



Implementing Cost-Effective 3D Printing in a Professional Design Environment

Steve Schain

President, Spectra3D Technologies

www.spectra3d.com

Class summary

This course will explore the process behind developing an in-house 3D printing capability and what the cost/benefits are of doing so. We will look at choosing a printer that fits your budget and needs and, once you settle on a printer, what it takes to maintain it. This course looks at real-world examples and enables an interactive discussion of how you can use 3D printing in your office.

Key learning objectives

At the end of this class, you will be able to:

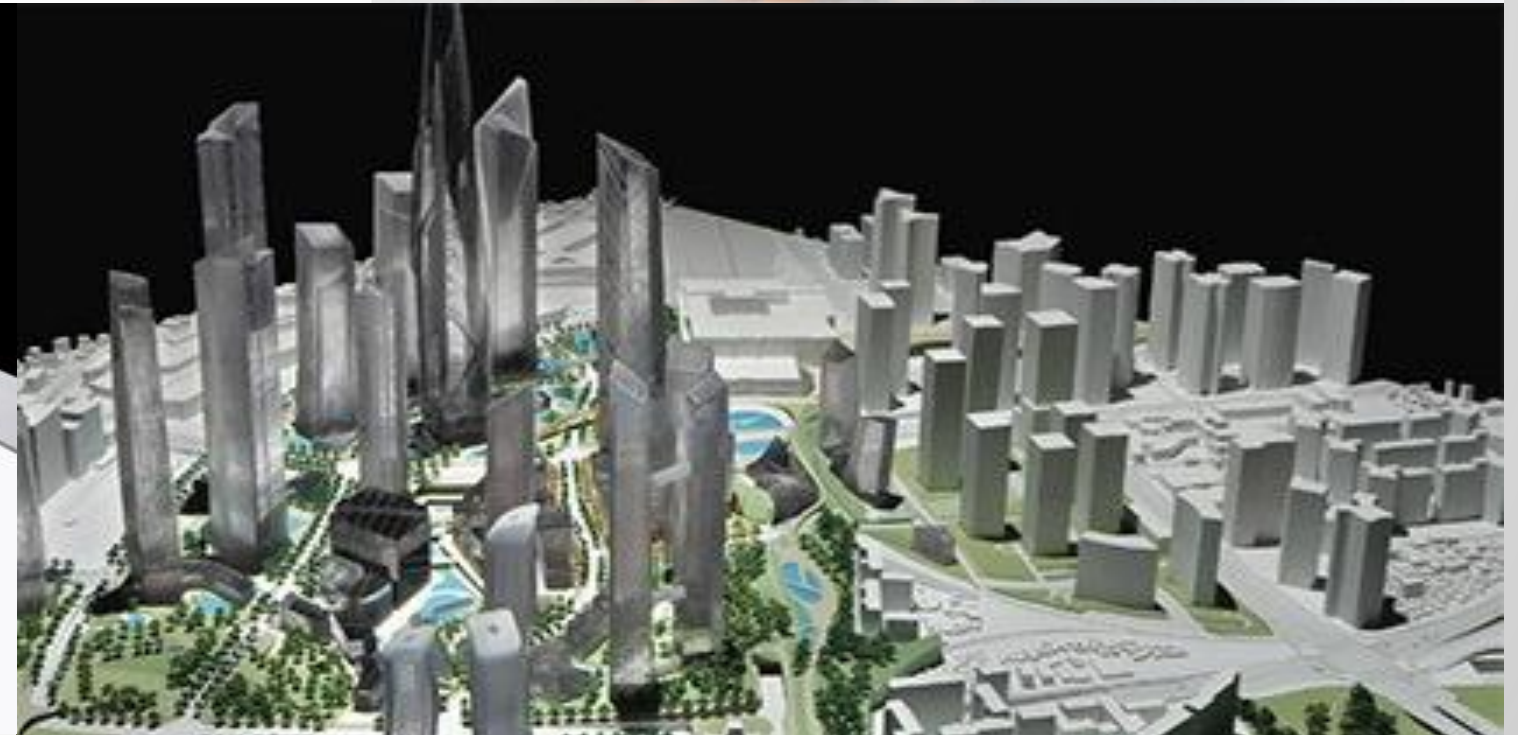
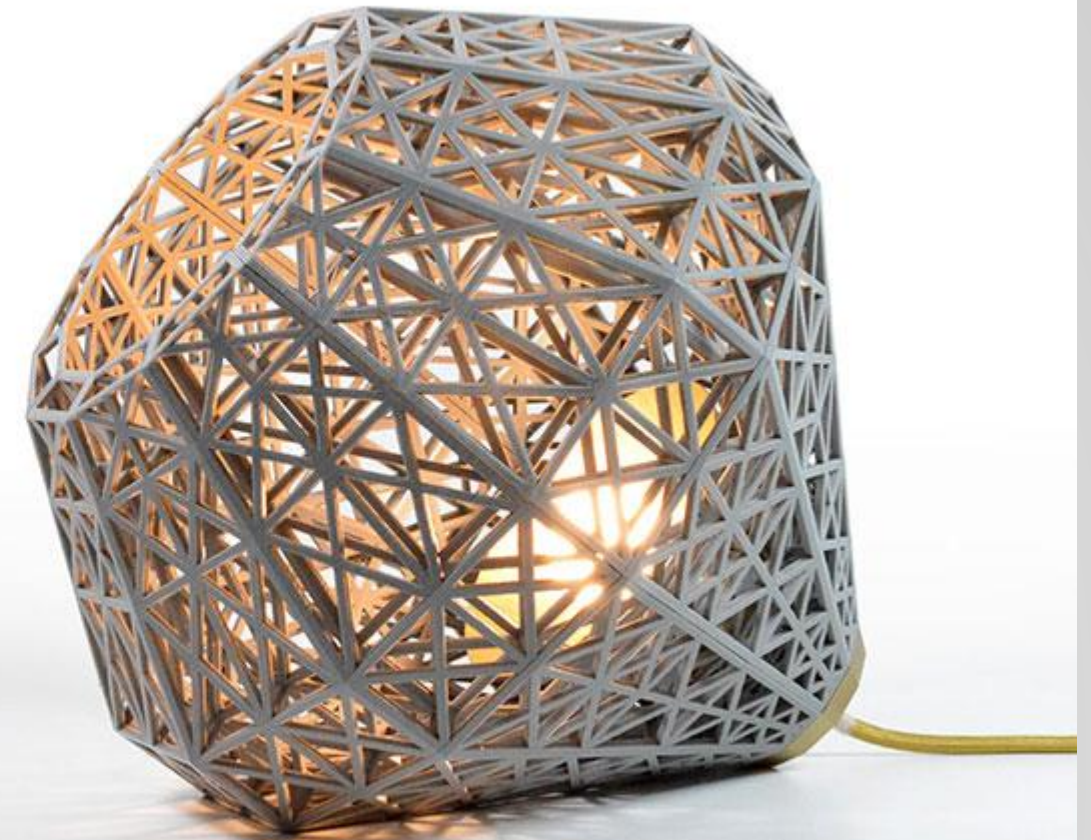
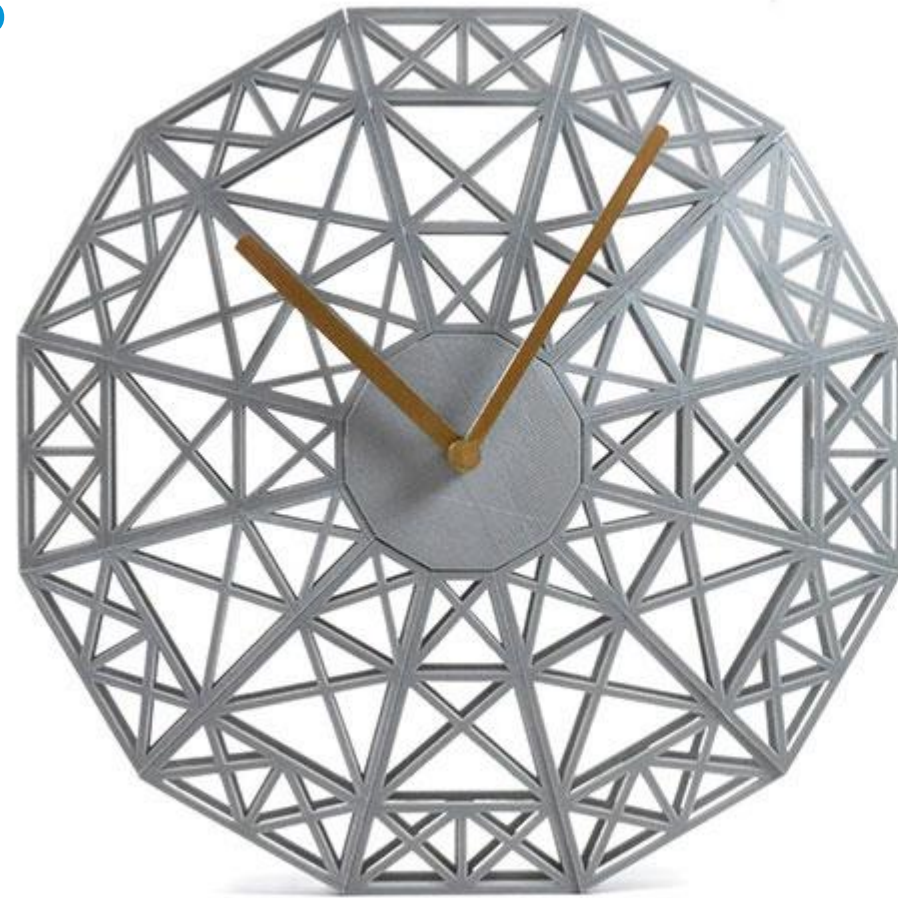
- Learn how 3D printing can be used in a design environment
- Discover the cost/benefit of different printer technology
- Discover what print materials are available for printing
- Learn how to identify real-world examples of successful implementation of 3D printing in a design/engineering environment

