical field, in the manufacture of titanium orthopedic implants.

# Laminated Object Manufacturing



Patented by Helisys, Inc. in 1998, Laminated Object Manufacturing (LOM) layers the build material – paper, plastic and even metal – cutting according to the object's file and then adhering those layers together. Though 3D printing is generally considered an additive manufacturing process, LOM shows some characteristics of traditional subtractive methods.

# 3D Scanners



# Digitizer Demo

# 3D Printing and Copyright Infringement

“The wrong questions is,  
‘Will 3D printers be used to infringe...?’  
The right question is,  
‘Whose problem will it be?’.”

*–Cory Doctorow (Make)*

# Legal Precedent

- 1976 – Sony sued for VCR
- 1984 – Betamax Rule
- 1998 – Digital Millennium Copyright Act
- 2000s – Napster
- 2005 – Inducement

**WE INVENTED THE COMPETITION.**

**Beta before. Beta now. Beta later.**

Our commitment to the Beta format is as strong as ever and the Beta format is stronger than ever. In addition to the 2.7 million Beta VCRs already sold, we expect over two million new Beta customers in 1984.

Beta is growing because Beta has the answer:

- Betamax™ the world's first one-piece VCR/camera combination, a first ground control, selling as fast as we can make them. Betamax offers great customers "one and done" simplicity using a standard Beta cassette for up to 5 hours and 20 minutes\*\* of recording with no adapters and nothing to lug around.
- Beta Hi-Fi™ the first stereo VCR to bring concert hall multi-quality into the home. The open price is Beta Hi-Fi's superperformance. It's the breakthrough. The very best stereo cassette decks, even our hi-end tape recorders—everything from the latest digital audio equipment. Right now, over 400 movies and music video programs are available in Beta Hi-Fi stereo cassette and especially all new releases will be offered in Beta Hi-Fi.
- Only Beta offers VCRs with the latest technology at prices that are now more attractive than ever.
- Model for model, all Beta VCRs provide remarkably better video, better audio, better function controls and the latest advances in styling.

There's even more Beta equipment on the way, more new ideas from the Beta makers that will mean an even greater opportunity to sell more Beta and make more money.

Adding Beta has never been easier. Now all you have to do is do it.

**theBetaMakers**

**SONY**  
THE ONE AND ONLY

©1984 Sony Corporation in America. Beta, Betamax and Betamax are trademarks of Sony Corp.  
\*\*Hi-Fi Stereo Cassette Deck. Beta Hi-Fi Hi-Fi Stereo Cassette Deck.

# Dissuading Investment

While to-date no investors  
have been held responsible,  
law suits have stymied  
investment.

# The Cutting Edge

Medicine

# Robohand

Richard Van As

Lost four fingers while operating  
woodworking machinery

Designs available on  
[thingiverse.com](http://thingiverse.com)

[robohand.net](http://robohand.net)



# Tracheal Splint

Designed to support underdeveloped trachea

Made of bioplastic the body will absorb.

