

# 3D Printing ... the Next Manufacturing Revolution

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Tech Breakfast  
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SURVICE Ranked as Top Work Place  
Baltimore, MD



SURVICE Wins SmartCEO Magazine  
Voltage Award for Technology Innovation

- Introduction to 3D Printing
- Practical Applications
- Latest capabilities
- Future

## In the beginning ...



“Every block of stone has a statue inside it and it is the task of the sculptor to discover it.”

- Michelangelo

... there was subtractive manufacturing

**After thousands of years ...**



**Drill**



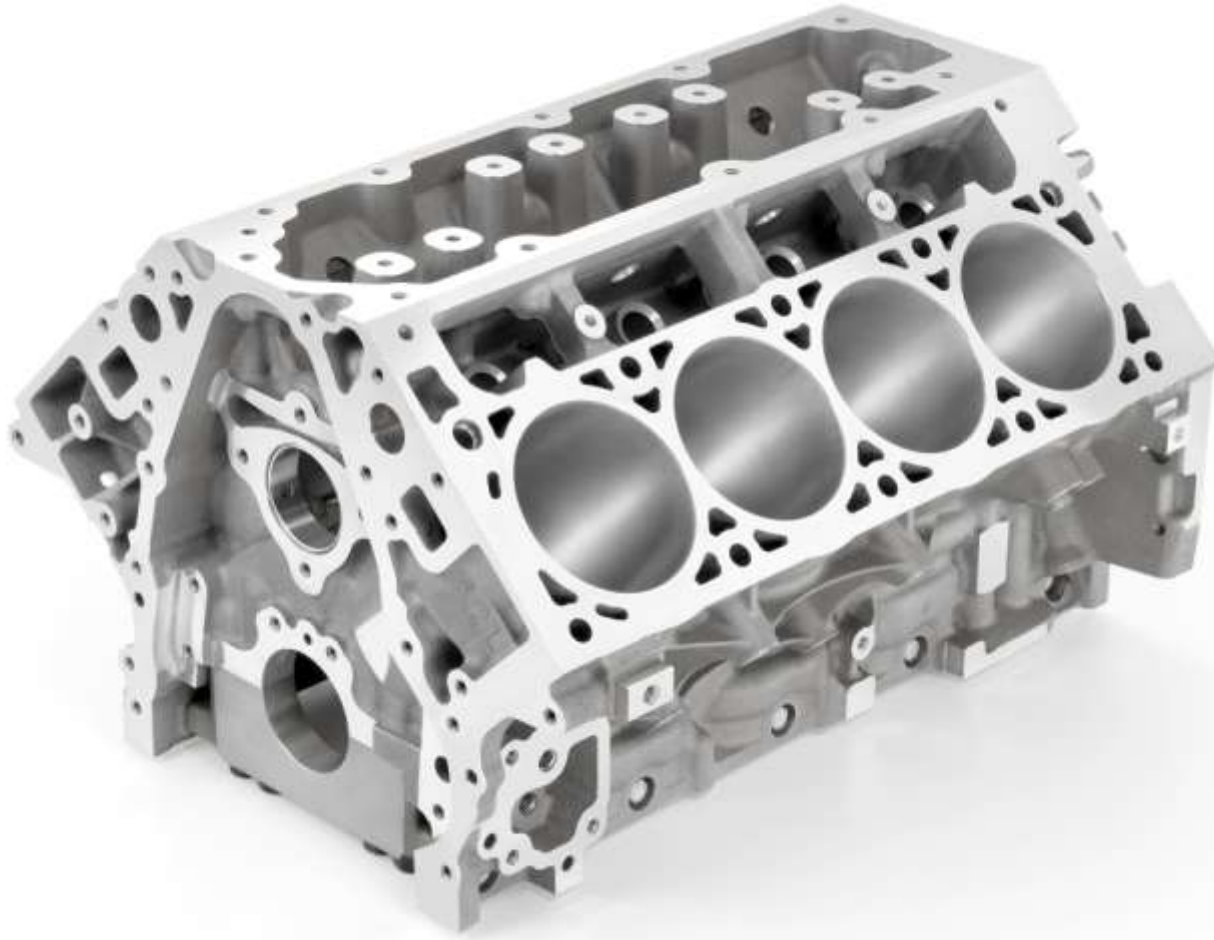