How Designers are Using 3D Printing

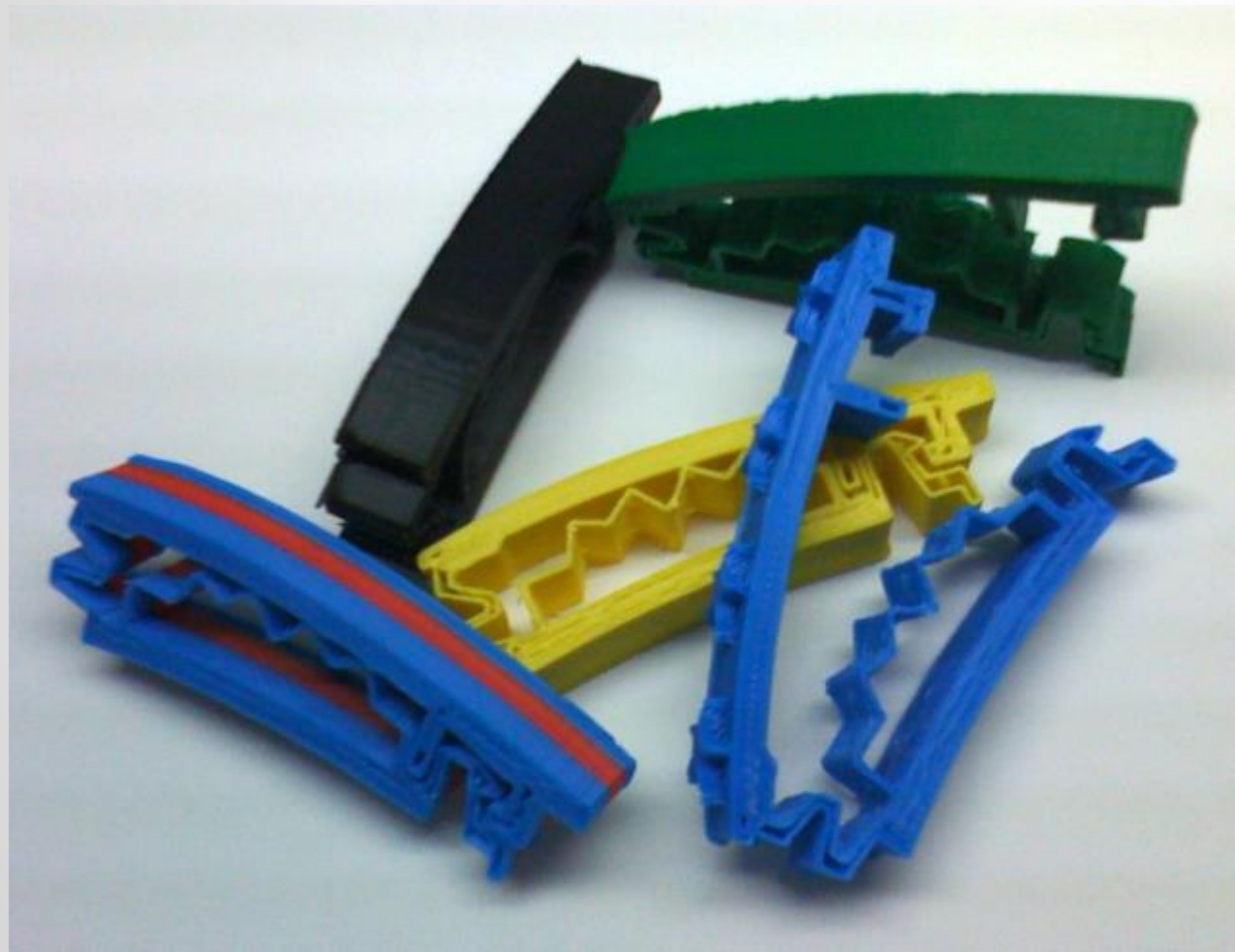
Prototyping



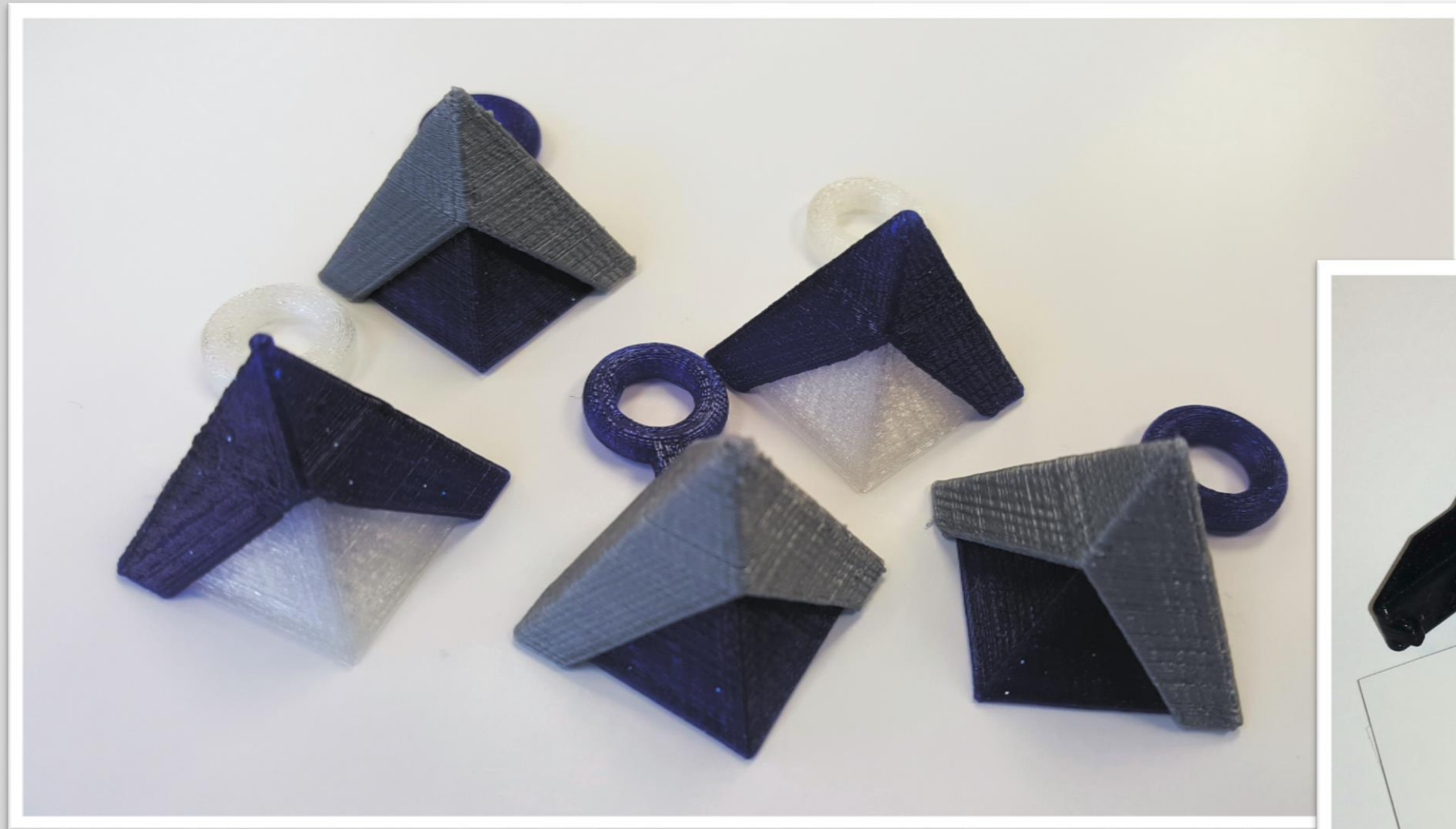
Creating Models



Small Run Manufacturing



Marketing

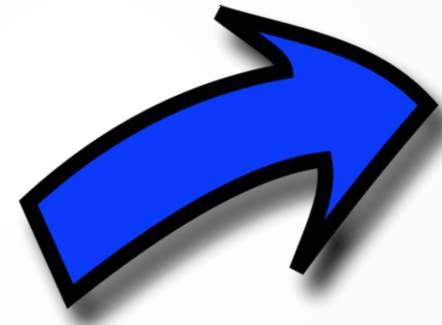


And So Much More....



Questions to Ask

What is my budget?



Do you have the necessary infrastructure in place?

- Space
- Electrical Requirements
- Water
- Ventilation



What exactly would you do with the printer right now?

- “It’s cool” is not a reason to buy a printer
- Have a plan in place and start working toward your ROI on day one

How often do you anticipate using the printer?

- If you will only use it occasionally – may choose one of the less expensive models
- If you want to run it around the clock – the proficiency of a higher end model will pay for itself.

Do you have the proper staff in place?

- Yes, you have the design portion covered, but do your employees know how to use the printer?
- What type of training does your staff require?
- Will you need to bring in outside contractors?

Costs and Benefits of 3D Printing

Quick Costs Analysis

- Printer
- Materials
- Accessories



Quick Costs Analysis

- Overhead
 - Utilities
 - Staffing
 - Infrastructure changes
 - Maintenance
- In the long run, overhead may become your biggest expense.