University of Michigan



# Joint Cartilage Scaffold

Structures on which cartilage can grow for treating osteoarthritis and injuries



University of Wollongong

# Organ Models

Operate before operating



University of Iowa

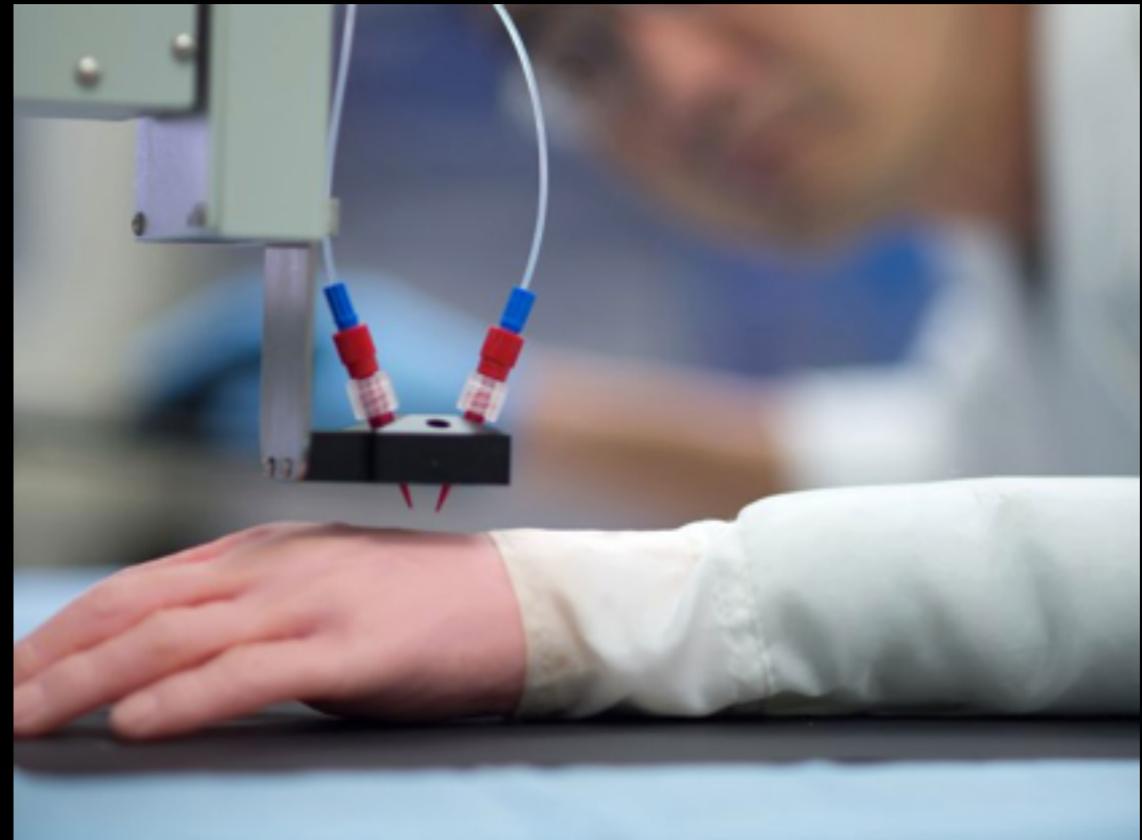
# Bone Implants



Oxford Performance  
Materials' OsteoFab

# Skin

Using inkjet cartridges to deposit dermal and epidermal skin cells on burn wounds



