

3-DIMENINSIONAL PRINTERS:

Technological Super Heroes

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Introduction

Three-Dimensional printers are technological feat, and as they become more easily accessible many people will realize the super powers of these extraordinary machines. Three-Dimensional Printers are a modern wonder. They are already making life easier for those companies and agencies that can afford them, and as they get more cost effective they will be able to help ordinary people do things that may have been out of their reach and price range. Three-d printers use lasers and electrical beams to create almost anything you can imagine from a tasty chocolate cake to the air plane that is flying over your head. (Marks, P. 2011.) They can use several different kinds of materials, or a combination of those materials like a plastic metal alloy to make things like a working wrench with no assembly necessary. ¹ (MrCrafty78, 2011) Three-d printers use various methods and fine powders to spray, layer and melt products into shape. “It is one of the fastest growing areas of manufacturing”. (Anonymous, 2011²)

Background

Three-Dimensional printers have been around for only about twenty years. In 1983 Charles Hull created the precursor to the modern day printer called a stereolithograph, and from

¹ Video- *Reference Page* (12)

² Anonymous (21)

that came prototyping and rapid prototyping technology.(patent)³ Charles Hull later created one of the first three dimensional printers with his company 3D Systems corp. In 1990 several other companies such as Z-Corp, the fastest printer and maker of one of the only printers that prints in color and Statasys another large and growing 3-D printer company appeared on the scene and have quickly made three-d printing the wave of the future. (Anonymous, 2011)⁴

Potential Benefits

Three-dimensional printers have infiltrated almost every area of our economy. While many universities are abandoning their manufacturing departments, schools like California State University, Long Beach, are expanding their programs because of three- dimensional printers. (Anonymous, 2011)⁵ Manufacturing with this new technology could definitely be on the rise.

Three-d printers can make cars, bikes, and even airplanes. The possibilities are infinite for the benefits of three-d printers. The **Urbee** a hybrid car that can go 200 miles per gallon was made almost entirely by 3-D printed parts.(Anonymous, 2011)⁶ “The strength of 3D-printed titanium can equal that of the traditionally machined metal, says Dan Johns, who is printing strong, lightweight metal parts for Bloodhound SSC, the rocket car aiming to break the land-

³ Patent listed *Reference Page* (10)

⁴ Anonymous (21)

⁵ Anonymous, *Reference Page*- 21)

⁶ Anonymous, *Reference Page* -20)

speed record in 2013.” Marks, P. 2011). The United States Air Force and Department of Defense are looking in to the technology to make drones or UAVs and airplane parts. A fully functional drone has already been made in the United Kingdom. Southampton University Laser Sintered Aircraft (SULSA) took a total of five days to create and make and it flew easily on the first try. (Marks, P. 2011)

Three-dimensional printers are also magnificent in the kitchen. They can make anything from cake (CNNMoney,2011) to spaghetti noodles and a myriad of things in between. Could three-d printers solve the worlds hunger issues? We may not be at that point yet, but restaurants and bakeries not just in this country, but around the world are using them all the time to create delicious creatively designed foods.

Medical researchers are experimenting with creating bones, appendages and even organs using three- dimensional printers. Medical researchers are very excited about the possibilities of three-d printers. Three-d printers have already begun making tissue for skin grafts and medical equipment. (anonymous, 2009)⁷

⁷ Anonymous- Reference Page- 15)

There are companies that are even using three-d printers to make scaled models of buildings and houses. These same companies hope to one day make entire buildings using concrete shaped by 3-d printers. . Researchers, from the USC Center for Rapid Automated Fabrication Technologies (CRAFT) have already made a brick wall from a 3-dimensional printer.(Reade, L. 2011).