**Grind**



**Machine**

**... there was still subtractive manufacturing!**

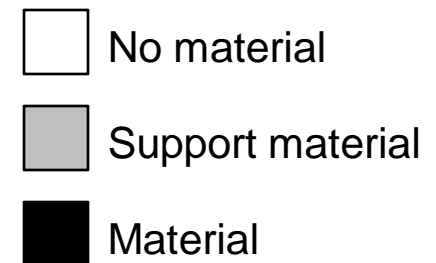
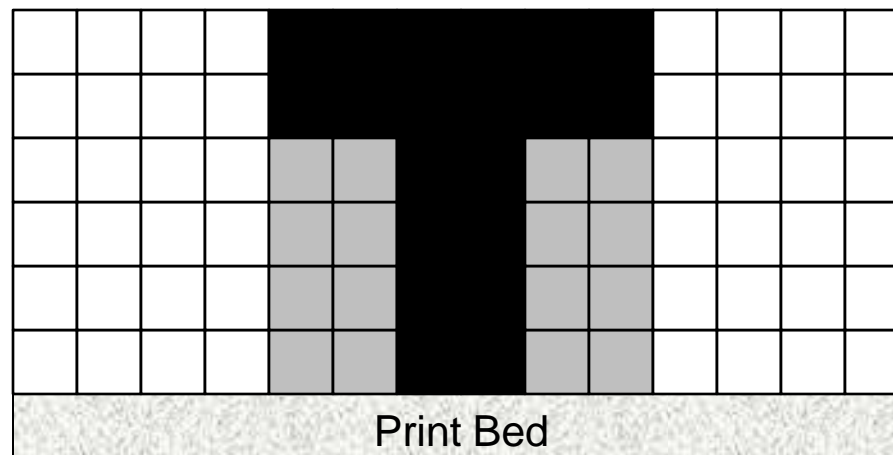
**... but we've gotten really good at it!**



**3D printing is the next step in manufacturing ...**

## What is 3D Printing?

- 3D printing is “additive manufacturing”, where parts are made by building-up a part rather than machining away unnecessary material from bulk stock.



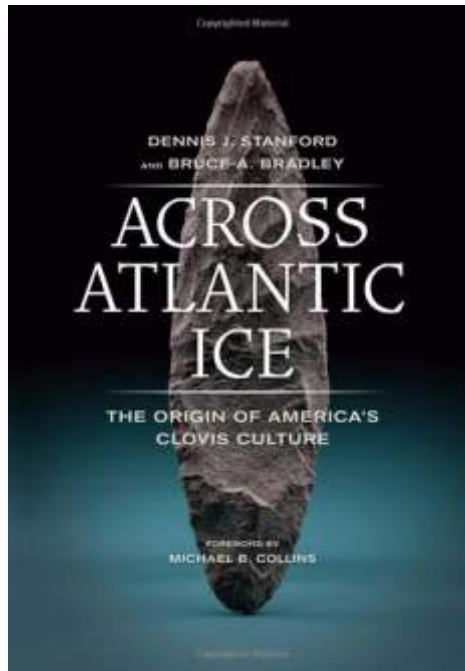


## **Time-Lapse 3D Print Video**

(Stratasys/Objet Eden 250)

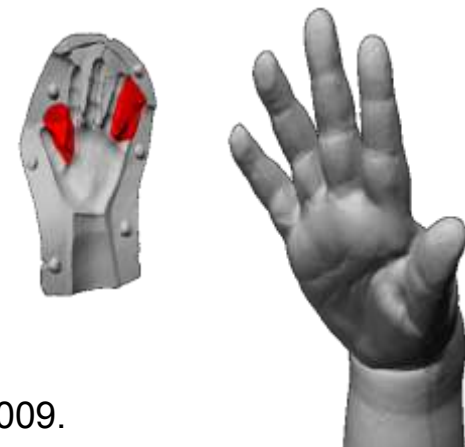
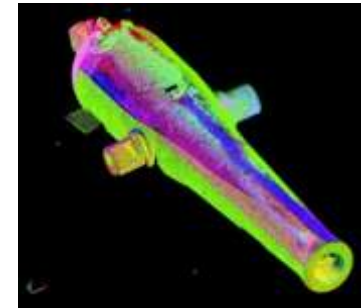
<http://tinyurl.com/SURVICE-Time-Lapsed-Print>

