

3D SCANNING FOR 3D PRINTING:

MAKING REALITY DIGITAL AND THEN PHYSICAL AGAIN



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3D Scanning vs. 3D Printing

Both over 20 years old, actually 30 years old

- largely industrial with recent consumer interest
- Was \$100K+ equipment cost with now sub-\$1K

Range of objects

- physical world has huge size & complexity variation

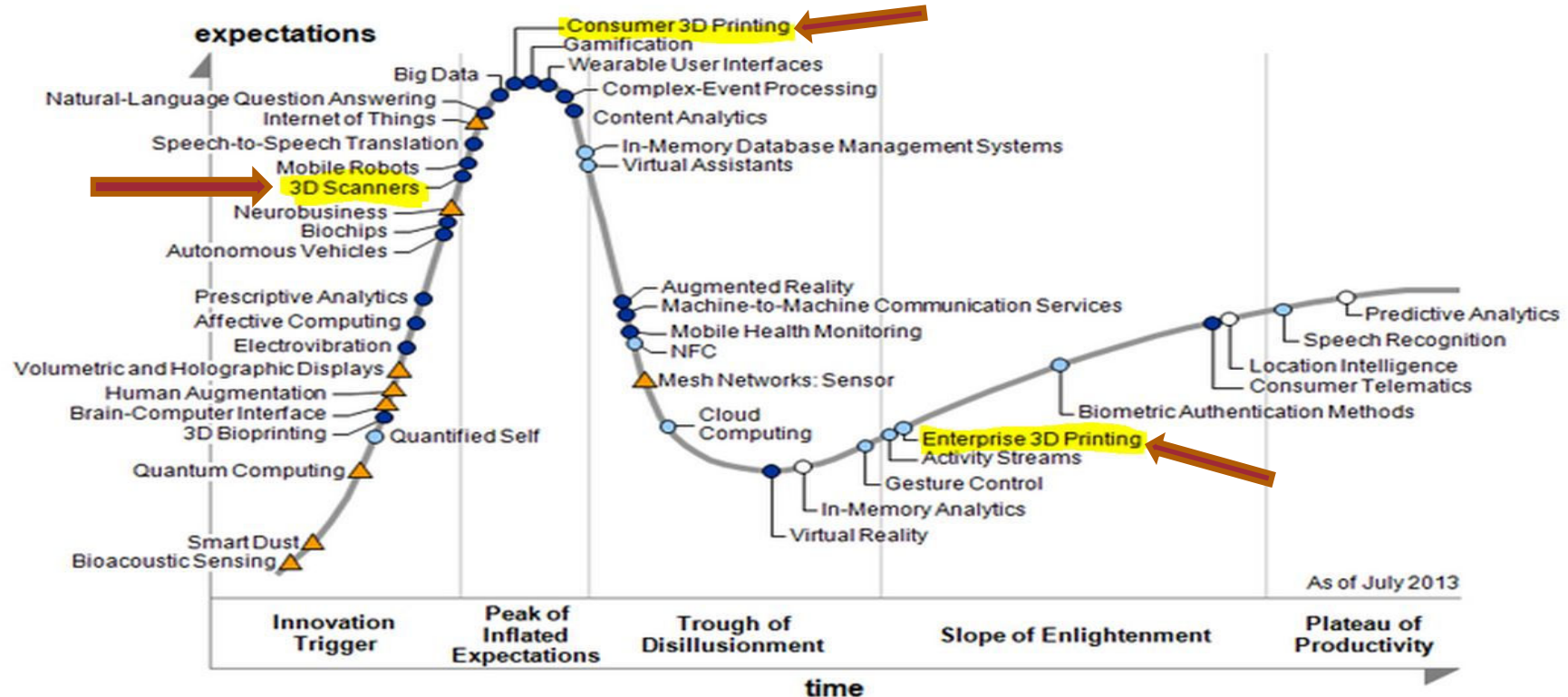
Massive change over last 3 years

- “desktop” and personal 3D scanning
- 123D Catch and Xbox Kinect

Future – what’s next?

- who needs 3D scanning and why?
- what will be the ‘killer apps’?

3D PRINTING & SCANNING Gartner's Hype Cycle



Plateau will be reached in:

○ less than 2 years ● 2 to 5 years ● 5 to 10 years ▲ more than 10 years ⊗ obsolete before plateau

3D Printing Market Facts

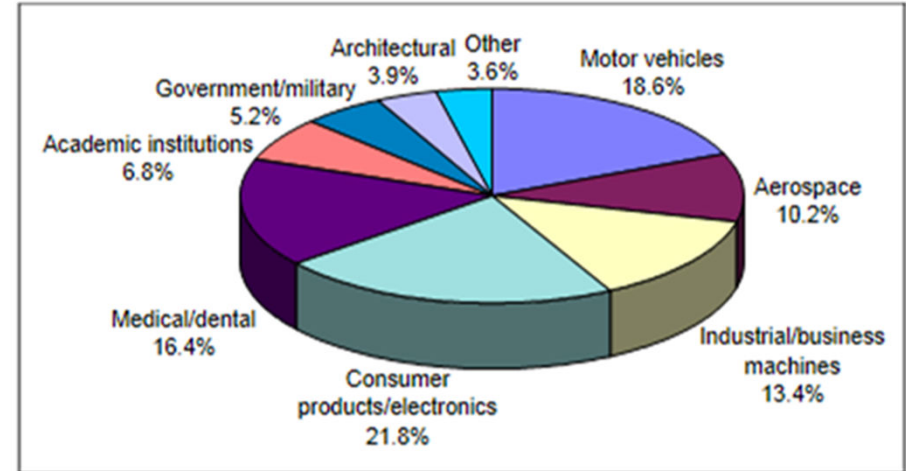
Source: Wohlers Report of Additive Manufacturing – 2013

- **Industry revenues were \$2.2 billion in 2012,**
 - up 29% from \$1.7 billion in 2011
- **Revenue projected to surpass \$10.8 billion by 2021**
 - 26.4% CAGR over the past 24 years
 - 27.4% since 2010
- **3D printing services were \$1.2 billion in 2012**
 - Up from \$879.5 million in 2011
- **Personal 3D printer unit sales (<\$5,000) are exploding**
 - 35,000 units in 2012 vs. 5,900 units in 2010.
 - 7,800 professional units sold in 2012



Traditional 3D Printing & Additive Manufacturing

- **Visual aids (for engineers, designers, medical professionals, etc.)**
- **Presentation models (including architectural)**
- **Prototypes for fit and assembly**
- **Patterns for prototype tooling & metal castings**
- **Tooling components**
- **Functional parts - short run production**
- **Education/research**
- **Other**



Source: Wohlers Associates, Inc.

Main 3D Printing Processes and Materials

PROCESS	SYSTEMS	MATERIALS
Material Extrusion - FDM	Stratasys Dimensions, uPrint MakerBot Replicator	ABS PLA
Material Jetting – jetting drops of material (similar to inkjet) Vat photo-polymerization (light cured)	Objet Connex Stratasys Polyjet	Multiple plastics or resins various color and transparencies
Binder Jetting – glue binds layered materials	Z Printer Projet x60 Series Projet 4500	Composite powders Plastics Full color
Sheet Lamination	MCOR	Colors, cuts and glues sheets of paper
Selective Laser Sintering (SLS)	EOS 3D Systems ProX and sPro	Selectively fusing powder materials – Nylon, polystyrene, metals


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Print

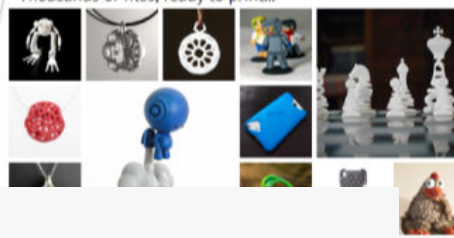
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Art Key Holder
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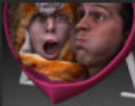


Office Bowl
\$87.00 by [andrewj3](#)



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Holiday Gifts



Scanning



Timeline Studio



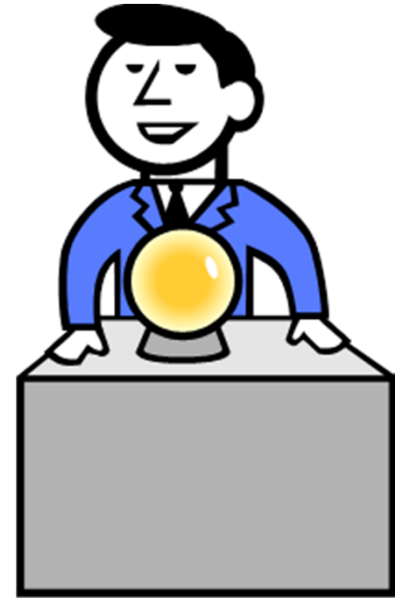
Events

Projecting the future for 3D printing

Market Research and Analysis - Source: Pete Basiliere, Research Director at Gartner

3D printing remains a emerging market, despite high levels of hype:

- Buyer demand is pressing for **easy-to-use** tools and materials
- Prices to drop with **competitive pressures** and higher unit sales
- **Advances in 3D** printers & scanners, design tools, and materials **will reduce the cost** and complexity of creating 3D printed item
- Businesses are only now beginning to fully comprehend ways in which a 3DP can be **cost-effectively used** in their organizations
- Makers and hobbyists will contribute to some form of “**plug and play**” tool — that will be key to driving consumer sales in future



Considerations -

- Define your niche: What customers will you best serve?
- What role: Will you print as a service, sell the equipment or both?
- Which Equipment & Materials?
- Content: Where will it come from? Who will own it?
- Data repair: How will you address the need for scan data processing into 3D printable files?