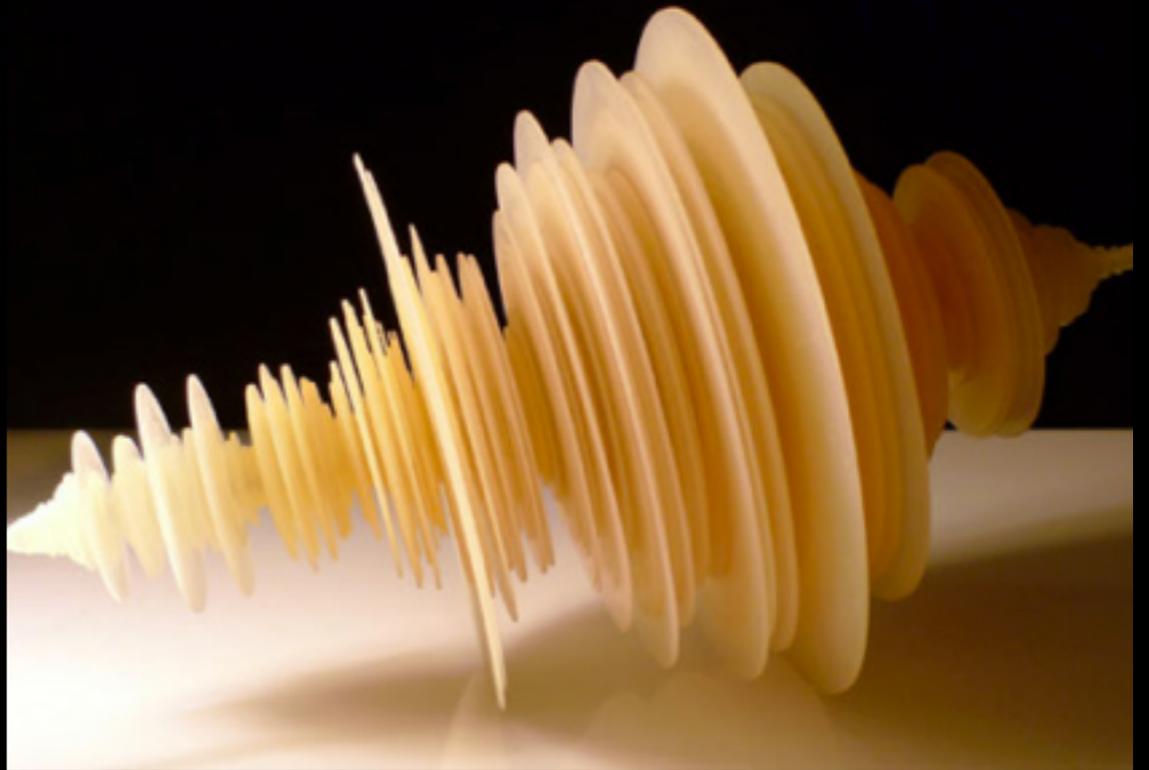
# Andrew Reynolds

Ezra designs and prints prostheses for his son at the public library,

allowing him to give his son “independence” and change his outlook from “I can’t to I can.”



Art



Engineering

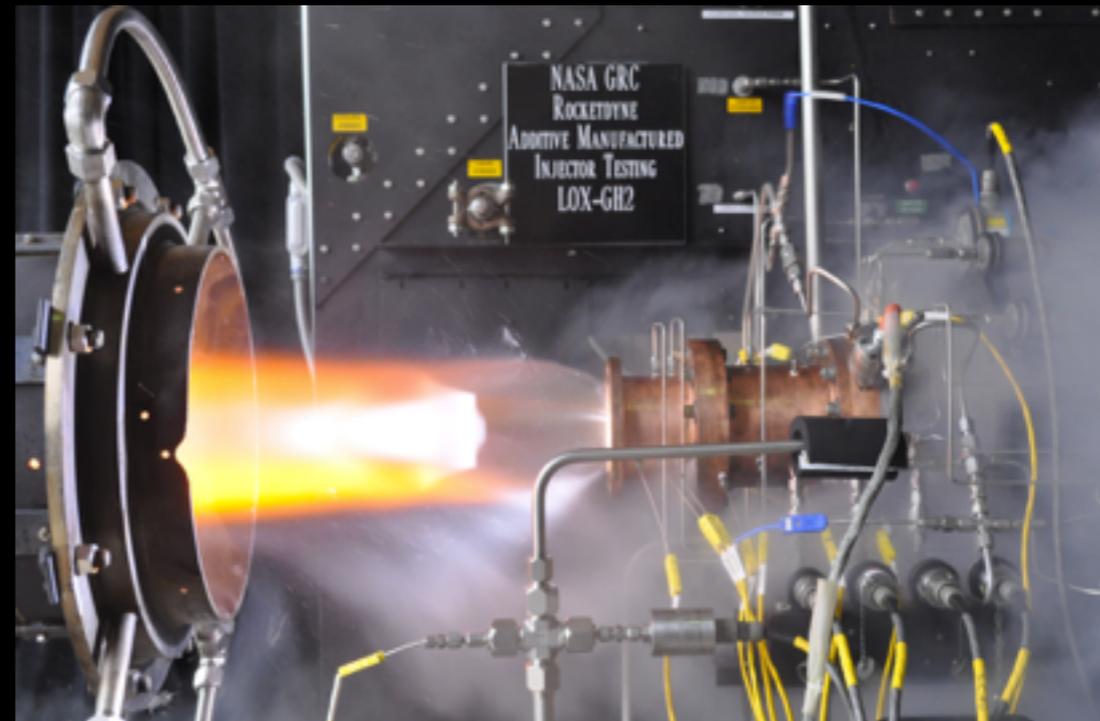
# NASA

Ratchet Wrench printed on  
the ISS



# NASA

Nickel-Chromium alloy rocket injectors



[makezine.com/go/  
rocketinjectors](https://makezine.com/go/rocketinjectors)

# ORNL

Big Area Additive  
Manufacturing

Shelby Cobra



# Cost Effective Prototyping

Business

# GIG TANK™

MAY 12 - JULY 31, 2014 | CHATTANOOGA, TN

A 3D isometric cube logo with an orange top face, a blue front face, and a grey right face. The letters '3D' are printed in a bold, grey, sans-serif font directly below the cube.