## Modeling using 3D Printing



Copyright © 2012

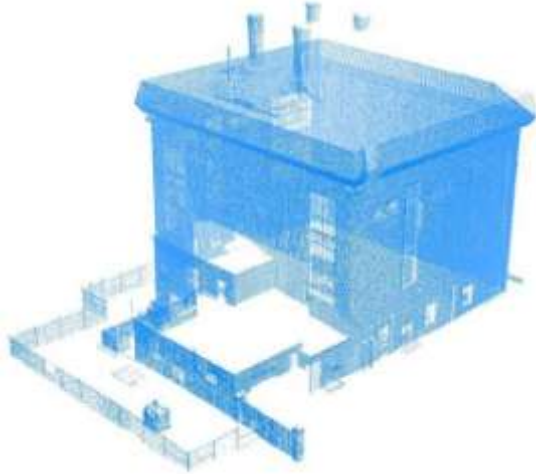
Cinmar Discovery – Earliest Man made tool found in Americas (22,000 years old)



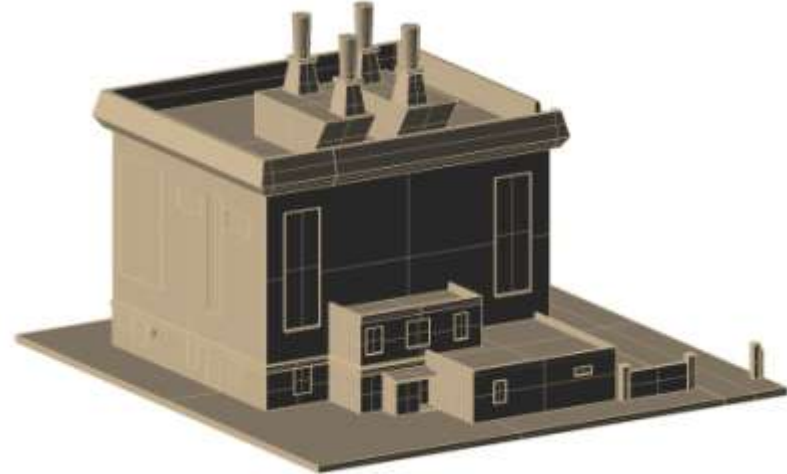
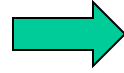
Wachowiak, Basiliki Vicky Karas and Robert E. Baltrusch  
“Reconstruction of a Nineteenth Century Plaster Piece Mold and Recreation of a Casting” Computer Applications to Archaeology 2009.



# Buildings and Landscapes



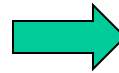
POINT CLOUD SCAN



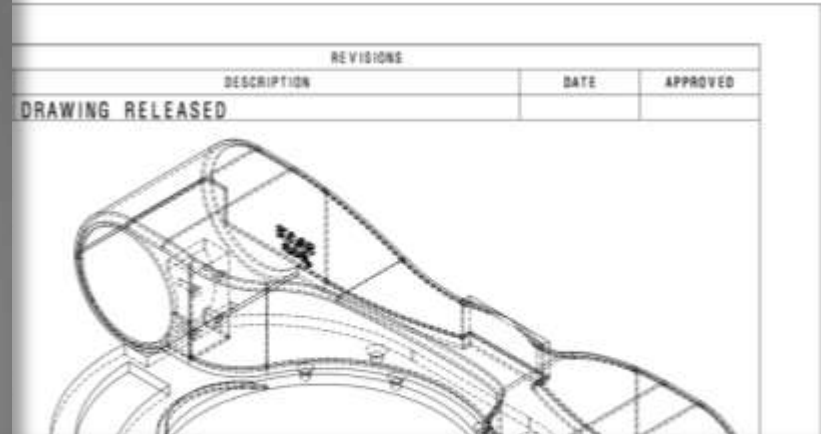
MESH MODEL TO SOLID MODEL



TEXTURE MAPPED 3D MODEL



# Recent Practical Example



NEXT ASSY	USED ON
APPLICATION	
MATERIAL	6061 Aluminum
FINISH	Blue Anodized

## 3D Printing Changing Lives

(What you can do with “just” plastic)