- “...**making stuff is going to become more localizable.** ...more objects can be manufactured closer to the end customers.” (Peter Weijmarshausen, CEO Shapeways –BARRONS.COM 5/9/14)
- Microsoft 8.1 has added a “**direct pipeline**” from 3D printing applications to 3D printers-(PC Magazine – 7/2/13)
- About HP - The company believes that 3D printing is a **natural progression of its 2D printer business**, where it has a sizeable share. (FORBES.COM – 3/28/14)

3D Scanning – is about building content



NYC Hotel Courtyard: Scan to Model to Print



NYC Hotel Courtyard: Scan to Print

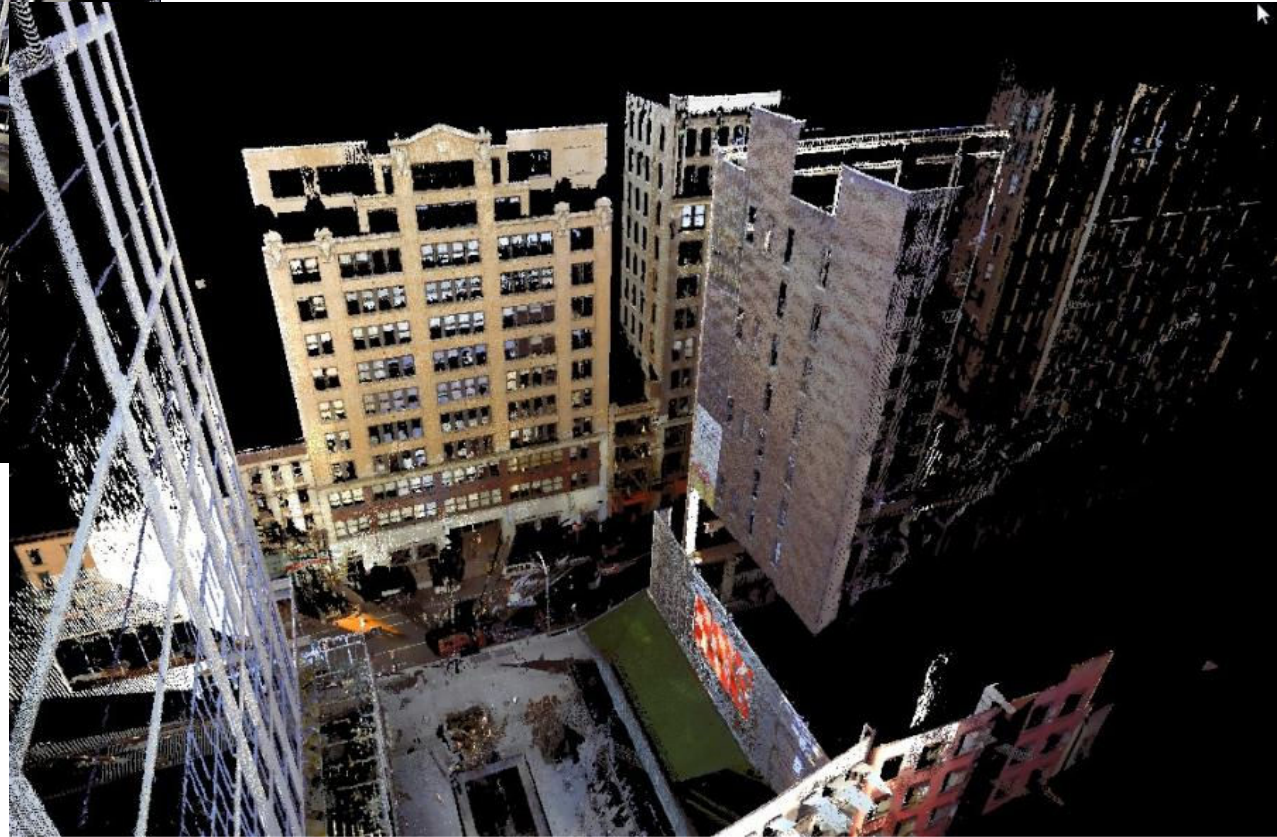
- Four laser scans taken at the Eventi Hotel
- Total time on-site approx. 40 minutes
- Max range approx. 120 meters
- Millions of raw 3D data points captured
- Data sufficient for preliminary architectural modeling of courtyard and portions of surrounding buildings
- Point cloud converted into 3D CAD model
- 3D CAD fabricated by 3D printing



NYC Hotel Courtyard: Scan to Model to Print



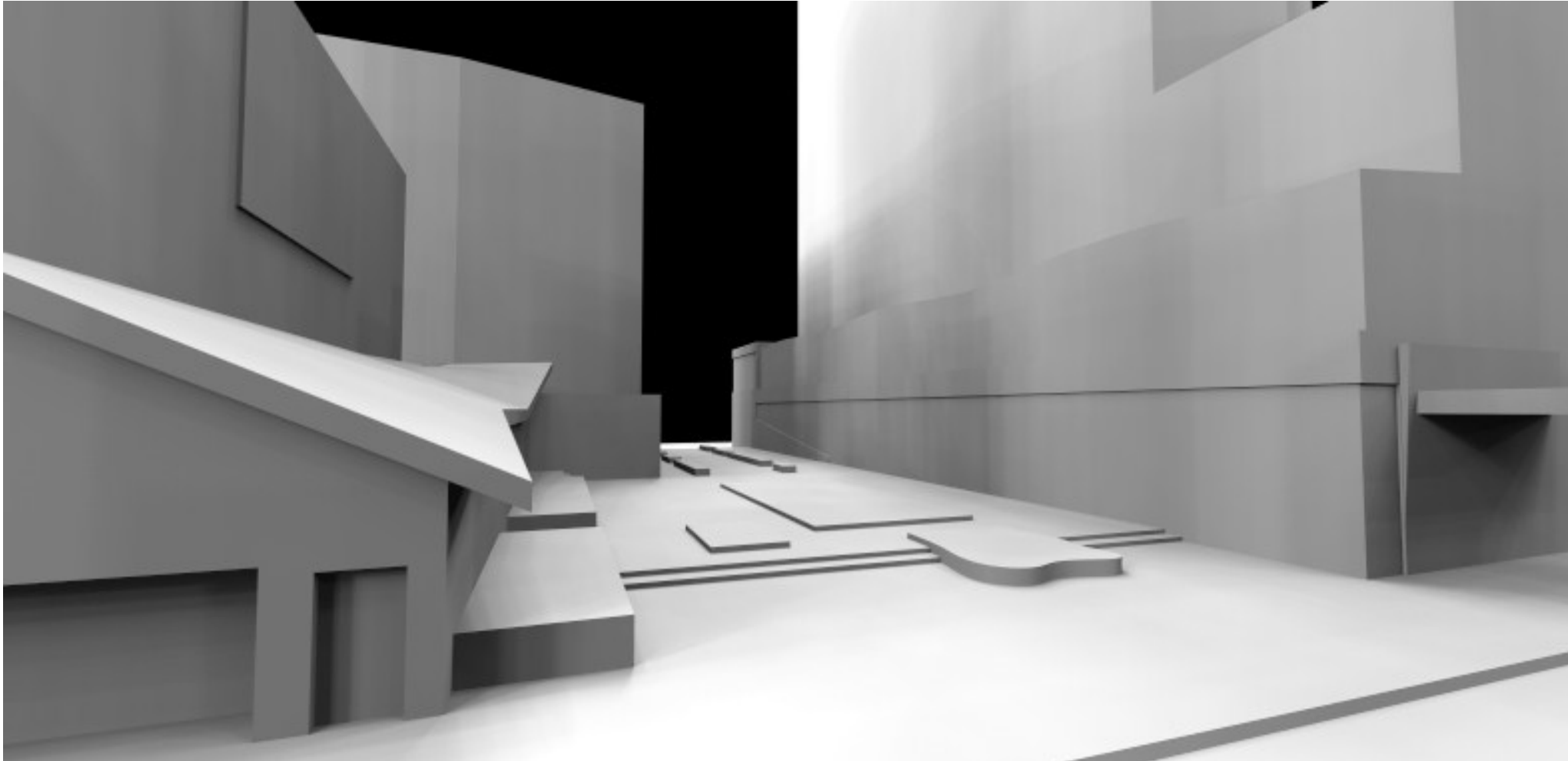
NYC Hotel Courtyard: Scan to Model to Print



