



**PRINTING
NETWORK**

3D PRINTING

What is it?

- 3D printing is also known as desktop fabrication or additive manufacturing, it is a prototyping process of making a three-dimensional solid object of any shape from a digital model.

How does it work?

- The object is created in 3D software and the digital 3D-model is saved in STL format and then sent to a 3D printer. The 3D printer then prints the design layer by layer and forms a real object.

What's the difference between 3D printing and other manufacturing techniques?

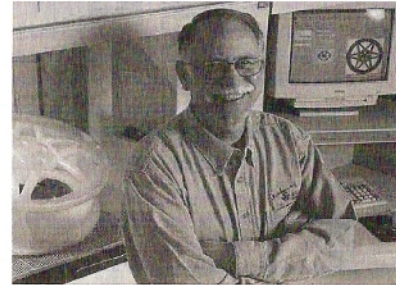
- 3D printing is also considered distinct from traditional machining techniques, which mostly rely on the removal of material by methods such as cutting or drilling (*subtractive* processes).

BRIEF HISTORY OF 3D PRINTING

1892 - Blather proposes a layering method of producing topographical maps.

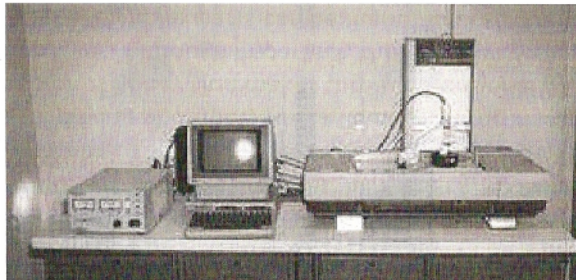
1972 - Mastubara of Mitsubishi motors proposes that photo-hardened materials (photopolymers) are used to produce layered parts.

1981 - Hideo Kodama of Nagoya Municipal Industrial Research Institute publishes the first account of a working photopolymer rapid prototyping system.



1984 - THE BIRTH OF 3D PRINTING

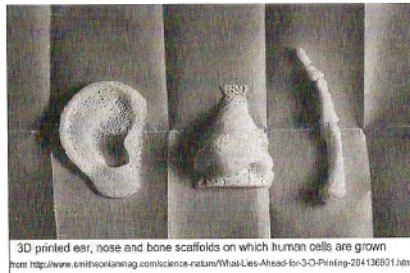
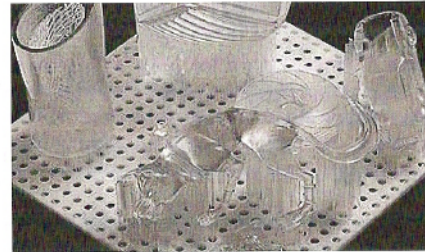
Charles Hull, later the co-founder of 3D Systems, invents stereolithography, a printing process that enables a tangible 3D object to be created from digital data. The technology is used to create a 3D model from a picture and allows users to test a design before investing in a larger manufacturing program. Stereolithography (SLA) – was patented in 1987



1991 - Stratasys produces the world's first FDM (fused deposition modelling) machine. This technology uses plastic and an extruder to deposit layers on a print bed.

1992 - 3D systems produce the first SLA 3D Printer machine. The machine's process involves a UV laser solidifying photopolymer, a liquid with the viscosity and color of honey that makes three-dimensional parts layer by layer. Although imperfect, the machine proves that highly complex parts can be manufactured overnight.

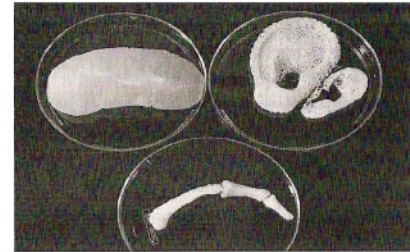
1992 - DTM produces first SLS (selective laser sintering) machine. This machine is similar to SLA technology but uses a powder (and laser) instead of a liquid.