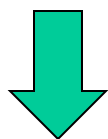
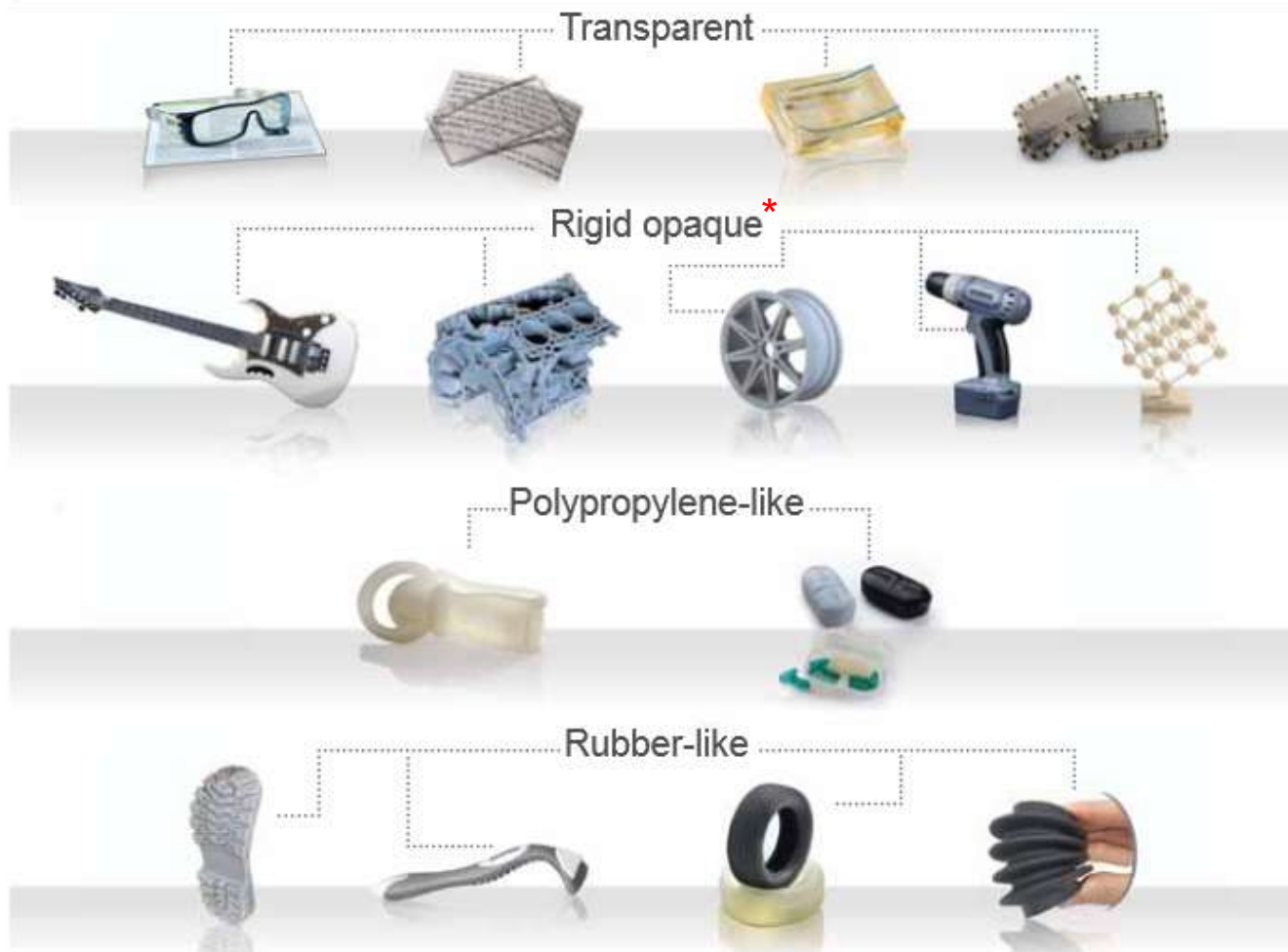


### **Magic Arms**

<http://tinyurl.com/MagicArms>

# Range of Material Types

## Simulating Standard Plastics



\* Metal plating is available to provide added strength, durability, and conductivity

## More than Just Plastic ...

- Direct Metal Laser Sintering (DMLS) & Selective Laser Melting (SLM)
  - Aluminum
  - Titanium
  - Stainless Steel