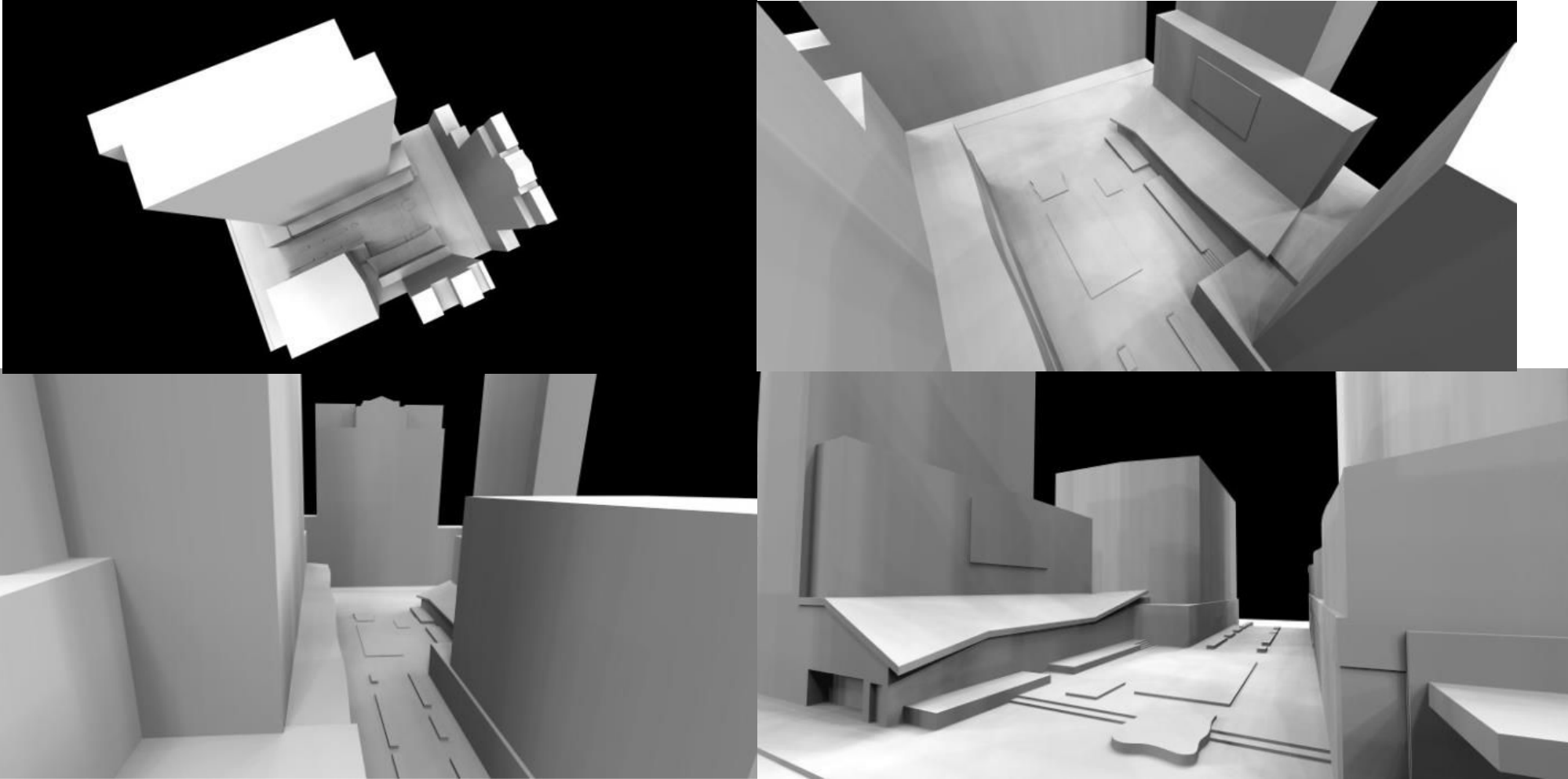
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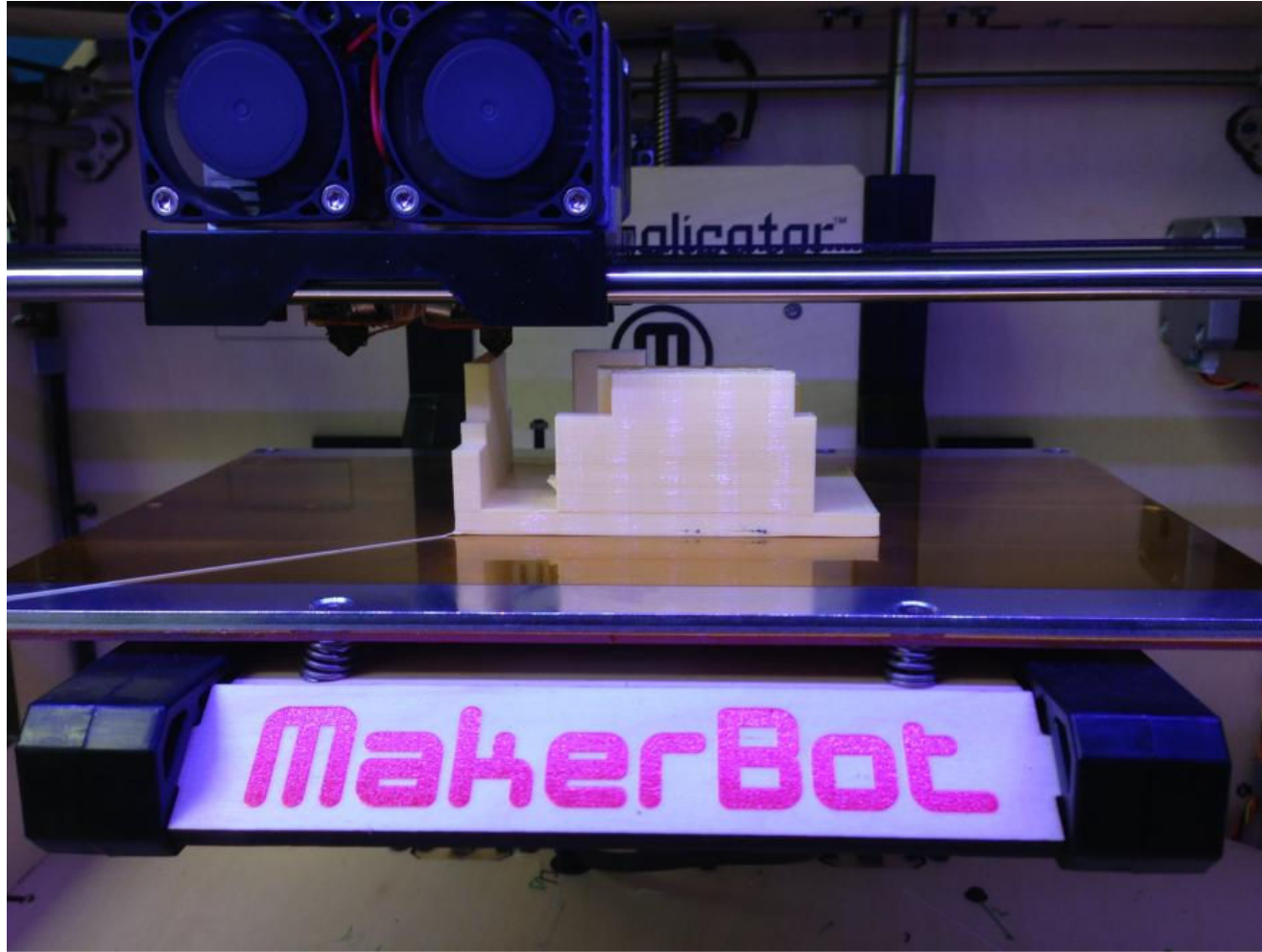
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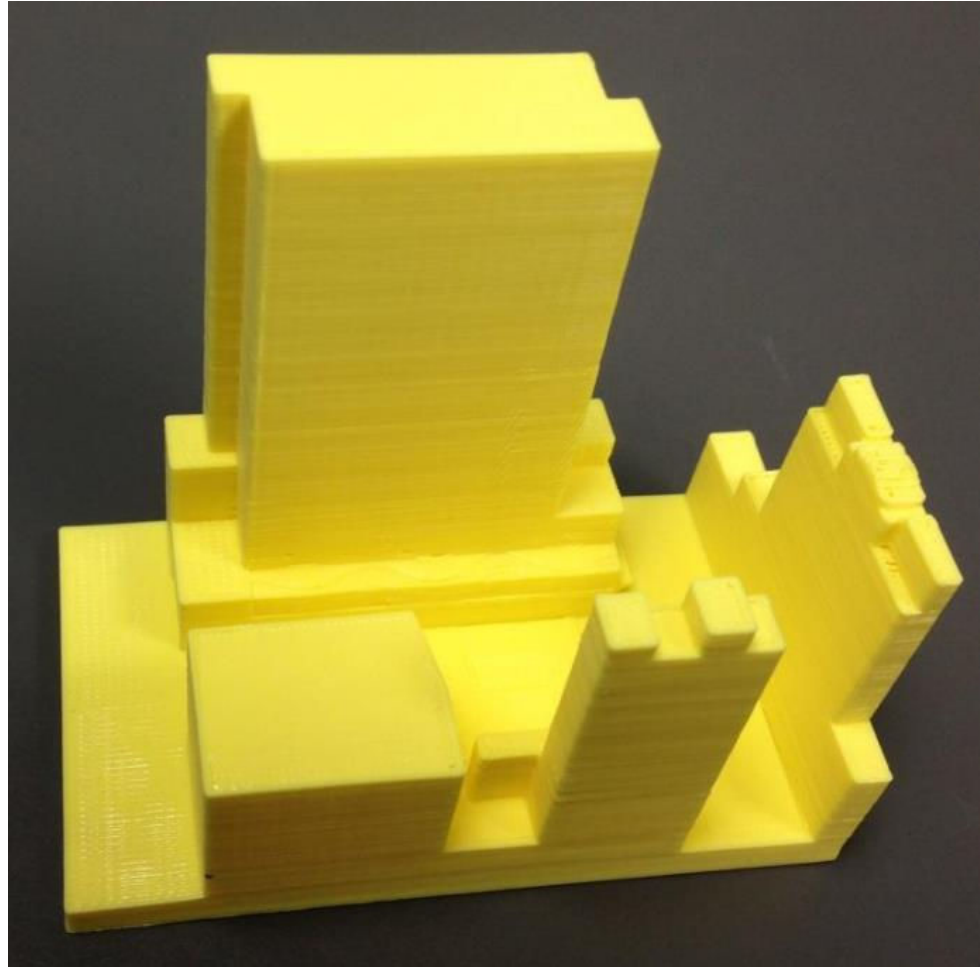
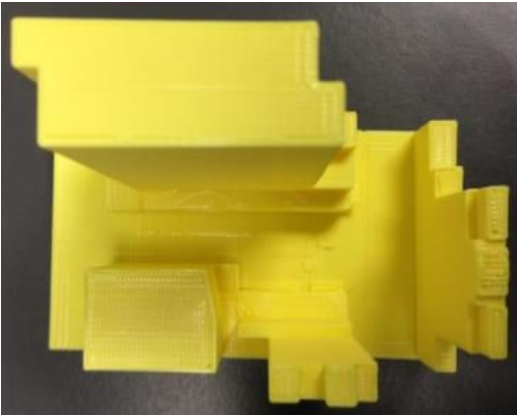
NYC Hotel Courtyard: Scan to Model to Print



NYC Hotel Courtyard: Scan to Model to Print



NYC Hotel Courtyard: Scan to Model to Print



Holzappel Hall Project: Scan to Print

Holzappel Hall (Horticulture)

Building Code: HZF
Building Number: 074
[Find on the map](#)