Brought 13 teams to  
Chattanooga, TN to further  
develop their additive  
manufacturing businesses

Working to build  
manufacturing facilities.

# Feetz

Custom shoes that conform to your foot from a few pictures.



## HOW IT WORKS

We make custom fit, 3D printed shoes just for you. Available soon!



### STEP ONE

Take three photos of each foot using the Feetz App.



### STEP TWO

Design and personalize your Feetz to fit your style.



### STEP THREE

Using the 3D model of your feet, we will make you a pair of custom fit shoes.

Practicality

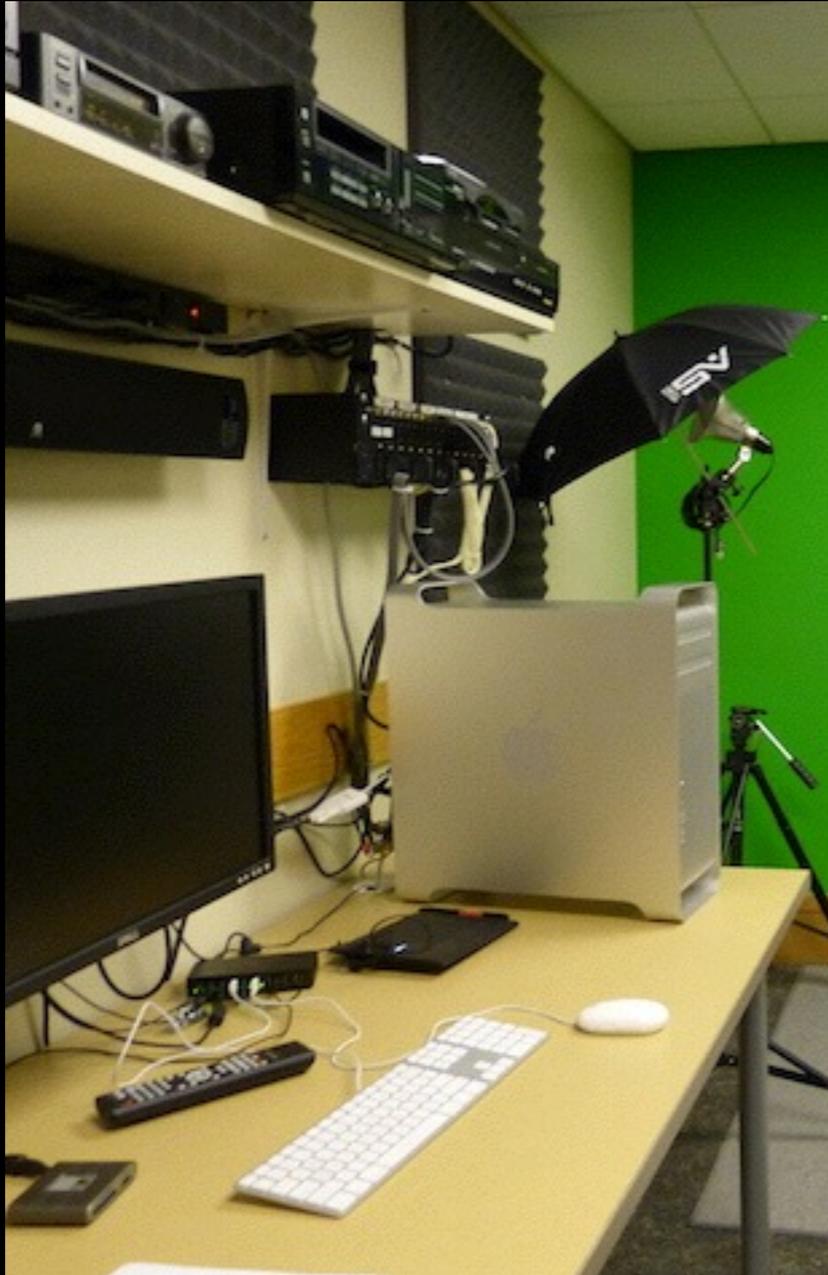
# Digital Media Lab



# Darien's Digital Media Lab

- Commodity vs. specialty computing
- Heavily focused on analog to digital conversion
- Provides professional-level tools to users
- May be reserved for two-hour time blocks
- Staff instruction is available