Benefits

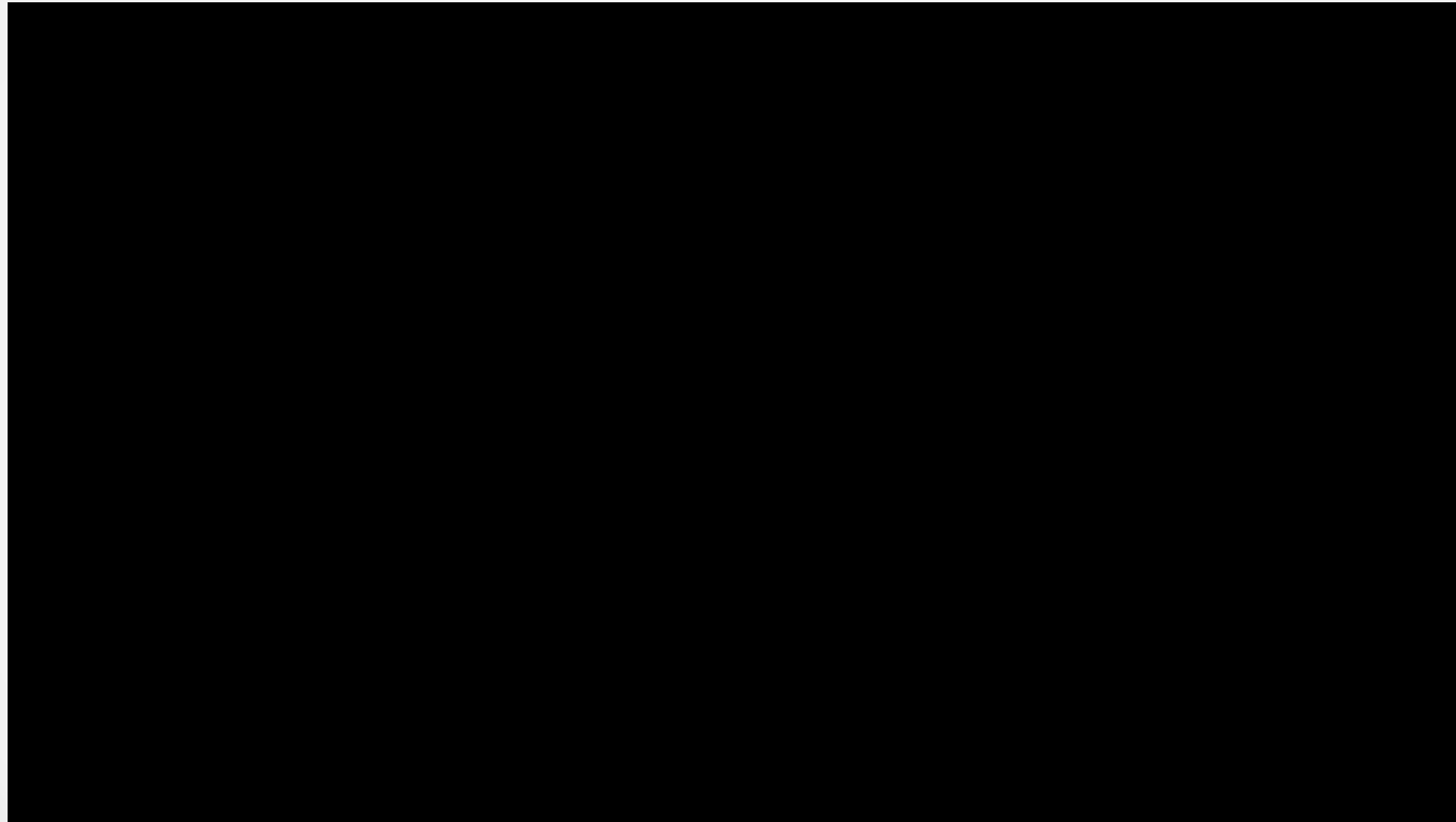
- Speed up design cycle
- Test multiple iterations
- Prototypes in hand within hours
- Bring products to market faster
- Save money over using outside vendors
- Customize marketing materials
- Replace clips, brackets, etc. around office for less
- And much more

ROI

$$\text{ROI} = \frac{\text{Total Revenue} - \text{Total Cost}}{\text{Total Cost}} \times 100$$

Types of Printers

FDM/FFF Printers



FDM/FFF Printers

Pros

- Compact and easy to use
- Prints are relatively easy to clean and finish
 - Especially with dual head printer
- Tons of material options

Cons

- Relatively Slow
- Visible layers
- Parts aren't as strong

Popular FDM and FFF Printers

The MakerBot Replicator (5th Generation)