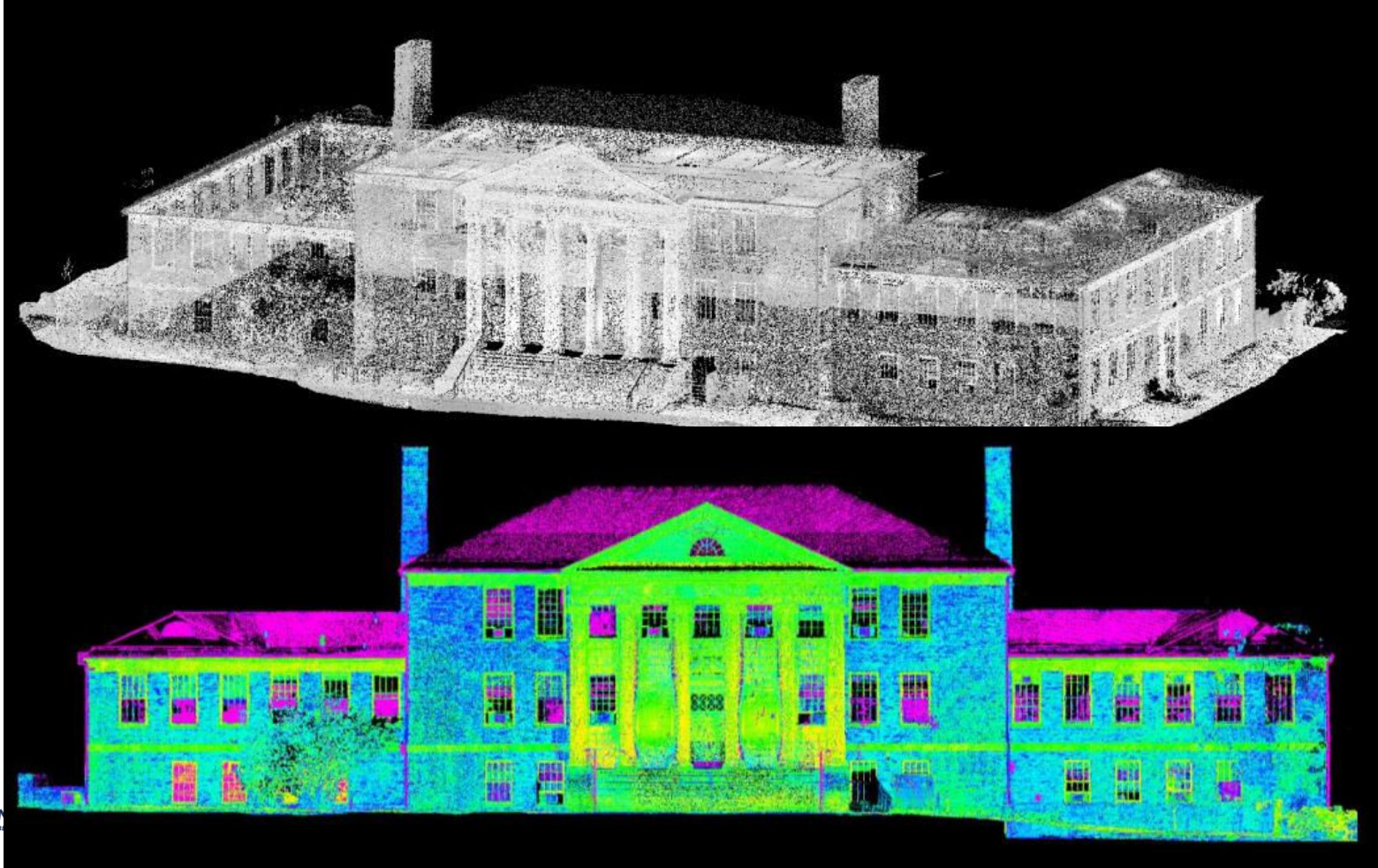


History

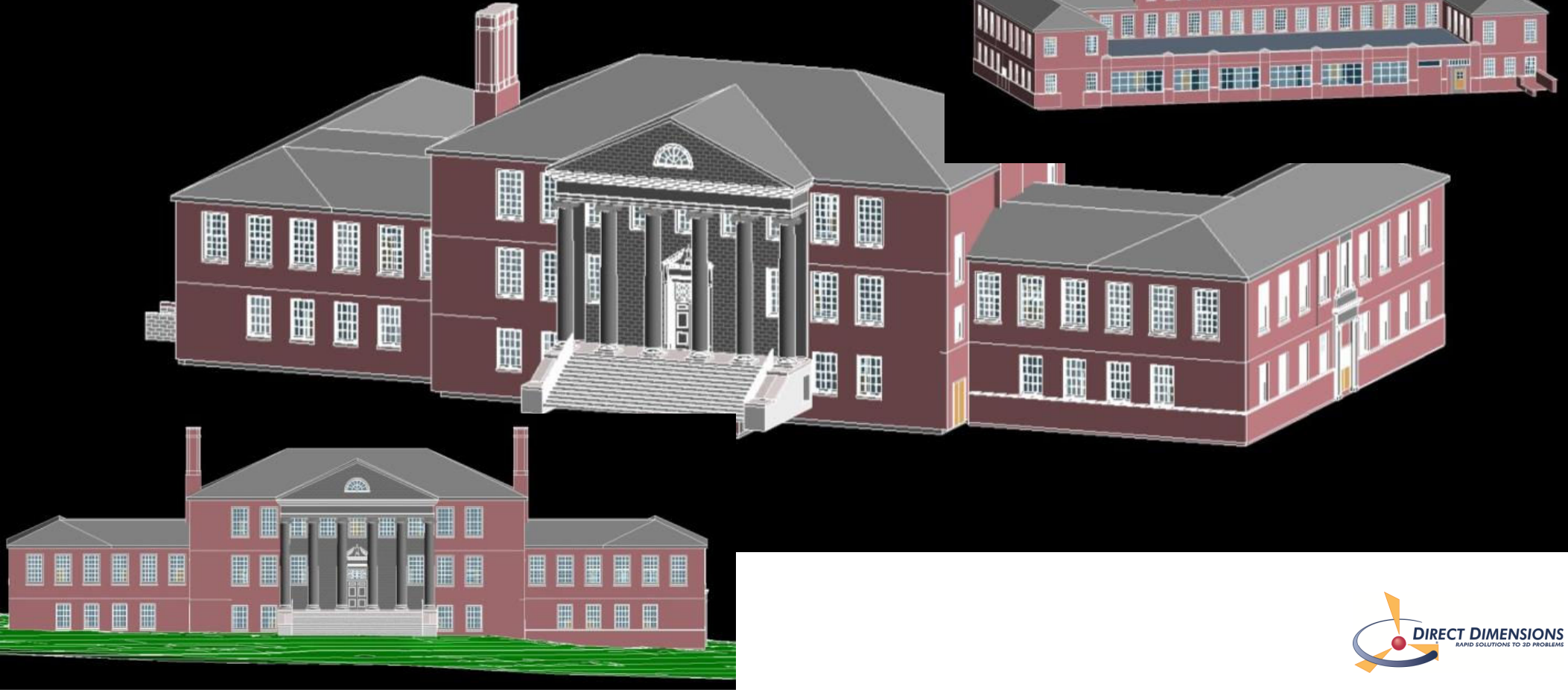
- 1934 - constructed
- 1954 - named Holzappel Hall.
- Named after: Henry Holzappel, Jr. Chairman/Board of Regents 1941-43.



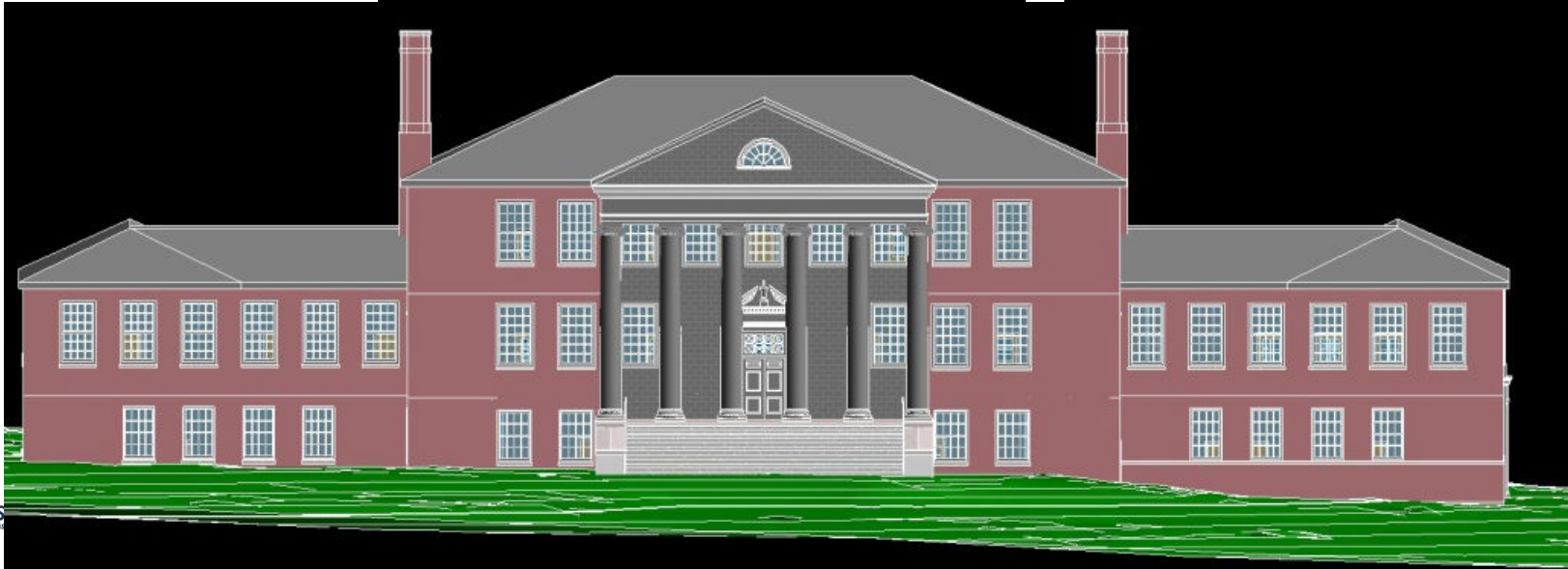
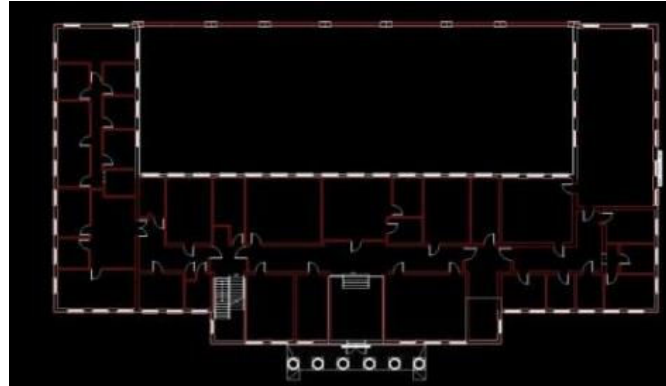
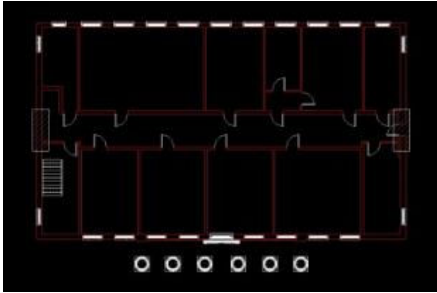
Holzapfel Hall Project: Scan to Print



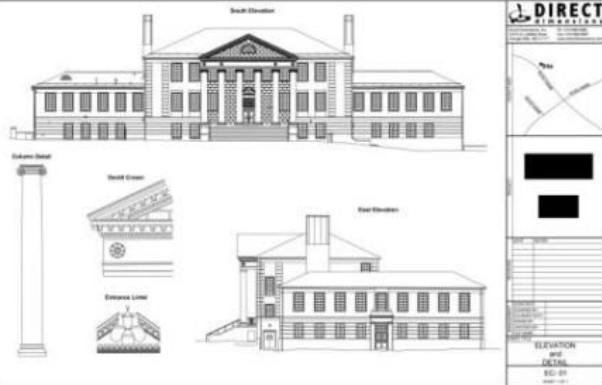
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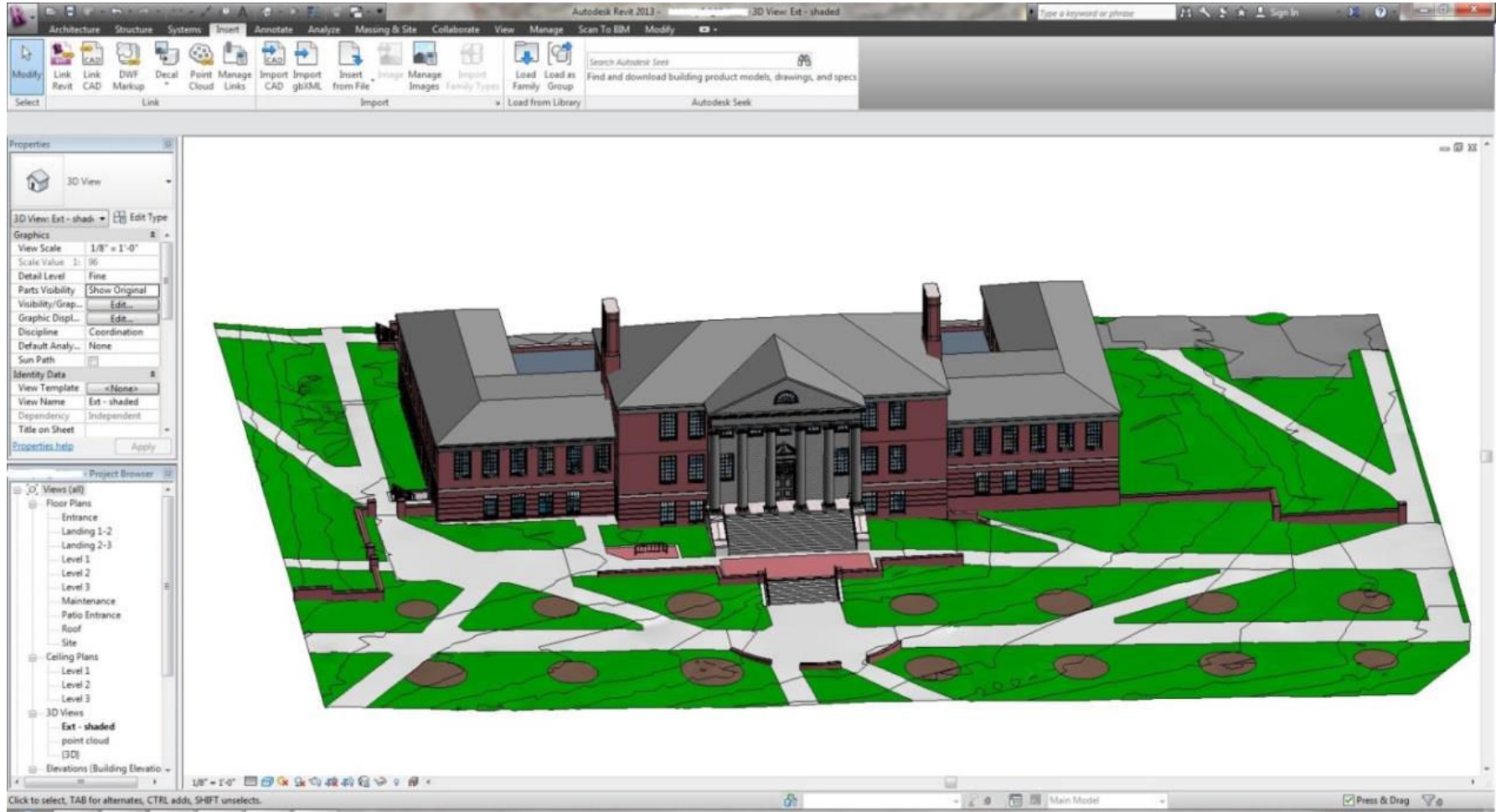
Holzapfel Hall Project: Scan to Print