# DML vs Maker Space



# Maker Spaces

## Pros

- Strong interest
- Existing expertise
- Versatile
- Fun
- "Active"
- Less Expensive
- High profile/visibility

# Maker Spaces

## Cons

- Alignment with library's mission is not immediately apparent
- Can be messy
- Achieving sustained usage can be a challenge
- Materials are an ongoing expense
- Safety and liability are considerations

# Digital Media Labs

## Pros

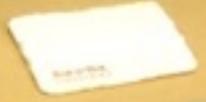
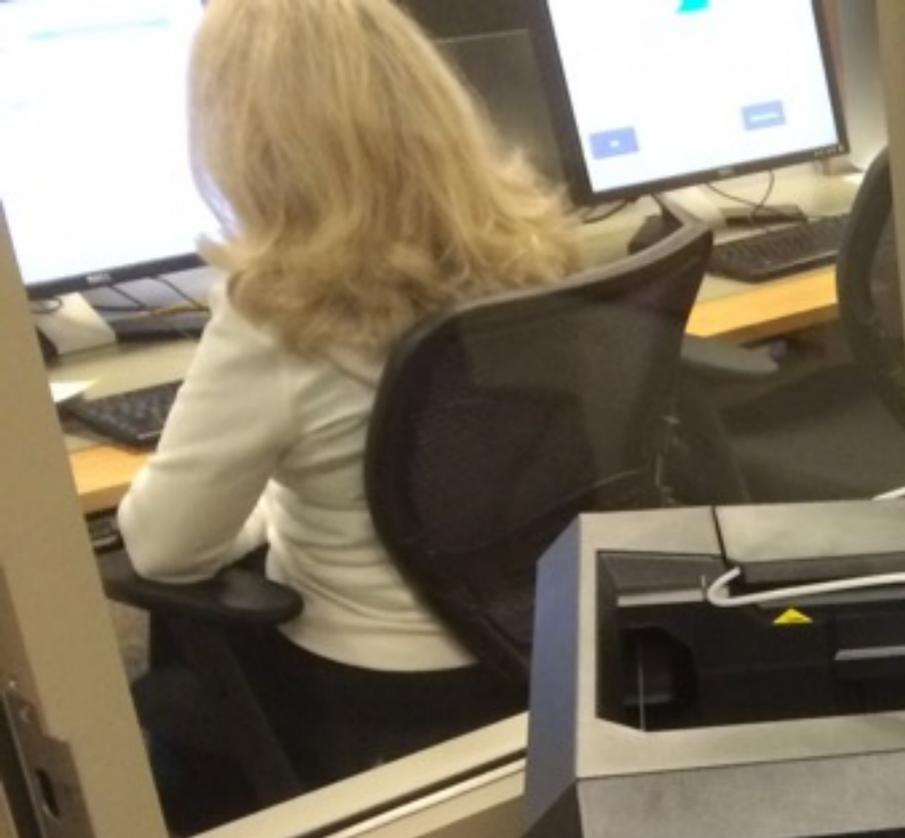
- Can leverage existing technology expertise
- Can piggyback on existing infrastructure & service models
- More apparently in-line with the library's mission
- Broader demand among library users
- Practical application for local businesses

