

3D Printing: The Next Industrial Revolution

August 2014
MP105-14

©Copyright Semico Research Corp. 2014. All rights reserved.

Reproduction in whole or part is prohibited without permission of Semico Research

The contents of this report represent the interpretation and analysis of statistics and information that is generally available to the public or released by responsible agencies or individuals, but is not guaranteed as to its accuracy or completeness.

Table of Contents

Table of Contents	iii
Table of Figures	v
Executive Summary	1
Introduction to 3D Printing	2
Applications	4
Prototyping	4
Consumer-level	4
The Maker Movement.....	4
Hollywood.....	5
Healthcare	6
Fashion and Art.....	8
Architecture	11
Automotive	11
Aerospace	12
The Military.....	13
General Electric	13
3D Printer Types	15
Pen-Based	15
RepRap	15
Mini Printers	16
Desktops	16
Larger Printers	17
Differentiators.....	17
Materials	19
Process Types	19
Plastics.....	20
Other Materials	21
Proprietary Filament	22
Medical	22
Multi-material	23
3D Printing in Electronics	25
3D Printing Ecosystem	27
Advantages	30
Design Advantages	30
Leaner Supply Chain	30
Environmentally Friendly	30
The Future of 3D Printing	32
Graphene	32
Self-assembly / 4D Printing	32

Project Ara - Racetrack	33
3D Printer Forecast	35
Conclusion.....	37

Table of Figures

Figure 1: 3D Chair Being Printed	2
Figure 2: Detail of a Patterned Vase Made of 3D Printed Sugar	3
Figure 3: 3D Printed Light Fixtures	3
Figure 4: Various 3D Printed Consumer Goods	3
Figure 5: Microsoft’s Arc Touch Mouse and Surface Tablet Concepts	4
Figure 6: Jimmy, Intel’s 3D Printed Robot	5
Figure 7: 3D-Printed Glove Pieces for “Iron Man”	6
Figure 8: 3D-Printed Faces for “ParaNorman”	6
Figure 9: 3D Printed Splint on Model of a Baby’s Trachea	7
Figure 10: Pelvis with 3D-Printed Titanium Prosthetic	7
Figure 11: Fairing on a Prosthetic Leg	8
Figure 12: Spiral Cuff stainless steel bracelet.....	9
Figure 13: Pneuma 2 (human lung), by Neri Oxman, MIT	9
Figure 14: Dita Von Teese Wearing a Fully-Articulated 3D Printed Gown	10
Figure 15: Nike’s Revento Duffle Bag and 3D Printed Cleats	11
Figure 16: 3D Printed Architectural Model.....	11
Figure 17: Made In Space 3D Printer Undergoing Tests	12
Figure 18: SpaceX’s SuperDraco Engine.....	13
Figure 19: GE Part Comparison	14
Figure 20: 3Doodler and Dancer Sculpture	15
Figure 21: RepRap Printer	16
Figure 22: MakerBot Replicator 2	17
Figure 23: 3D Printing Materials List	19
Figure 24: 3D Printing Technologies	20
Figure 25: ABS Filament	21
Figure 26: 3D Printed Treats at CES	22
Figure 27: Dual-Material Prints	23
Figure 28: Rabbit Proto Printing Peanut Butter.....	24
Figure 29: Structur3D’s Discov3ry, Filled Syringes, and Final Printed Products .	24
Figure 30: 3D Printed Antenna.....	25
Figure 31: 3D MID Demonstrator Circuit -- Ag on PA6 with added SMDs	25
Figure 32: 3D Printing Ecosystem.....	27
Figure 33: Revenues for Five 3D Printer Manufacturers, 2011-2013.....	28
Figure 34: The EKOCYCLE Cube	31
Figure 35: Self-Assembly Example	33
Figure 36: Project Ara Devices	34
Figure 37: 3D Systems’ Racetrack Design	34
Figure 38: Revenues by Printers, Services, and Materials	35

Table 1: 3D Market Revenues, Including Services and Materials..... 35
Table 2: 3D Printer Revenues, Units, ASP – 2010-2020..... 36
Figure 39: 3D Printer Units and Aggregate ASP..... 36