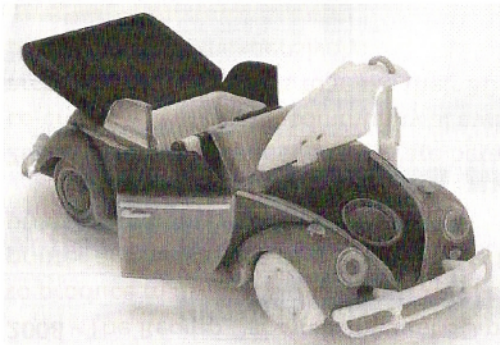
3D printed ear, nose and bone scaffolds on which human cells are grown
from <http://www.smithsonianmag.com/science-nature/What-Lies-Ahead-for-3D-Printing-20130531.html>

1999 - Scientists manage to grow organs from patient's cells and use a 3D printed scaffold to support them. The first lab-grown organ is implanted in humans when young patients undergo urinary bladder augmentation using a 3-D synthetic scaffold coated with their own cells. The technology, developed by scientists at the Wake Forest Institute for Regenerative Medicine, opened the door to developing other strategies for engineering organs, including printing them. Because they are made with a patient's own cells, there is little to no risk of rejection.

2002 - Scientists engineer a miniature functional kidney that is able to filter blood and produce diluted urine in an animal. The development led to research at the Wake Forest Institute for Regenerative Medicine that aims to “print” organs and tissues using 3D printing technology.



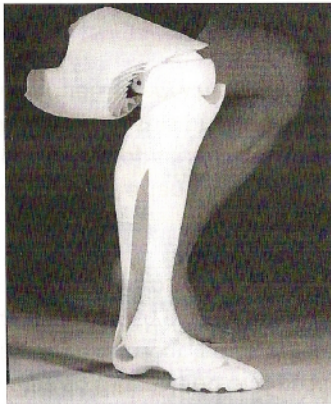
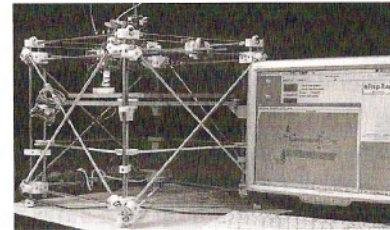
2005 – Dr. Adrian Bowyer at University of Bath founds RepRap, an open-source initiative to build a 3D printer that can print most of its own components. The vision of this project is to democratize manufacturing by cheaply distributing RepRap units to individuals everywhere, enabling them to create everyday products on their own.



2006 - The -first SLS (selective laser sintering) machine becomes viable. This type of machine uses a laser to fuse materials into 3D products. This breakthrough opens the door to mass customization and on-demand manufacturing of industrial parts, and later, prostheses. That same year Objet, a 3D printing systems and materials provider, creates a machine capable of printing in multiple materials, including elastomers and polymers. The machine permits a single part to be made with a variety of densities and material properties.

2008 - The Reprap Darwin is the first 3D printer to be able to produce many of its own parts. This self-replicating printer allows users to print components to create other printers for their friends.

2008 - Shapeways launches a private beta for a new co-creation service and community allowing artists, architects and designers to make their 3D designs as physical objects inexpensively.



2008 - MAJOR BREAKTHROUGH FOR PROSTHETICS

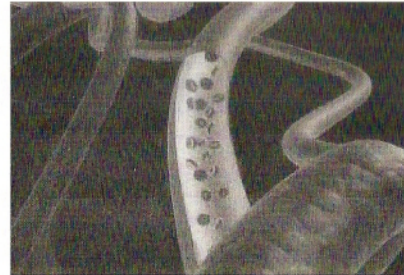
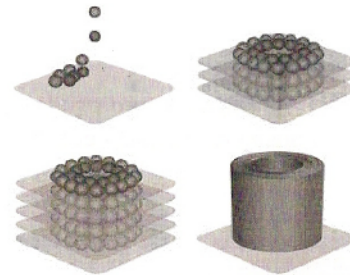
The first 3D prosthetic leg is produced. The first person walks on a 3D-printed prosthetic leg, with all parts — knee, foot, socket, etc. — printed in the same complex structure without any assembly. The development guides the creation of Bespoke Innovations, a manufacturer of prosthetic devices which makes customized coverings that surround prosthetic legs.