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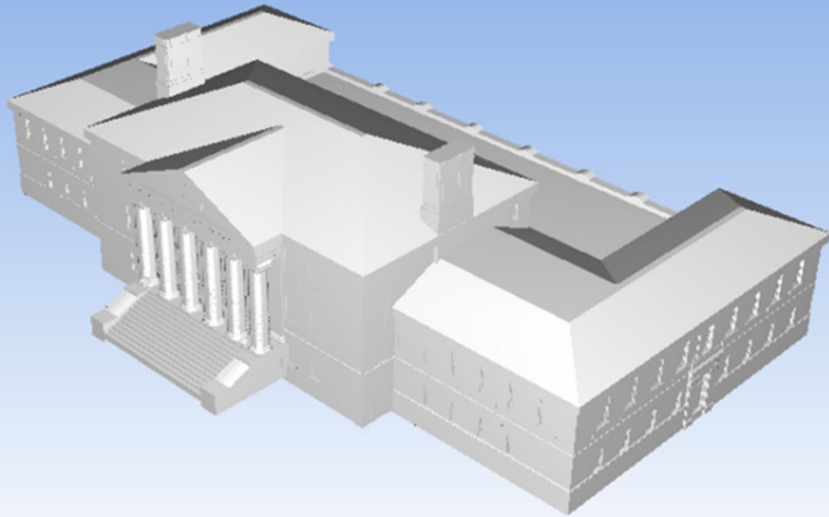
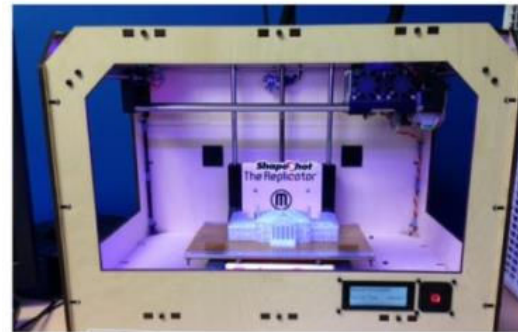
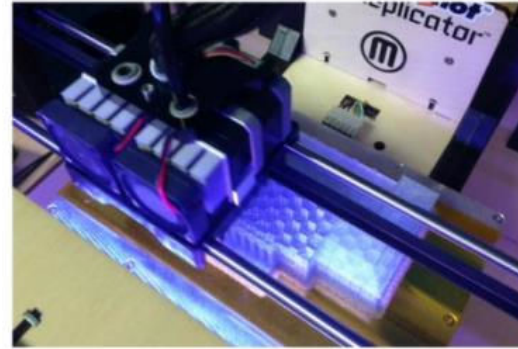
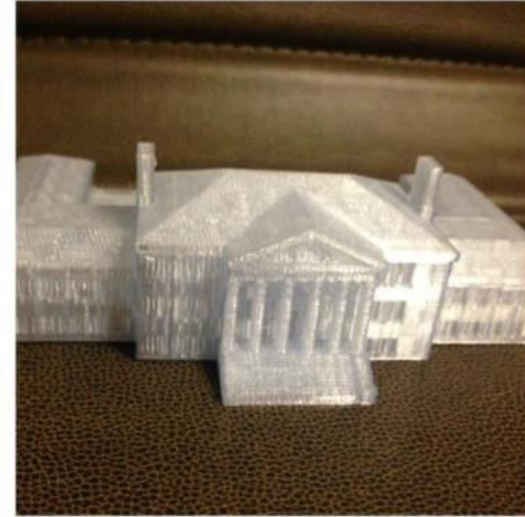


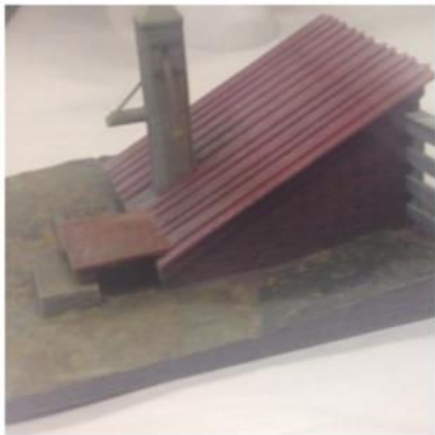
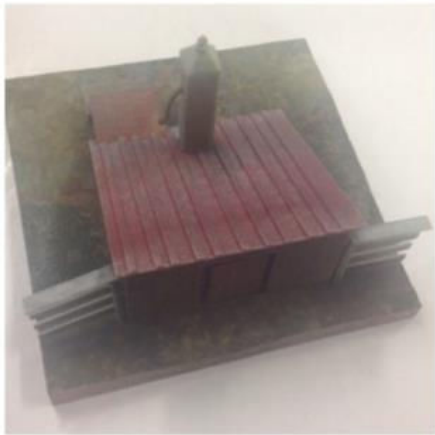
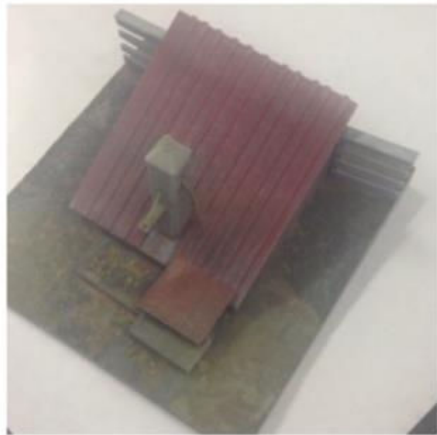
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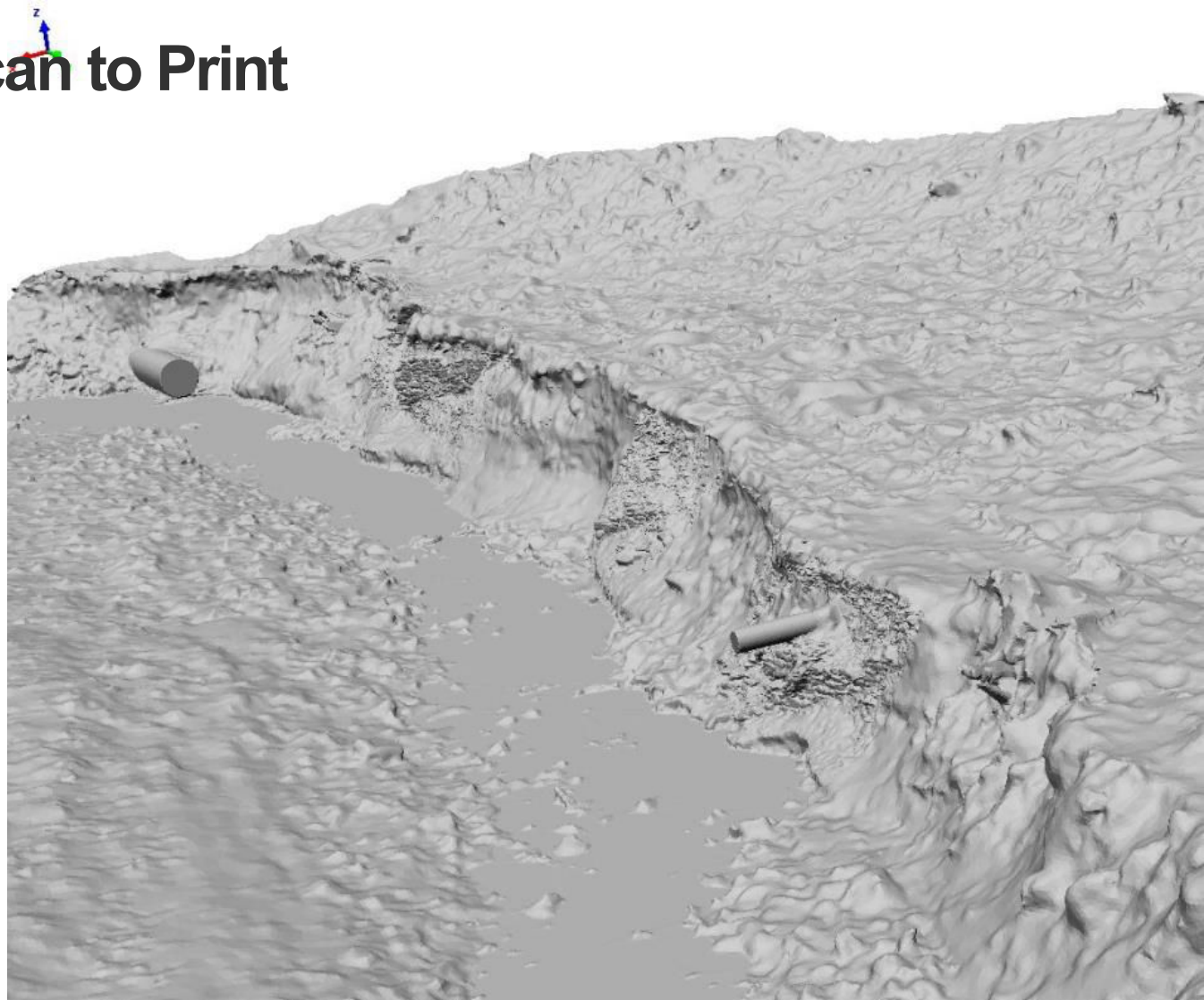
Holzapfel Hall Project: Scan to Print