Three-d printers do not just create objects. They are creating lots of future scientist and engineers at several schools across the country. Three-d printing “helps a great deal... [with getting kids and parents interested in science and engineering] and the enthusiasm it generates is priceless”. (“3d printer brings,” 2010) You may even be able to create clothes and shoes from three-d printers in the very near future.(A factory on your desk;. 2009, September) “Terry Wohlers, a consultant based in Colorado who monitors the industry(3-D printing), reckons the global market for additive manufacturing was worth \$1.2 billion in 2008 and that it could double in size by 2015”. (A factory on your desk; 2009, September). You can make things that in the past were “too pricey and tough to make.” (Marks, P. 2011)

Legal and Ethical Issues

Three-d printers may take jobs away from some people. In the beginning we could see some job loss at the hands of another machine, but if in the long run it makes manufacturing

more affordable. Perhaps we could see resurgence in manufacturing in this country along with more job opportunities for all people. A legal issue that we have seen arise on a global scale is that of intellectual property rights. We could see several more cases of intellectual property rights being taken. People could in fact steal another person's ideas without giving any kind of credit.

Security Concerns

If you wanted to buy a three- dimensional printer and make Barbie® in your basement theoretically you could. Patents being stolen and copied and materials being created without permission of companies is a strong possibility with a three-d printer. Without government regulations or controls three-d printers could become the new wave of piracy. It could be a **Napster** like situation all over again. Technological piracy could rise to new levels.

Social Problems

Three-D printers are very expensive at the moment as well as cumbersome. With prices ranging from 1000- several million depending on the job you want the printer to do, and the company you get it from. (MOCK, D. 2010). They also are not very practical for most households, yet. The smallest printer weighs in at about 120 pounds, (3d printer brings, 2010). and some metal

3-d printers can fill up a large warehouse. (Imaterialise, 2010⁸) Three-d printers are beginning to be marketed to the generally public, but only in an order online fashion, and unless you have a three-d printing facility in your area. It can be inconvenient. There are companies like **Fortus** and **Objet** that will print three-d items for you and ship them to you for a small fortune. In the future however you may be able to go to your local FedEx® and get a item copied for a nominal fee.

Further Research

Three-d printers seem to be improving rapidly. They are revolutionizing the way people think about manufacturing. There are already printers on the market that can duplicate themselves. (Simonite, T. 2010) They are getting easier to use and much more user friendly for the technologically inept. It takes only a short training class for the smaller printers and if you have any experience with CAD software or any other kind of engineering software it can be “surprisingly easy to use”. (Computer Electronics; 2011, September). The cost of three-d printers is decreasing exponentially “prices of 3D printers have declined substantially in the past five years, to as low as \$1,000 from \$400,000 five years ago”. (Kross, 2011). If they continue to grow in popularity and shrink in cost they will cost less than an IPAD and be more popular too.

⁸ Video- Reference Page 14)

Conclusion

It took almost fifty years for the computer to do what a three-d printer has done in less than thirty. Three-dimensional printers like computers in the last century will continue to get more compact and light weight. They also appear to be getting cheaper to make. “Three-d printer companies are making more money every year” (A factory on your desk,2009, September). and their products are getting cheaper. The most revolutionary advances for 3D printing are probably at least 10 to15 years away, but as three-d printers prices continue to fall, much like basic printer prices and computers before them, it will not be long before average people can afford a three-d printer. When this happens, “the dreams of inventors and entrepreneurs will be realized” (Kross, R. 2011, August) Companies are finding cheaper ways to make the printers. There was a time even 15 years ago when people could not imagine having a regular two dimensional printer in their home. In fifteen years maybe we will all have printers that can print out the latest fad in clothes or that new bicycle we have been wanting. (BromptonWorld, BBC,2011)⁹

⁹ Video- Reference Page (18)

Reference Page

- 1) Marks, P. (2011). Flying on printed wings. *New Scientist*, 211(2823), 17-18. Retrieved from EBSCOhost. visited last: (OCT 06, 2010)

This article is about the creation of an UAV or Drone aircraft. This article goes into great detail about 3D printer capabilities. It talks about manufacturing prospects of three-dimensional printers. It also talks about some of the materials used and their practicality as far as real world usage is concerned.

- 2) Computer Electronics; Z Corporation's 3D Printing Technology Gives Google Ad Campaign a Stunning New Look. (2011, September). *Computer Weekly News*, 1180. visited last: (OCT 06, 2010)

This article discusses the qualifications of several different three-dimensional printers and their ability to advertise a new product of **Google's**. The article goes into detail about how the company **Grow** decides about which printer to use and why they chose it. It also talks about how advertising using this technology really demonstrated the idea they were going for.