# Digital Media Labs

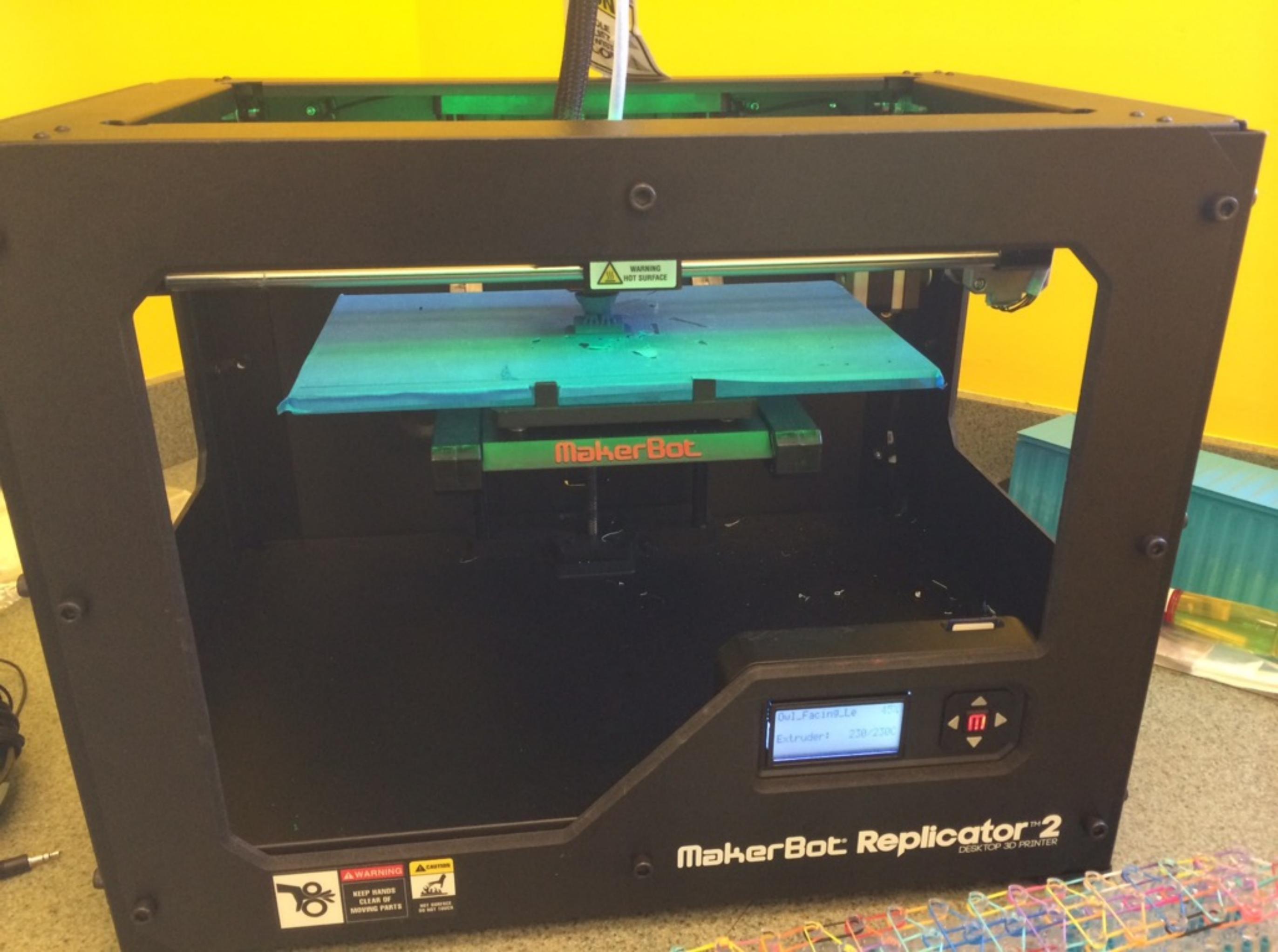
## Cons

- More expensive
- Requires high-level technical expertise
- More intensive training for staff
- More ongoing one-on-one work with users
- Equipment failure and replacement create ongoing costs

Budget?



Staffing?



WARNING  
HOT SURFACE

MakerBot

Obj\_Facing\_Le 45%  
Extruder: 230-230C



MakerBot Replicator™2  
DESKTOP 3D PRINTER

WARNING  
KEEP HANDS  
CLEAR OF  
MOVING PARTS

CAUTION  
HOT SURFACE  
DO NOT TOUCH

Safety?

Policy?



Education?



Several informational cards or posters are pinned to the wall behind the desk. One card has the heading "What's behind this screen?" and another has "TECH AND CODE".



TECH AND CODE  
TECH CHALLENGE  
Make a game using the iPad and...  
...graphics, audio, drawings to...  
...something that's responsive...  
to your life.

TECH AND CODE  
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Make a game using the iPad and...  
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