Prepared for 3D Printing

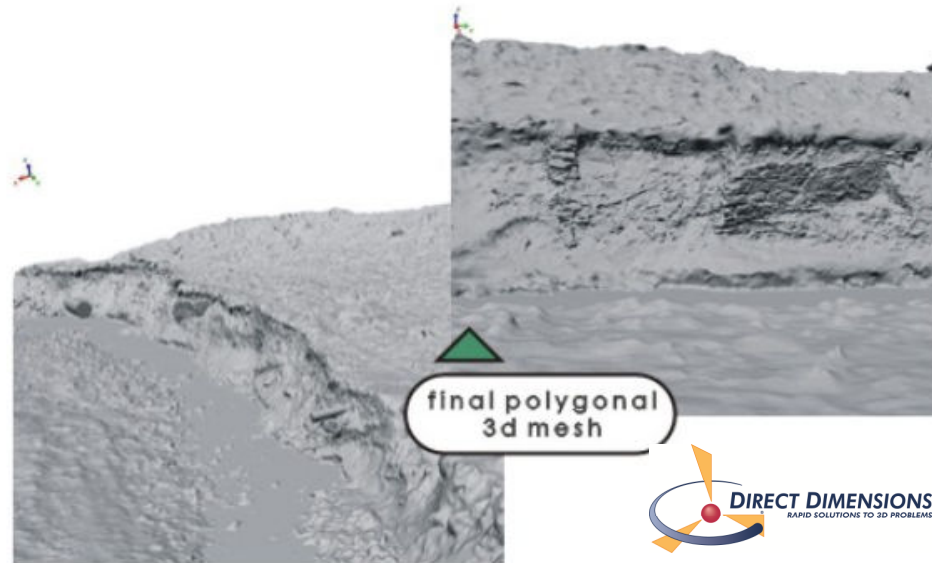




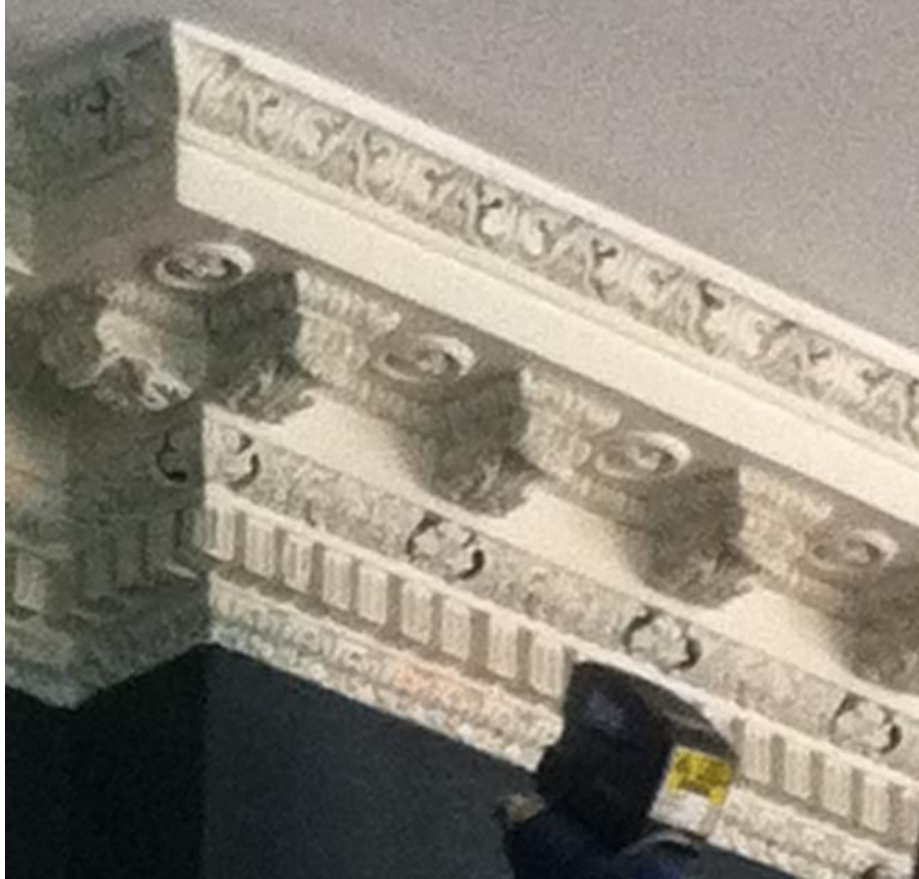
Valley Forge Project: Scan to Print



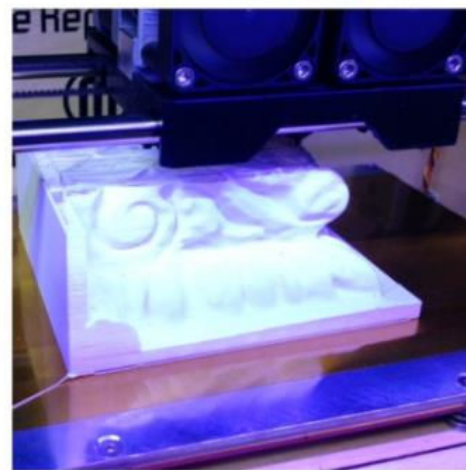
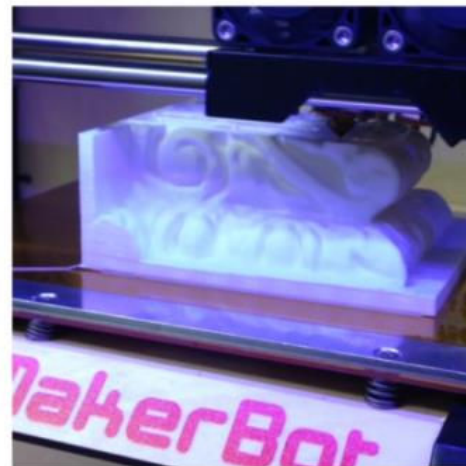
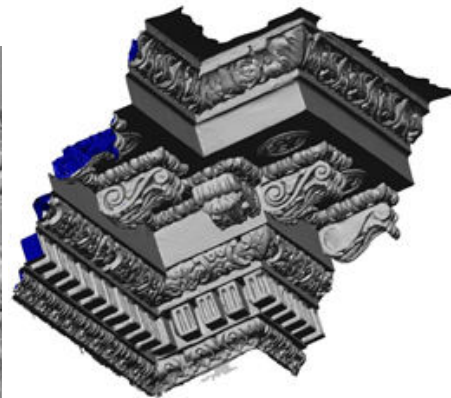
Valley Forge Project: Scan to Print



State House: Scan to Print



State House: Scan to Print

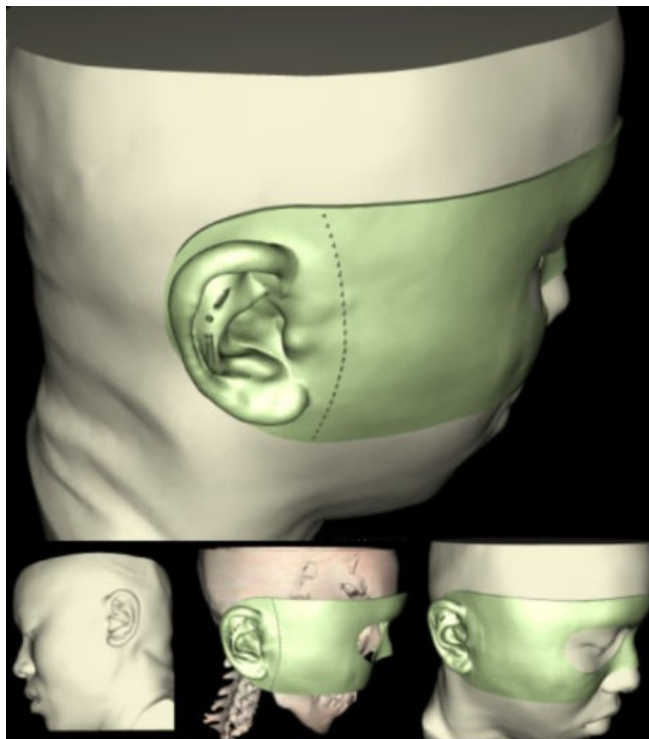
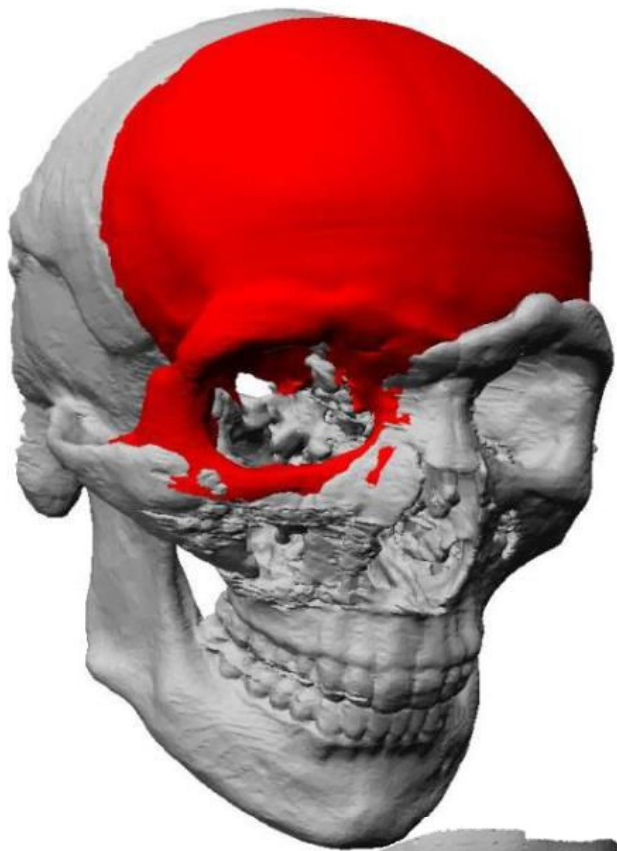


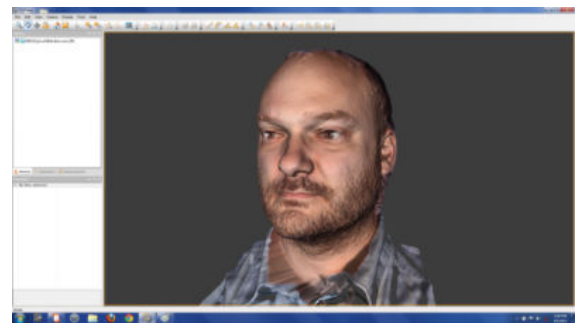
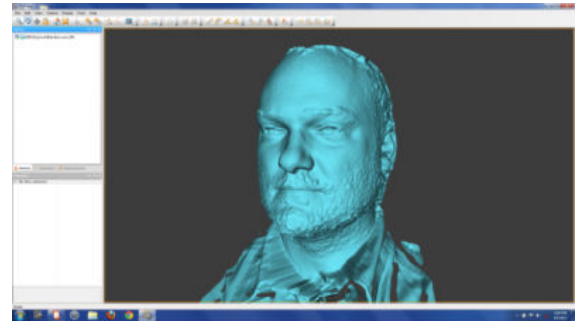