*NASA uses SLM to print part for J-2x engine for the SLS*



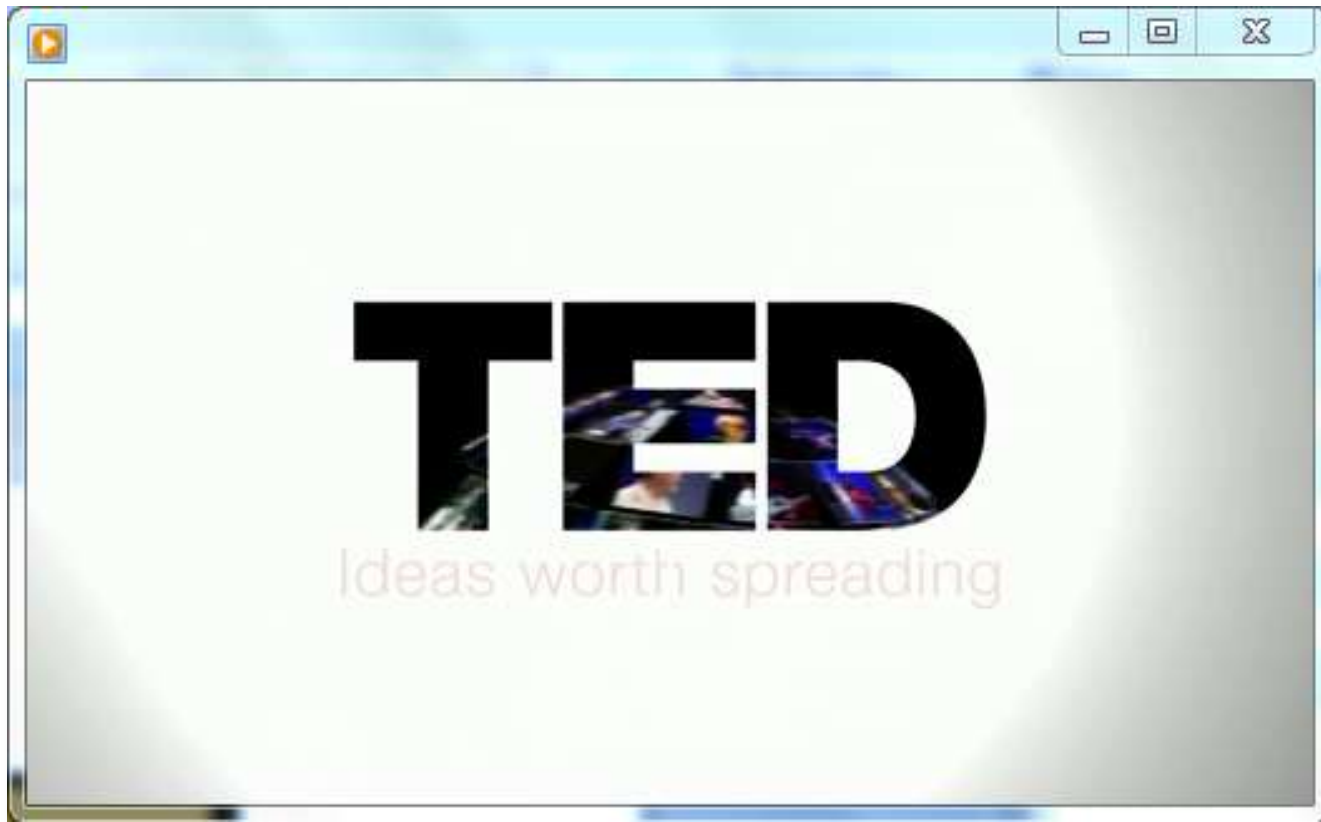
*Cobalt-Chrome alloy knee implant*



*Custom hip implant.  
(Photo courtesy of Royal Perth Hospital - Australia)*

**Common Theme – 3D printing used for custom parts, or parts that cannot be manufactured any other way**

# The Future of 3D Printing



**Wake Forest Research**

<http://tinyurl.com/WakeForestResearch>

[7:19 – 15:24]

## 3D Printed Food?

- NASA Funds 3D Pizza Printer
  - “NASA has awarded a Small Business Innovation Research (SBIR) Phase I contract to study the feasibility of using additive manufacturing, better known as 3D printing, for making food in space.” (<http://tinyurl.com/SpacePizza>)



- 3D printing (or additive manufacturing) is changing how we design and manufacture products.
  - Rather than replacing traditional manufacturing techniques, it adds new capabilities and options.
    - Ideal for custom solutions and concept prototyping.
    - Ability to form shapes never before possible with machining.
  - More and more materials with better properties are being used in 3D printing, to include bio-materials.



**Questions/Comments?**