



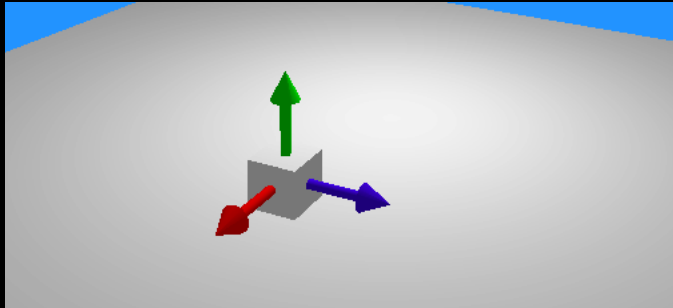
# INTRO TO 3D PRINTING

# WHAT IS 3D PRINTING?

Additive manufacturing process that creates a **physical object** from a **digital design** by adding material layer by layer

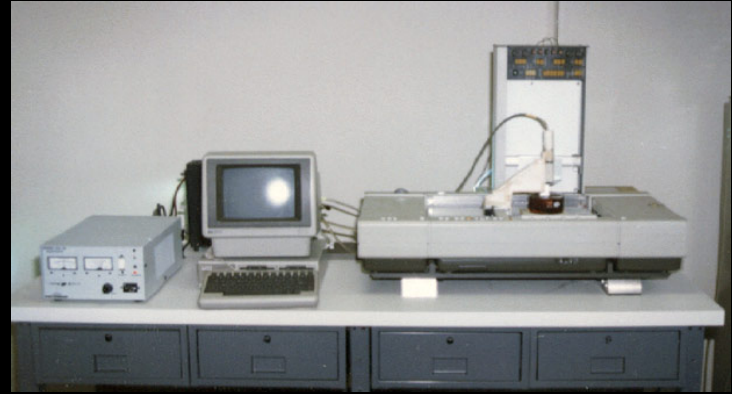
Design + 3D Printer = 3D Object

# 3D OBJECT



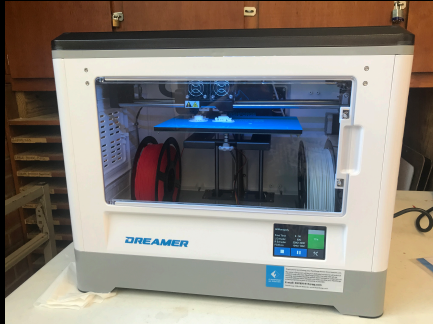
- Width, Length, Height
- X-axis, Y-axis, Z-axis
- Front View, Side View, Back View
- Top View, Bottom View

# How old is 3D Printing?

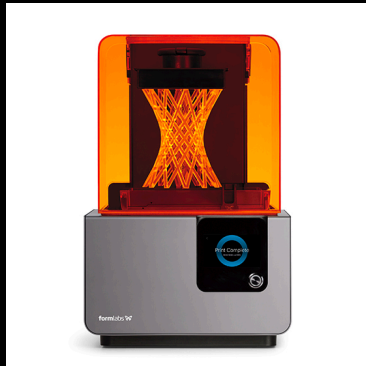


- First patent filed in 1980 by Dr. Kodama for rapid prototyping.
- In 1983, Chuck Hull created the first 3D printer capable of printing an actual part.

# Different Types of 3D Printers



- FDM – Fused Deposition Modeling
  - What we will be using at SAA
  - Uses a heated extruder



- SLA – Stereolithography
  - Laser into a pool of photo liquid polymers that hardens it

# Applications of 3D Printers

- Rapid Prototyping
- Additive Manufacturing
- Industrial
- Medical
  - Braces, Shoes, Artificial Limbs
- Food
- Art
  - Make Molds for Jewelry, Ceramics, etc
  - Sculpture
  - Game Pieces!

# Different Types of Filament

## Filament is the Material Being Layered:

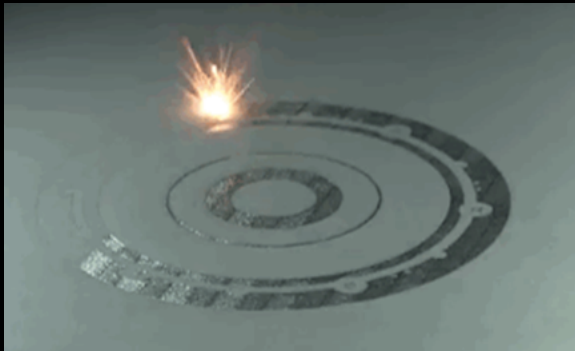
- Plastics
  - ABS and PLA
  - What SAA will use
- Wax
- Wood
- Metal
- Concrete
- Ceramics
- Pancakes!