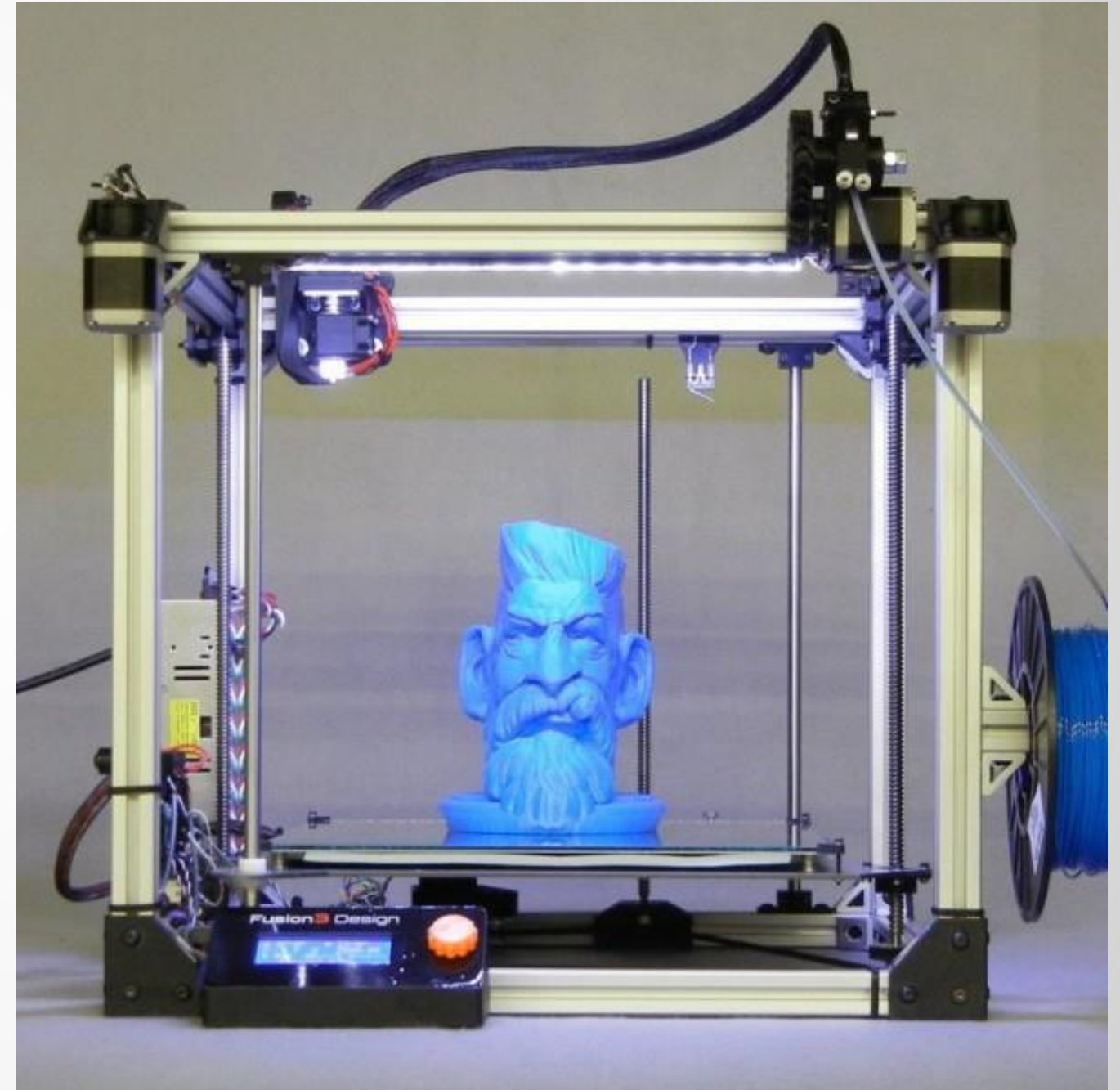
- \$2,899
- Accurate prints
- New materials - limestone, bronze, iron, and maple wood



Popular FDM and FFF Printers

Fusion F306

- From \$3,975 to \$4,975
- Fast and consistent
- Large build volume
- Dual head option
- Multiple materials