2008 - Makerbot's Thingiverse launches – a website for free 3D (and other models) file sharing.

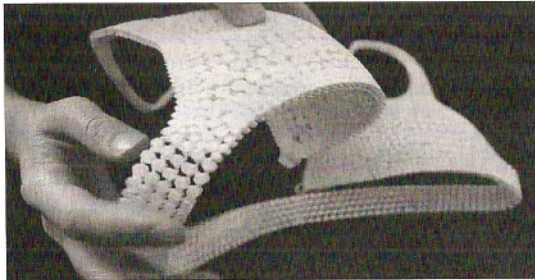
2009 - DIY KITS FOR 3D PRINTERS ENTER THE MARKETPLACE

MakerBot Industries, an open-source hardware company for 3D printers, starts selling DIY kits that allow buyers to make their own 3D printers and products.

2009 - Bioprinting innovator Organovo,
relying on Dr. Gabor Forgacs's technology,
uses a 3D bioprinter to print the
first blood vessel.



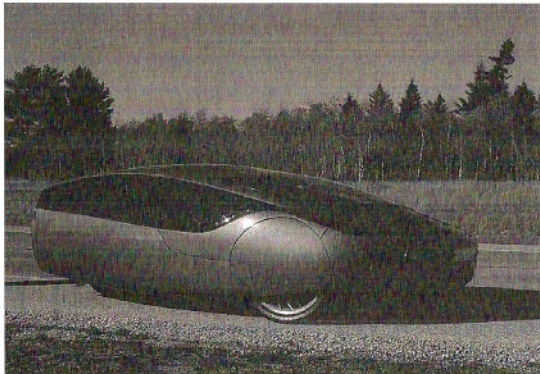
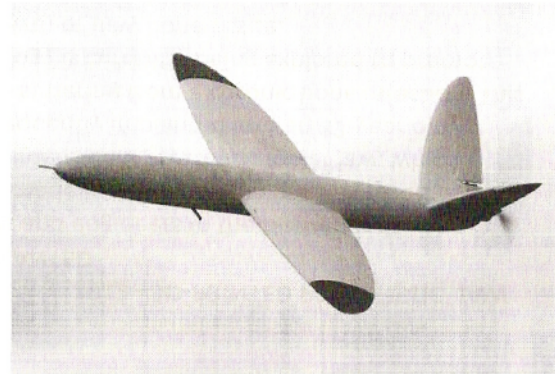
2011 - Researchers at Cornell University began to build 3D food printer. And few months later led by the University of Exeter, the University of Brunel and application developer Delcam, researchers in UK have presented the world's first 3D chocolate printer.



2011 - Shapeways and Continuum Fashion announced the first 3d printed bikini.

2011 - WORLD'S FIRST 3D-PRINTED ROBOTIC AIRCRAFT

Engineers at the University of Southampton design and fly the world's first 3D-printed aircraft. This unmanned aircraft is built in seven days for a budget of £5,000. 3D printing allows the plane to be built with elliptical wings, a normally expensive feature that helps improve aerodynamic efficiency and minimizes induced drag.

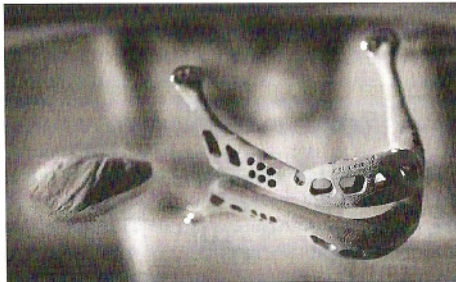


2011 - WORLD'S FIRST 3D-PRINTED CAR

Kor Ecologic unveils Urbee, a sleek, environmentally friendly prototype car with a complete 3D-printed body at the TEDxWinnipeg conference in Canada. Designed to be fuel-efficient and inexpensive, Urbee gets 200 mpg highway and 100 mpg city. It is estimated to retail for \$10,000 to \$50,000 if it becomes commercially viable.