- 3) Z Corporation; Congressman John Tierney and Z Corporation Announce New Education Program Aimed at Skills Crisis. (2011, September). *Computers, Networks & Communications*, 191. Retrieved October 10, 2011, from ProQuest Computing. (Document ID: 2444717901). visited last: (OCT 08, 2010)

This article describes Congressman John Tierney efforts to improve a lack of interest in science and engineering in his state. It talks about how he has partnered with Stratasys

to combat falling grades in these areas and how. Three-D printers are hopefully going to bolster interest in the field of science.

- 4) Computer Peripherals Companies; Stratasys Selected by Georgia Tech and DARPA MENTOR Program to Provide 3D Printers for High Schools across U.S. (2011, September). *Defense & Aerospace Business*, 97. Retrieved October 10, 2011, from ProQuest Science Journals. (Document ID: 2451598411). visited last: (OCT 09, 2010)

This article discusses how Stratasys a leading 3D printing corporation has been selected by Georgia Tech to and DARPA MENTOR program to provide 3D printers to schools all across the country in an effort to increase interest and raise scores in science and science related classes. This article discusses the benefits of Stratasys and how it will hopefully get children excited about science by allowing them to have hands on experience with 3d printers.

- 5) A factory on your desk;. (2009, September). *The Economist*, 392(8647), S.26-S.29. Retrieved October 10, 2011, from ABI/INFORM Global. <http://www.economist.com/node/14299512> visited last: OCT, 10, 2010

This magazine article describes a future where you will be able to do virtually anything with 3D printers. It then describes the capabilities they have now and the potential of the technology in the future. The article describes the financial aspects of 3D printing. Where it was financially years ago and where it may be in the future.

- 6) Simonite, T. (2010). I, replicator: Self-replicating machines come of age. *New Scientist*, 206(2762), 40-43. Retrieved from EBSCOhost. visited last: (OCT 09, 2010)

This is an article about a computer that can make almost anything. It can even remake itself or parts of itself so that it can repair itself. This article goes into detail about the Maker bot a desktop sized machine that replicates itself. It also describe how it is one of the smaller 3D printers on the market.

- 7) Reade, L. (2011). 3D print: shaping the future. *Chemistry & Industry*, (8), 14-15. Retrieved from EBSCOhost. visited last: (OCT 07, 2010)

This article discusses rapid prototyping or 3D printing and its various uses. It also talks about the future of rapid prototyping and how it has grown in the last several years. It discusses some of the medical uses and other areas that are already using this technology.

- 8) MOCK, D. (2010). Lower Prices Drive 3-D Printer Market. *Design News*, 65(5), 49-50.

Retrieved from EBSCOhost. visited last: (OCT 07, 2010)

This magazine article describes the prices of 3D printers and other similar technology and how they continue to shrink. It also talks about how they are expensive at this point in time but how the price of this machinery has gone to rapidly over the last few years.

- 9) Patent Information: Charles W. Hull **Patent number:** 4575330

Filing date: Aug 8, 1984

Issue date: Mar 11, 198 **United States Patent m**

[li] Patent Number: 4,575,330 [45] Date of Patent: Mar. 11,1986

[54] APPARATUS FOR PRODUCTION OF THREE-DIMENSIONAL OBJECTS BY STEREO LITHOGRAPHY

[75] **Inventor: Charles W. Hull, Arcadia, Calif.**

[73] Assignee: UVP, Inc., San Gabriel, Calif.

[21] Appl. No.: 638,905

[22] Filed: Aug. 8,1984

[51] Int CI/ B29D 11/00; G03C 00/00

[52] U.S. CI 425/174.4; 425/174;

425/162; 264/22; 430/269; 156/58; 365/119 visited last: (OCT 08, 2010)

This is the patent number and information that is listed in the US Patent directory. This gives the creators information and when this technology was first patented.