# PancakeBot





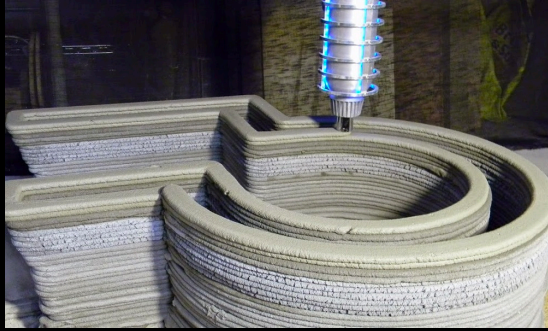
# Example Use



GE Aviation uses **DMLM** or **Direct Metal Laser Melting**.

- It involves melting metal powder layer upon layer.
- Stronger than cutting from a solid block of metal.
- The GE Catalyst, a turboprop jet engine, originally had 855 parts. GE was able to combine them into 12 parts, reducing weight, shortening production time, and improving engine performance.

# Example Use

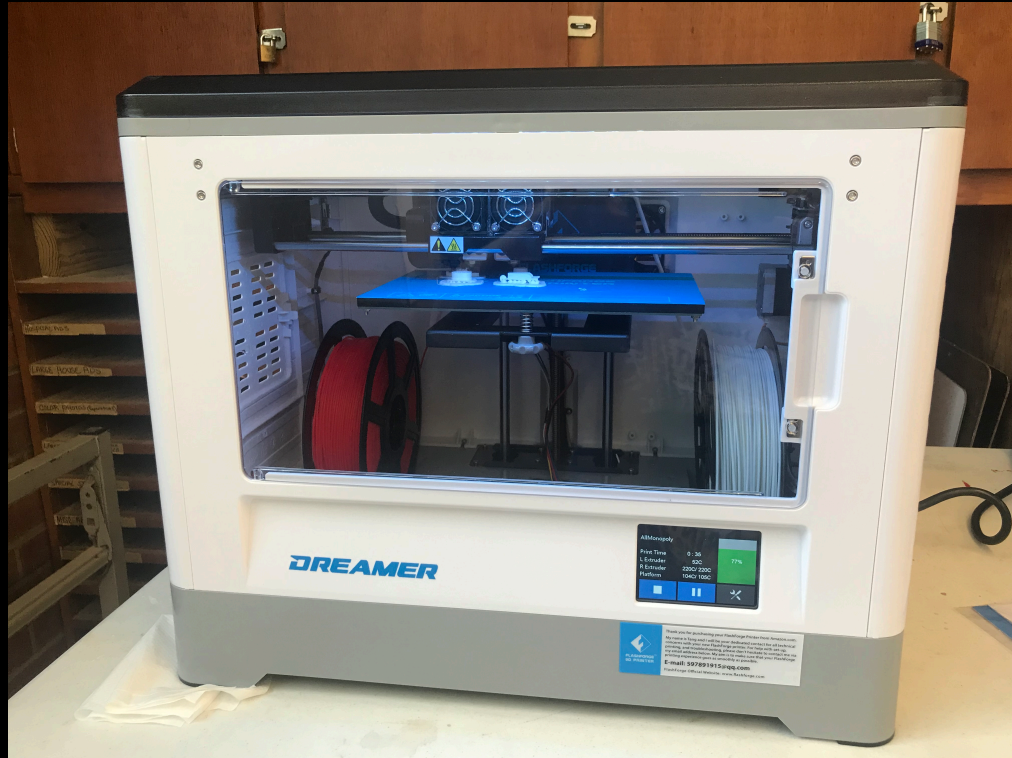


## Army Uses Concrete Printers to Make Offsite Barracks

- Uses composite concrete mix of locally available materials
- Implement additive manufacturing technology directly on the ground increasing efficiency in terms of cost and time



# FlashForge Dreamer 3D Printer



## Parts:

- Nozzle
- Extruders
- Build Platform (Printbed)
- Touch Screen
- Filament
- Front Door
- Top Cover
- Ventilation Fans
- SD Card Port

# Getting Ready to Print

1. Design an object using a CAD (computer aided design) program and save as a .stl (stereolithography) file.
2. Load into a Slicer Program which tells the printer how to layer and build. Save as a .gcode (geometric code) file to print.
3. Take to 3D Printer and Print!