2011 - 3D PRINTING IN GOLD AND SILVER

i.materialise becomes the first 3D printing service worldwide to offer 14K gold and sterling silver as materials — potentially opening a new and less expensive manufacturing option for jewellery designers.



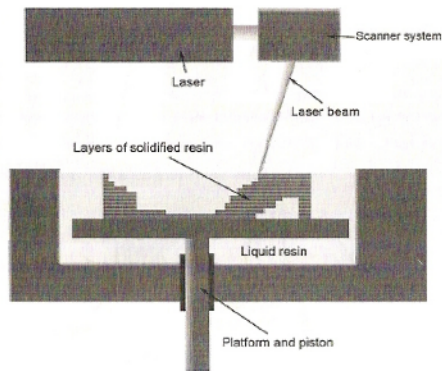
2012 - 3D-PRINTED PROSTHETIC JAW IS IMPLANTED

Doctors and engineers in the Netherlands use a 3D printer made by LayerWise to print a customized three-dimensional prosthetic lower jaw, which is subsequently implanted into an 83-year old woman suffering from a chronic bone infection. This technology is currently being explored to promote the growth of new bone tissue.

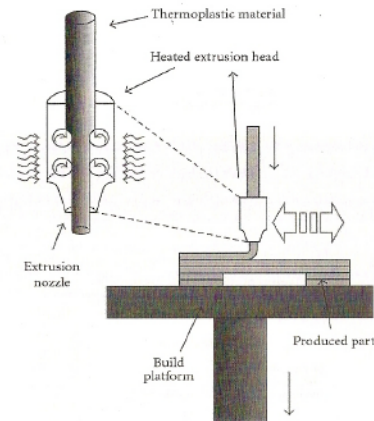
3D printing technologies

Quite a few technologies are capable to do 3D printing. The main differences are how layers are built to create parts. The most widely used technologies for 3D printing are:

- **SLA – stereolithography;**

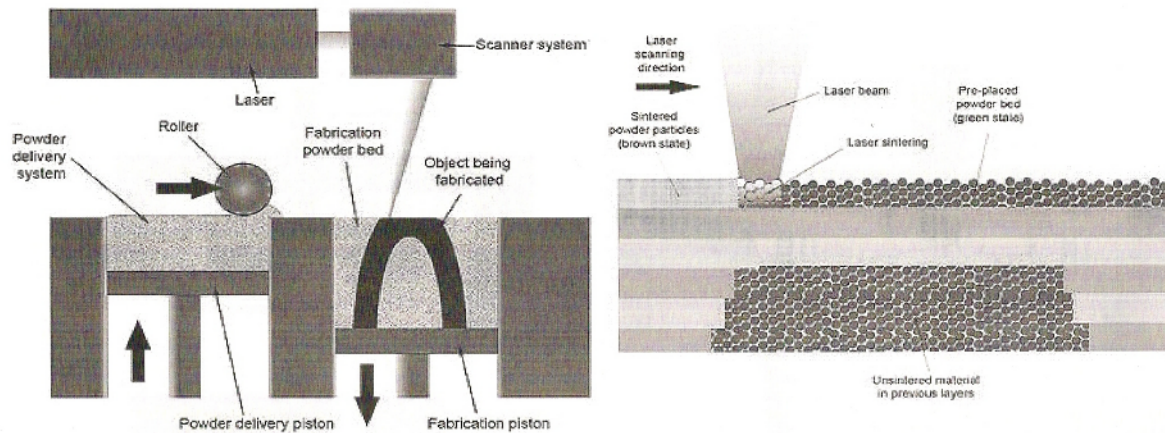


- **FDM - fused deposition modelling ;**



The main difference between the first technique and two others is that selective laser sintering (SLS) and fused deposition modelling (FDM) use melting or softening material to produce the layers