Fallen Soldier Memorial: Scan to Print to Bronze

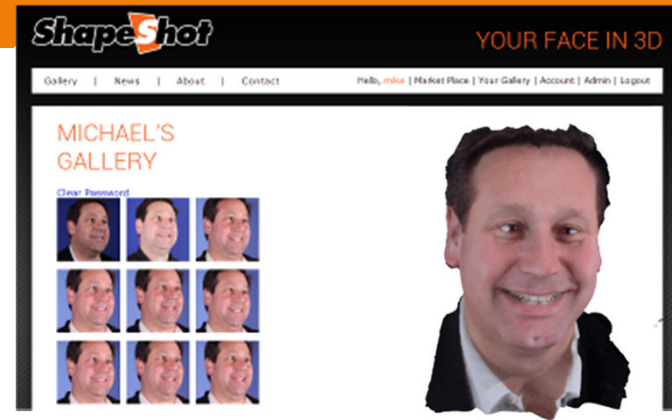




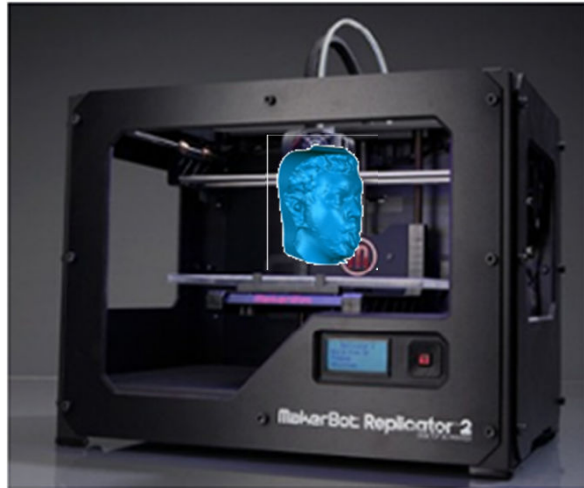




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2. Instantly view your personal on-line gallery and on ShapeShot mobile app



4. Files sent to our service providers for fulfillment

ShapeShot™ 3D Photo Booth



3. Buy personalized products from our ShapeShot online Marketplace web store



ShapeShot™





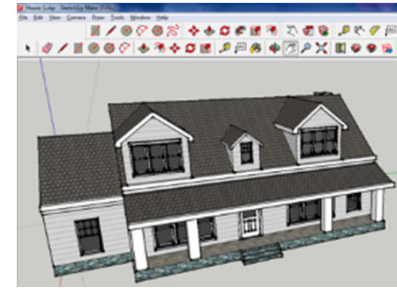




Ensuring the ability to print in 3D
Software as a service

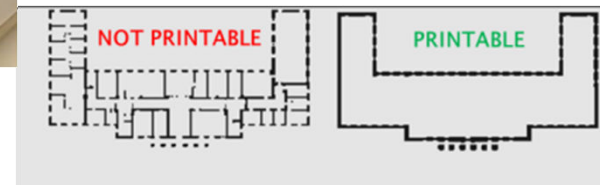
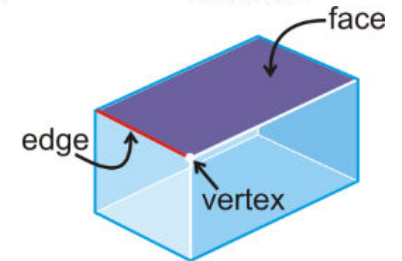
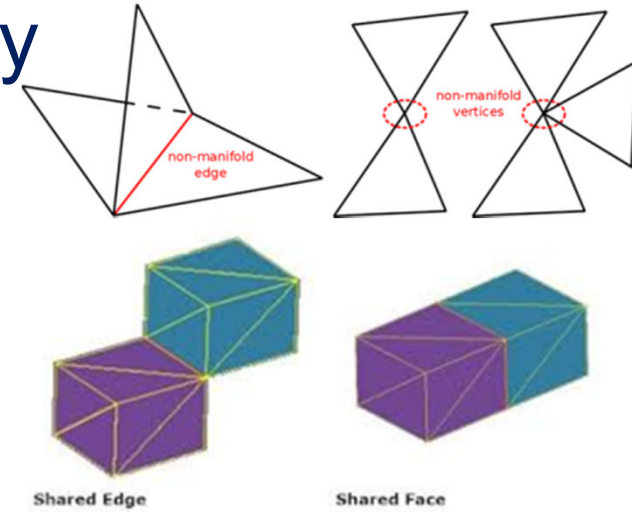
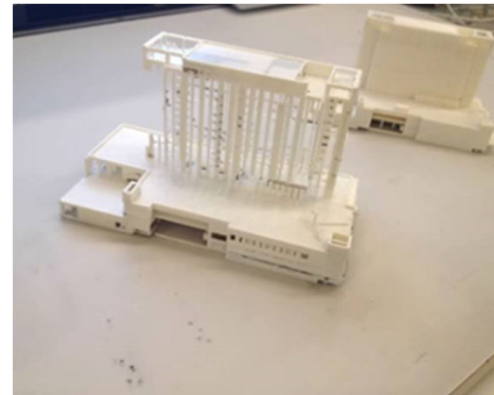
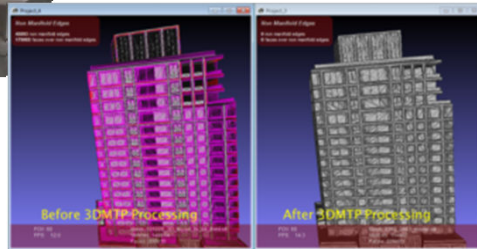
3DMTP: 3D Model to Print - File Fixing for 3D Printing

- Creates 3D printable files from any native 3D CAD and BIM formats
- Quickly and accurately converts 3D files into 3D printable formats
- Automatically fixes geometric and structural issues
- Precisely sets minimum thicknesses for selected parts of a model
- Repairs existing STLs or WRLs making them 3D printable



Challenges to making files 3D print ready

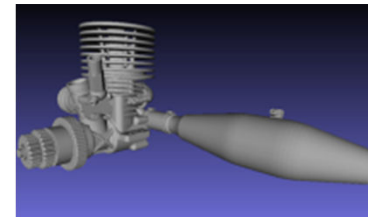
- Typical issues that prevent successful 3D printing:
- Mesh repair, is the file 'water tight' and self supporting?
- Non-volumetric geometry and non-manifold relationships
- Thickness in relationship to printer, material and tolerances
- Form, fit and function





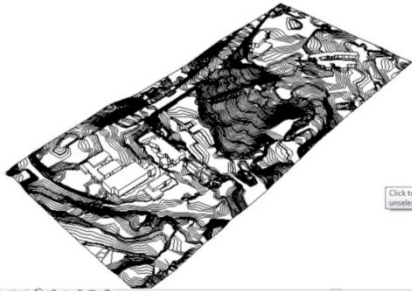
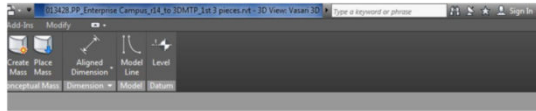
Ensuring the ability to print in 3D
User types and applications

- **Users of 3DMTP include:**
- **Architects** designing in: SketchUp, Revit, AutoCAD 3D and others
- **Engineers** designing mechanical components & scaled prototypes
- **Interior designers** for making models for marketing & sales displays
- **Service bureaus** for making customer-supplied files 3D print-ready
- **Artists and designers** to save time preparing their files for 3D printing

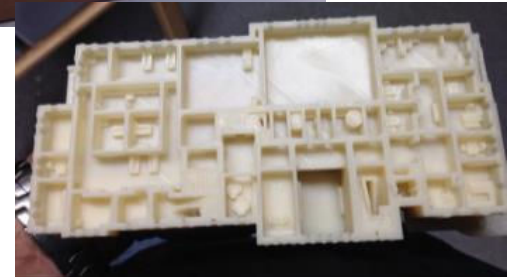
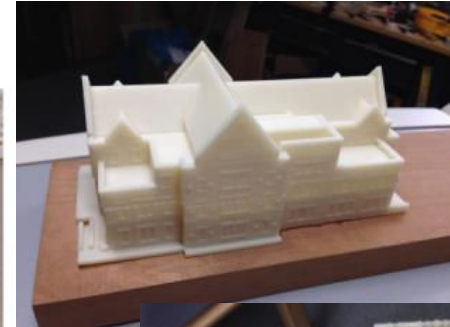
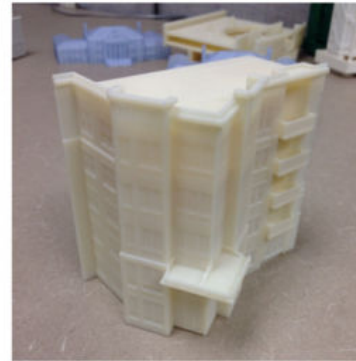
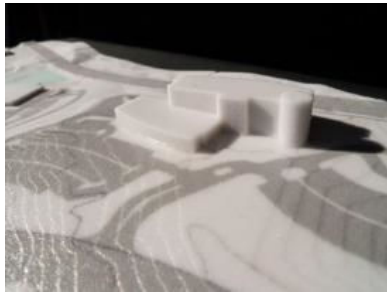
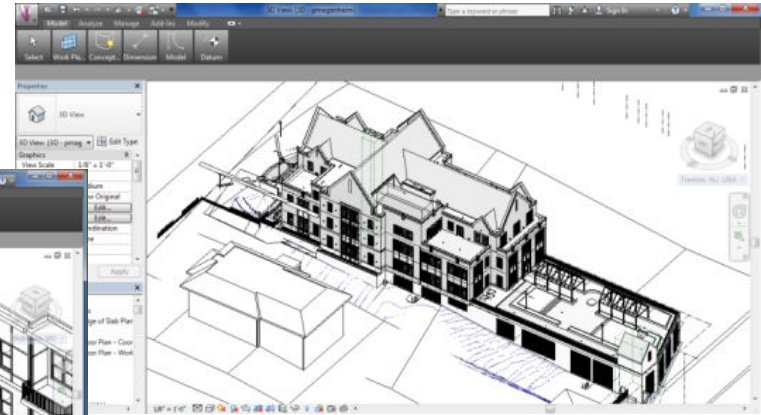
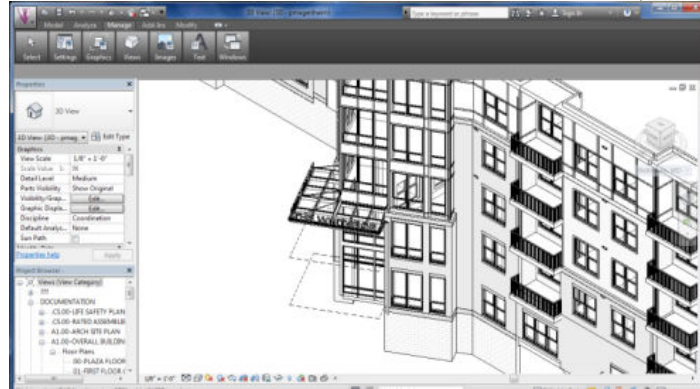