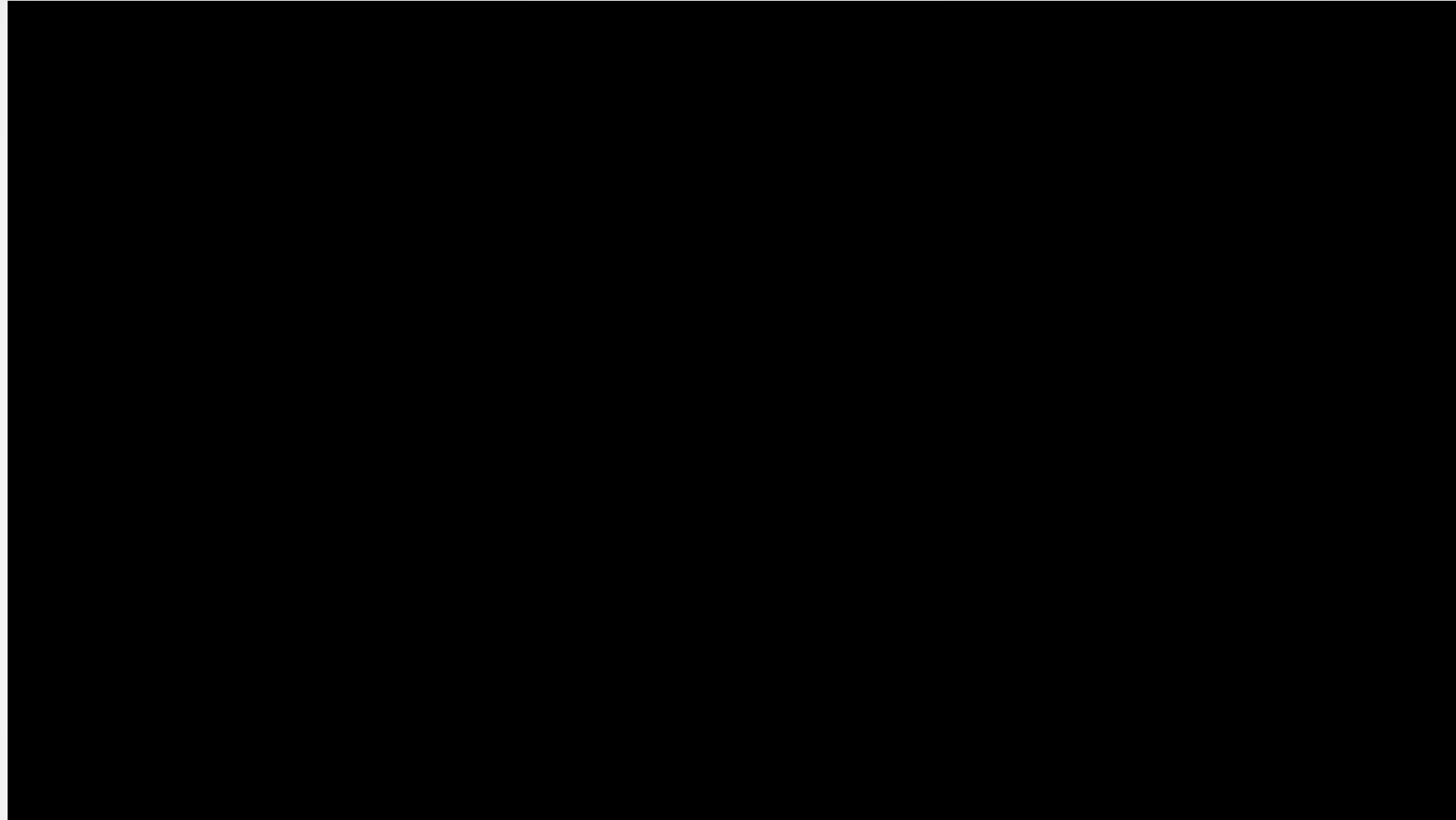
Popular FDM and FFF Printers

Stratasys uPrint SE Plus

- \$21,000 - \$27,000 based on configuration
- True workhorse
- Dual heads
- Dissolvable filament
- Accurate and dependable



SLA Printers



SLA Printers

Pros

- Beautiful parts
- High resolution, $<25\mu$
- Very durable
- Usable parts

Cons

- Unpleasant chemicals
- Requires ventilation
- Light functional testing limited
- Few material options

Popular SLA Printers

XYZprinting's Nobel 1.0

- \$1,499
- Closed printing area
- Autorefiller
- 25, 50, and 100 microns



Popular SLA Printers

Formlabs Form 2

- \$3,499
- Build volume of 5.7" x 5.7" x 5.7"
- Peel mechanism
- Heated resin tank
- Accurate, detailed prints



SLS Printers

- Selective Laser Sintering

SLS Printers

Pros

- Wider variety of materials compared to SLA
- Less brittle than SLA
- Fast and accurate

Cons

- Prints can be difficult to finish
- Out of printer, matte surface quality
- expensive

Popular SLS Printers

The Sinteris

- Low-cost SLS printer market is limited
- Sinteris, available for pre-order, will be first
- Approximately \$5,000



Printer Maintenance

Maintenance Tips

- Keep materials dry and protected
- Maintain clean working area
- Learn how to unclog a print head
- Keep an eye on prints to detect problems early
- Perform periodic visual inspection on printer

Case Studies

Mishimoto Automotive

- Initially, didn't think out 3D printing process
 - First printer - expensive proprietary materials
- Re-analyzed situation – bought cheaper printer
- Today, 30% of prototypes include 3D printed parts
- Products to market 6 to 8 weeks faster
- \$100,000s in additional sales each year



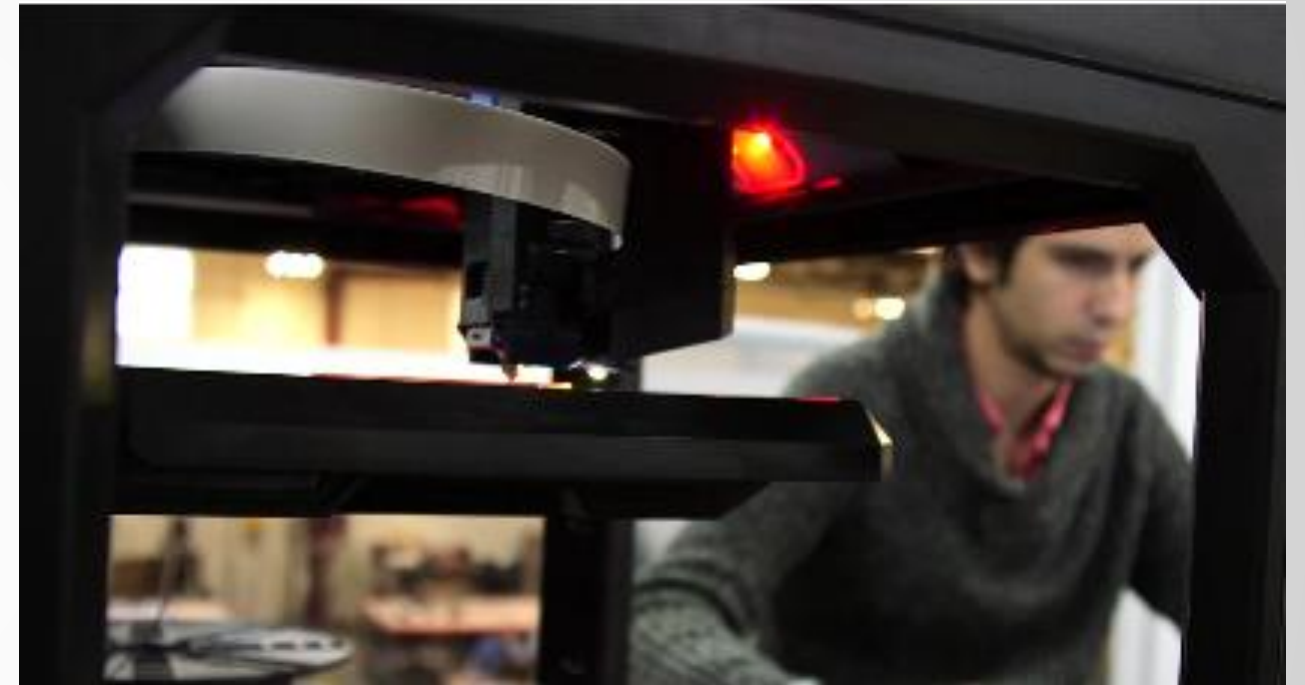
1212-Studio

- 3D printers let them create artistic pieces not otherwise possible
- Tasked with creating lighting system and microphone for U2's tour
- 3D printed several iterations to optimize pressure points, quality, and strength
- After design complete, final product also 3D printed