- SLS - selective laser sintering



3D printing applications

Industries:

- Medical
- Manufacturing
- Automotive
- Aviation
- Jewellery
- Fashion
- Do it yourself

One of the most important applications of 3D printing is in the medical industry. With 3D printing, surgeons can produce mock-ups of parts of their patient's body which needs to be operated upon.

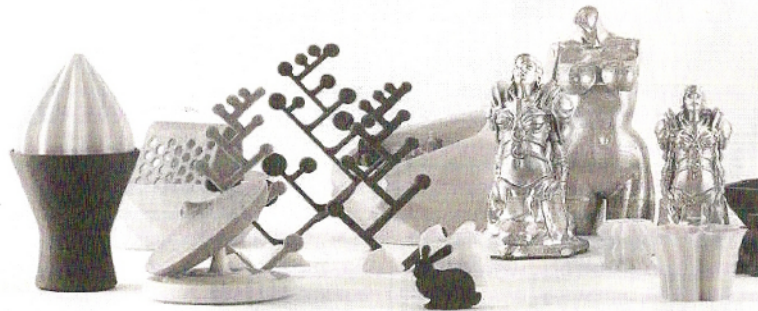
3D printing make it possible to make a part from scratch in just hours. It allows designers and developers to go from flat screen to exact part.

Nowadays almost everything from aerospace components to toys are getting built with the help of 3D printers. 3D printing is also used for jewellery and art, architecture, fashion design, art, architecture and interior design.

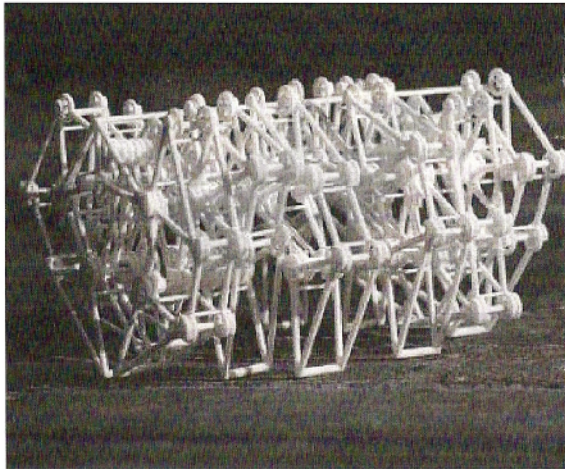
What are the materials used to print 3D objects?

Types of filaments:

- ABS plastic,
- PLA,
- polyamide (nylon),
- glass filled polyamide,
- stereolithography materials (epoxy resins),
- silver,
- titanium,
- steel,
- wax,
- photopolymers and polycarbonate,
- wood,
- rubber...

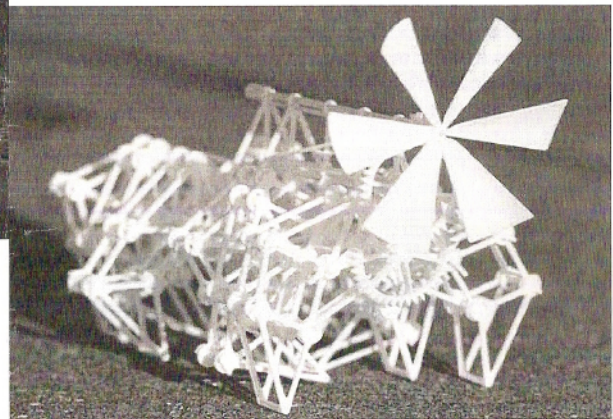


Curious objects



By Theo Jansen

STRANDBEEST



<http://www.strandbeest.com/>