- 10) *MrCrafty78. (Producer). (2011). *National geographic known universe s03e06 print tools*. [Web Video]. Retrieved from <http://www.youtube.com/watch?v=pQHnMj6dxj4&feature=related> visited last: OCT, 10, 2010

This video goes into great detail about the capabilities of 3Dprinters and gives you a real clear idea of what they can do. You can find the terms of use for this video in -

<http://www.youtube.com/t/terms>

- 11) *Tech Labs Educ. (Producer). (2010). *Z corp - z printer 450* . [Web Video]. Retrieved from <http://www.youtube.com/watch?v=xP-Gqi4YQhk&noredirect=1> visited last: Nov, 12, 2010

This is a video about one of the kinds of printers in my article. You can find the terms of use for this video in - <http://www.youtube.com/t/terms>

- 12) *Imaterialise . (Producer). (2010). *3d metal printing*. [Web Video]. Retrieved from <http://www.youtube.com/watch?v=i6Px6RSL9Ac&feature=related> visited last: OCT, 10, 2010

This is a video about 3D printing Metal objects. You can find the terms of use for this article in -

<http://www.youtube.com/t/terms>

- 13) Anonymous. (2009, December 10). Retrieved from <http://rdmag.com/New-To-Market/2009/12/New-to-Market-First-commercial-3-D-bio-printer-makes-human-tissue-and-organs/> visited last: OCT, 10, 2010

This is a website article about the medical uses of 3D printers. This article discusses some of the already commonly used things that 3d printers do, and goes into detail about some of the things they are hoping to use 3D printers for in the future. Such as organ and tissue repair and replacement.

- 14) Kross, R. (2011, August 08). *How 3d printing will change absolutely everything it touches*. Retrieved from <http://www.forbes.com/sites/ciocentral/2011/08/17/how-3d-printing-will-change-absolutely-everything-it-touches/> visited last: OCT, 10, 2010

This is a website article about the modern marvel that the 3D printer is. It does into great detail about some of the common everyday things 3D printers will be able to do.

- 15) *CNN Money. (Producer). (2011). *3-d food printer makes dessert* . [Print Video]. Retrieved from <http://www.youtube.com/watch?v=XQni3wb0tyM> visited last: OCT, 10, 2010

I have used this video strictly for information from **CNN** . It is does not allow use as an embedded video and so I have not used as such. You can find the terms of use for this video in - <http://www.youtube.com/t/terms>

- 16) *BromptonWorld, BBC. (Producer). (2011). *Printing a bicycle with a 3d printer* . [Web Video].

Retrieved from <http://www.youtube.com/watch?NR=1&v=hmxjLpu2BvY> visited last: OCT, 10, 2010

I used this video and some of its information. This video discusses how a 3D printer can make an entire Bike with working parts. The video is in 3DPRINTERS1. You can find the terms of use for this article in - <http://www.youtube.com/t/terms>

- 17) Anonymous. (2011, September 27). 3d printer-maker Stratasys expands production capacity.

Business Wire. New York. Retrieved from

<http://mutex.gmu.edu:2048/login?url=http://proquest.umi.com/pqdweb?did=2469555851&Fmt=3&clientId=31810&RQT=309&VName=PQD> visited last: OCT, 10, 2010

This magazine article discusses the growth of the 3D printing industry. It mostly focuses on Stratasys Corp. It does however discuss 3D printing and the whole industry.

- 18) Anonymous. (2011, September 15). A machine that gives shape to your ideas:. *New York Times*, p. B.6. visited last: (OCT 09, 2010)

This newspaper article discusses a popular at home model of 3D printer known as the *Maker Bot*. It talks about the creator and other creators of this 3D printer and how people all over the country are making and improving this machine all the time. This article discusses the many things the printer has created and how small it is.

- 19) 3d printer brings kids into engineering lab. (2010, December 10). *MAN: Modern Applications News*, 44(12), 10. visited last: (OCT 06, 2010)

This article talks about kids in Minneapolis, Minnesota, and how they are using math science and a 3D printer to create car parts. It also discusses how this technology is improving children's interest in math and science.

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