3D Model To Print

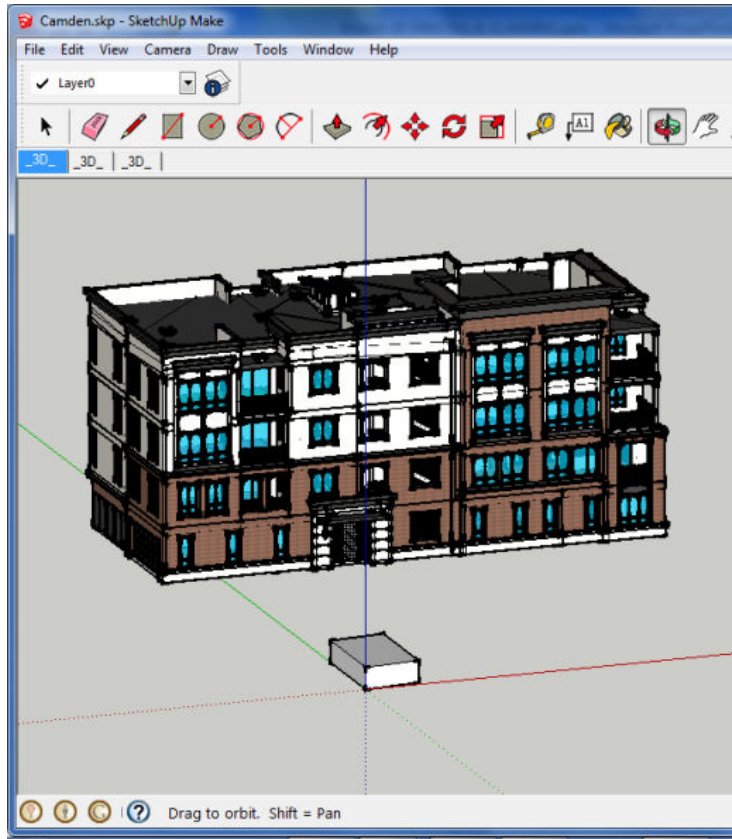
Revit



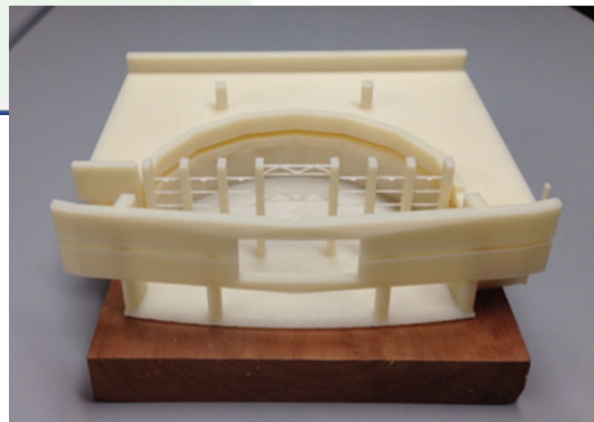
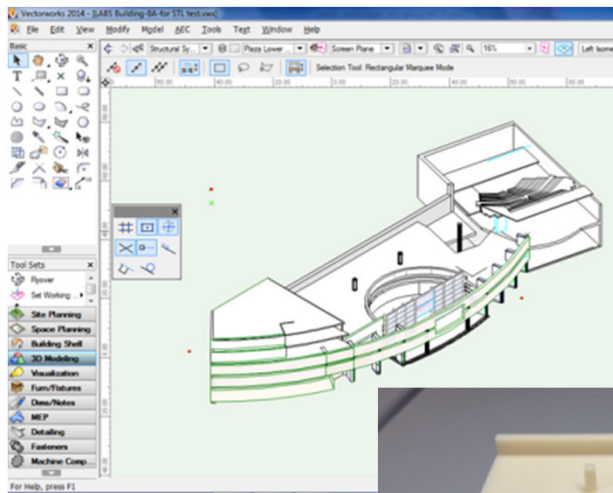
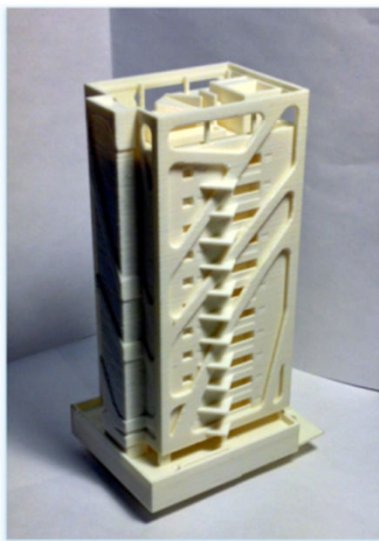
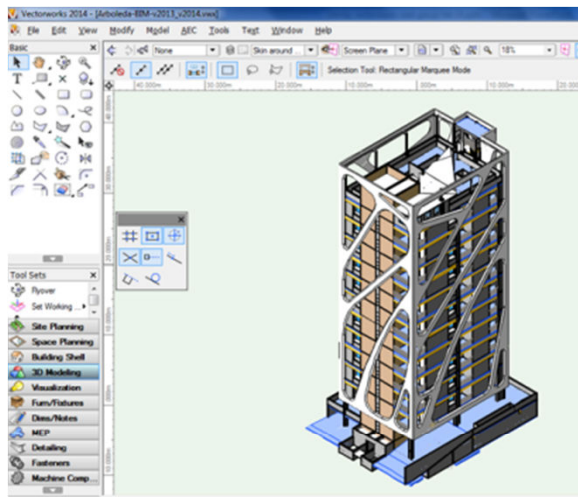
Click to see unselects.



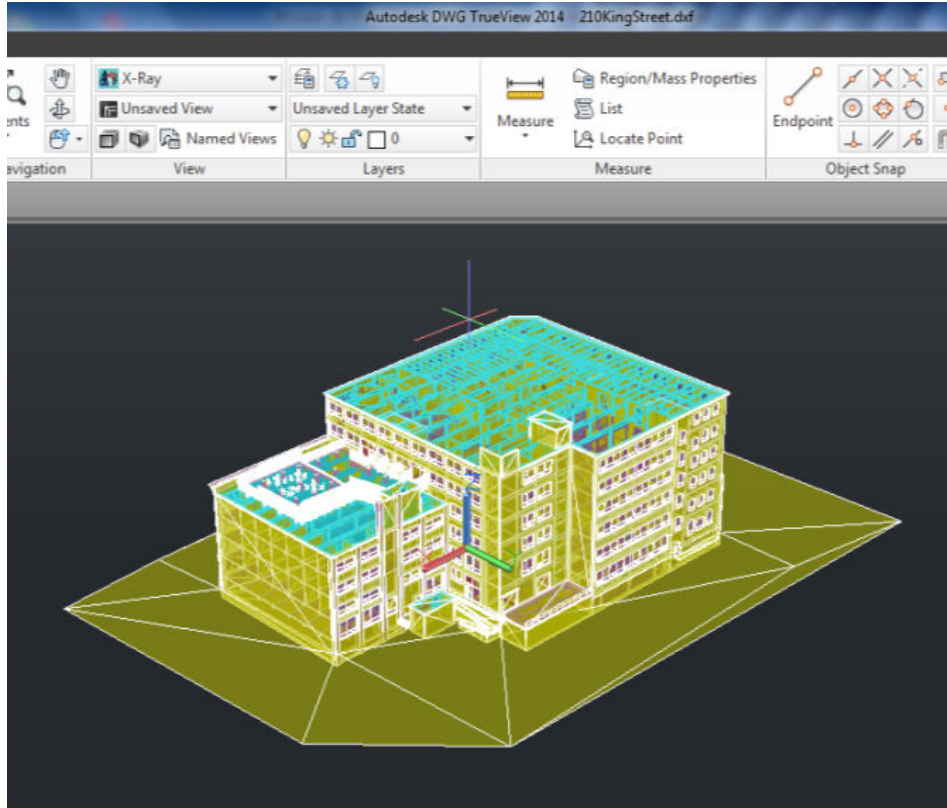
SketchUp



Vectorworks & ArchiCAD



3D CAD (DWG, DGN, DXF etc.)



Various formats – Rhino, 3D Studio MAX and many others





Ensuring the ability to print in 3D
Register for an account

- **Information needed to get started:**
- **Output scale or dimensions**
- **3D printer model to be used to print**
- **Minimum thickness requirement**
- **Output file format: STL or WRL**
- **Any other special instructions, including: interior removal, sectioning or other changes to the file**

FOR MORE INFORMATION

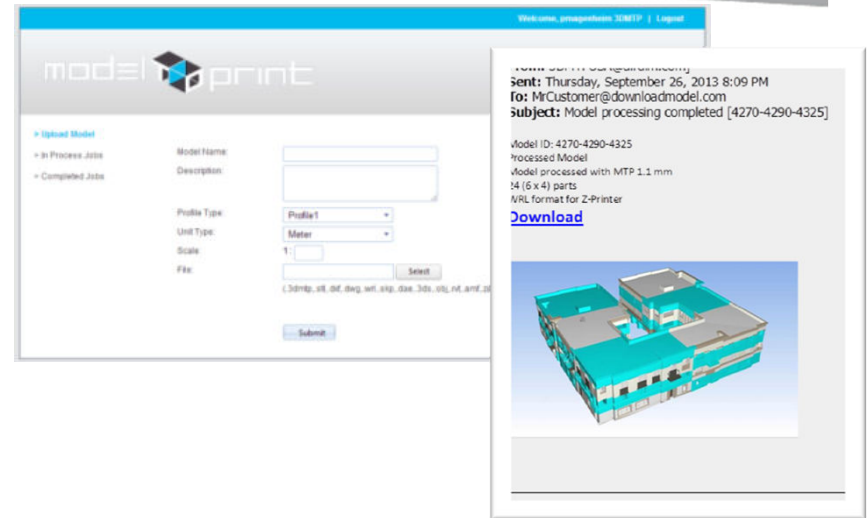
(410) 998-0880 ext. 111
Phil@3DMTPUSA.com





*Ensuring the ability to print in 3D
Easy to use*

- Full service on-line portal
- Secure upload of 3D CAD/BIM design files
- Provides easy submission of 3D files for processing
- Notification is sent to download STL or WRL files when processing is complete
- Free quote and consultation for your file



3DMTP FULL SERVICE PORTAL

www.3DMTPUSA.com



Direct Dimensions, Inc.

Offers a wide range of services & tools for the 3D scanning and printing worlds

RAPID SOLUTIONS TO 3D PROBLEMS:

- 20-year experts in coordinate metrology for reverse engineering & inspection
- 1000's of 3D laser scanning and point cloud processing projects
- 3D CAD & BIM modeling, and visualization/animation
- Processing of 3D data for reproductions and 3D printing
- Product sales and application support and training
- Specialized 3D applications and process development
- Creators of ShapeShot 3D Photo Booth

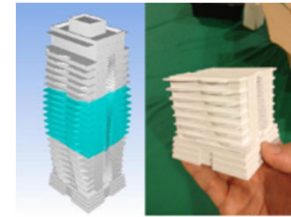


Overview of Direct Dimensions, Inc.

Offers a wide range of services & tools for the 3D scanning and 3D printing worlds

Key industries served:

- Most Industrial Applications
- Military & Defense
- Art, Sculpture, Museum
- Buildings & Facilities (AEC/BIM)
- Historic Preservation
- Entertainment and TV/Movie VFX
- Digital Fabrication
- Model preparation for 3D printing



Thank you!

Michael Raphael

Direct Dimensions, Inc.

and 3DMTP

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@dirdim