GE First Build

- Subsidiary of General Electric trying to get products to market faster
- 3D printers help designers prototype, test, and tweak designs
- Can test models within hours
- Has dramatically decreased GE's development time



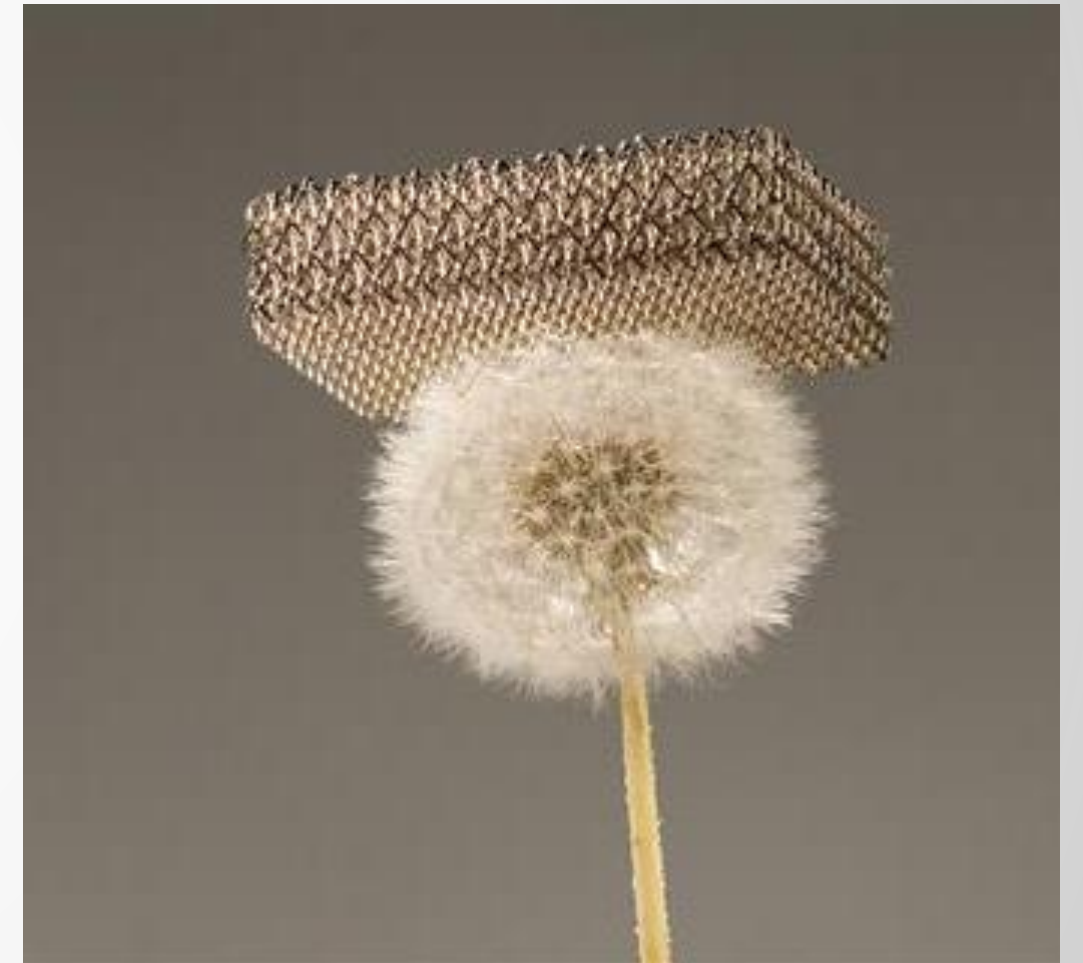
Lockheed Martin

- Hired to help NASA design James Web Telescope
- Lockheed Martin had previously outsourced parts
 - By bringing in-house, able to cut down dramatically on design time
- With MakerBot printers, designing system that will operate 1.5 million kilometers from earth.



Boeing

- In 2013 had already installed more than 20,000 printed parts in aircraft
- April 2015, FAA approved first 3D printed part to be included in GE engine used in Boeing plane.
- Developed new 3D printed metal, called microlattice, 100 times lighter than Styrofoam



Conclusion

With 3D Printing You Can:

- Experiment more
- Try out design iterations
- Fail faster
- Get products to market quicker
- Start generating additional revenue

Having a plan in place and a good understanding of how to implement a 3D program will help ensure that your organization can benefit from the immense potential of 3D printing

Thank You

Steven Schain

Steve@sli-3d.com

www.spectra3d.com



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