CAD Program → .stl file → Slicer Program → .gcode file → Print

# CAD Software



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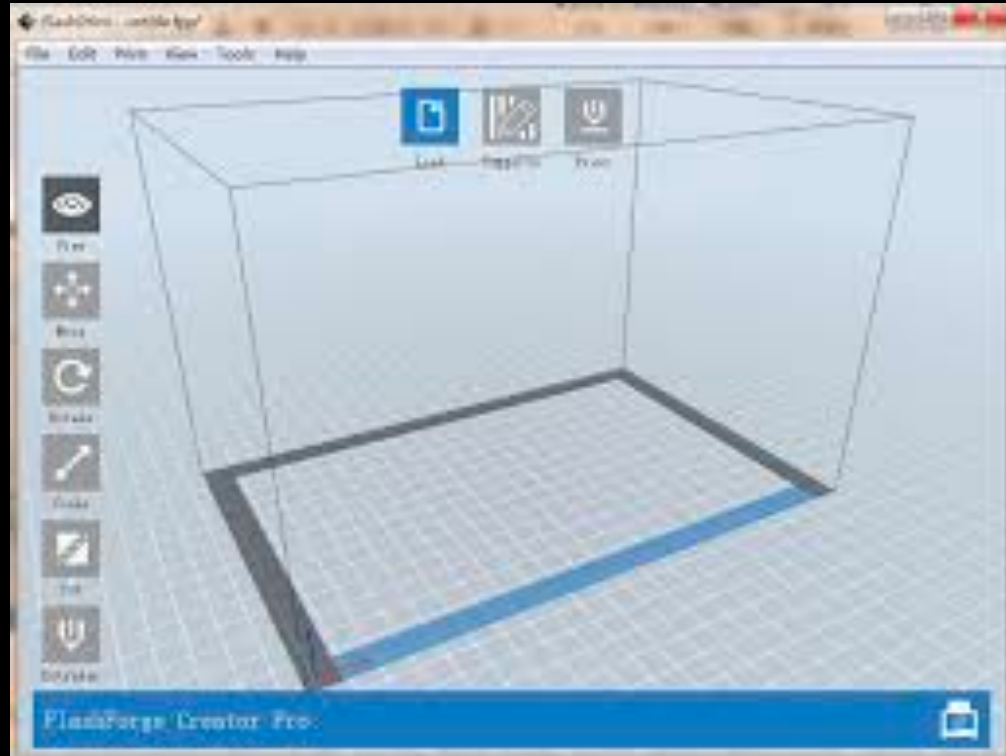
Tinkercad is a simple, online 3D design and 3D printing app for everyone.

Tinkercad is used by designers, hobbyists, teachers, and kids, to make toys, prototypes, home decor, Minecraft models, jewelry – the list is truly endless!

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# Slicer Software



# Design Your 3D Print

1. Create using  or Find a Design:

[www.thingiverse.com](http://www.thingiverse.com)

2. Download to the .stl file(s) to a computer.

3. Load the file to the FlashForge print software, add supports, and save the .gx file to print.

4. Save to an SD card and bring to SAA or email to [mdburke4@gmail.com](mailto:mdburke4@gmail.com).

# SAFETY RULES

- Do NOT touch print nozzle! It is blister worthy hot.
- Do NOT touch print-bed platform, let it cool down before removing the model.
- Door must be closed during printing.
- Top cover must be on during printing.
- Do NOT reach into the 3D printer when the print is operating.
- DO monitor the start of the print to ensure it is properly adhering to the print-bed platform properly. Cancel the print if necessary.
- ONLY use the provided spatula tool to remove the model from the print bed. Keep fingers behind the direction of applied force. Take care not to gauge or scrape the bed.



# PRINTING GUIDELINES

- The 3D printers may be used only for lawful purposes and may not be used to create materials that are:
  - Prohibited by local, state or federal law.
  - Unsafe, harmful, or pose an immediate threat to the well-being of others.
  - Not be used to create weapons of any kind.
  - Obscene, violent, or otherwise inappropriate.
  - In violation of intellectual property rights. For example, the printers may not be used to reproduce material that is subject to copyright, patent or trademark protection.
- The SAA reserves the right to refuse any 3D print request.
- The SAA provides computers with design software however any 3D drafting software may be used to create a design if the file can be converted to a Flashforge Dreamer file format. Designs are also available from file-sharing databases such as Thingiverse.com and Shapeways.com.
- No model will be started which cannot be completed during SAA operating hours.
- Staff will provide a best estimate of the time required to complete a print; however, it is difficult to estimate exact times. Completed models may be picked up by the submitter at the front desk during open hours.
- Items printed from the SAA's 3D printers must be picked up by the submitter within 30 days.
- Procedures governing use of the 3D printers are subject to change.