



ADDITIVE MANUFACTURING

- Build platform – platform on which the parts are build. Just imagine a plate which can lowered and raised.
- Build chamber – chamber in where the 3D printing takes place. It consists of the build platform, heads / laser or projectors and the material distribution and depositing mechanisms
- Layers – 3D printers build parts in layers which are stacked on top of each other. In most cases you can recognize the layering when examining a 3D printed part
- Support structures – structures to help the printing process. The structures support overhangs while printing making sure the part does not collapse on itself during printing
- Support material – special material for making support structures. The reason to use a different material is because it is easier to remove and recognize during cleaning.

SLA – Stereolithography Apparatus

This is the oldest commercial 3D printing technology invented by Chuck Hull in 1984 and commercialized by founding 3D systems in 1986. The printing works by having laser solidifying a liquid resin in a VAT on a build platform. The next layer is added by lowering the build platform inside the VAT. After printing the part is cleaned in a chemical bath and cured in an UV oven. This technology needs support structures.

A variation of this technology uses DLP (Digital Light Processors) instead of a laser to cure the resin. This makes the printing process go faster.

SLA systems are manufactured by 3D Systems, Envisiontec (DLP) and ZCorp (DLP)

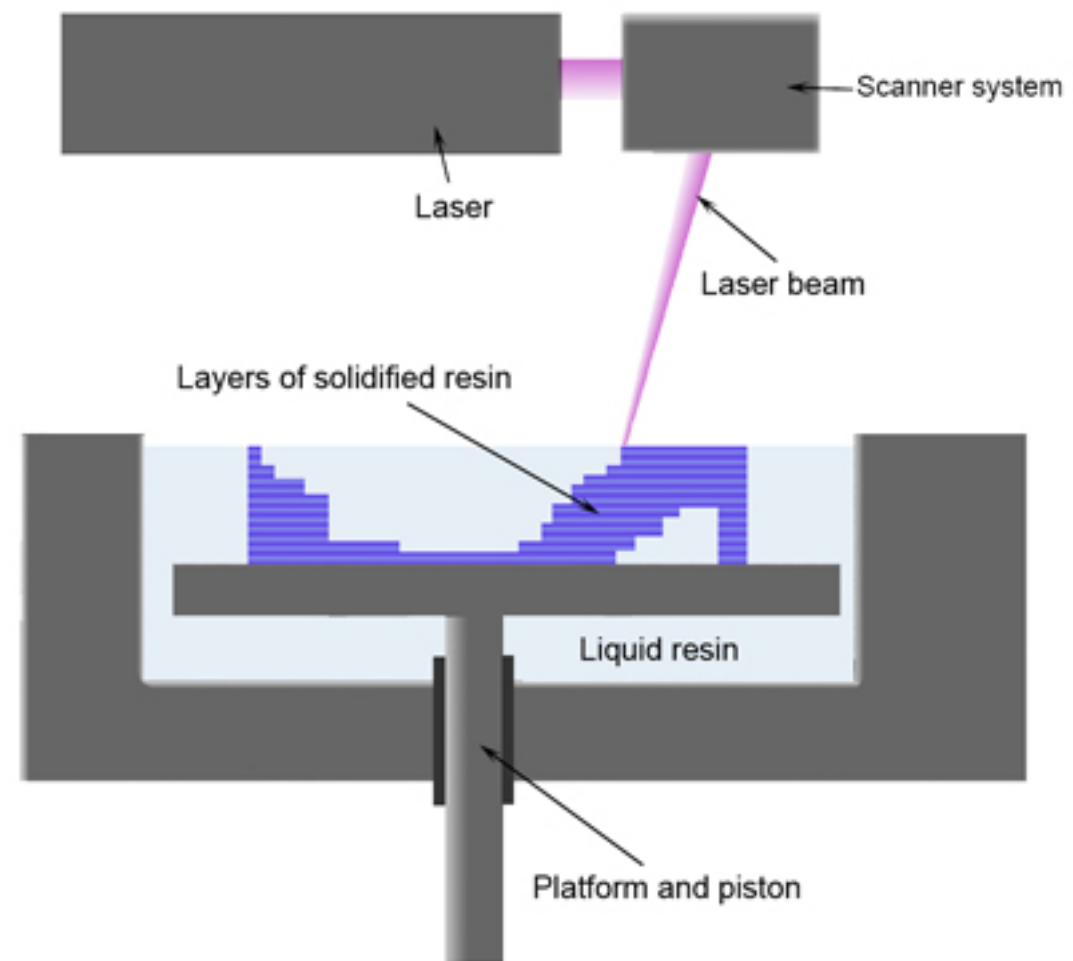
Why choose stereolithography?

Stereolithography is the ideal solution for:

- “Show and tell” parts with smooth surfaces and fine details
- Visual prototypes for photo shoots, market testing and checking 3D drawings
- Prototypes for limited functional testing
- Masters for copying techniques ([Reaction Injection Moulding](#) & [Vacuum casting](#))
- Metal components when coated with the [metal plating process](#)
- [Low volume production](#) of complex geometries

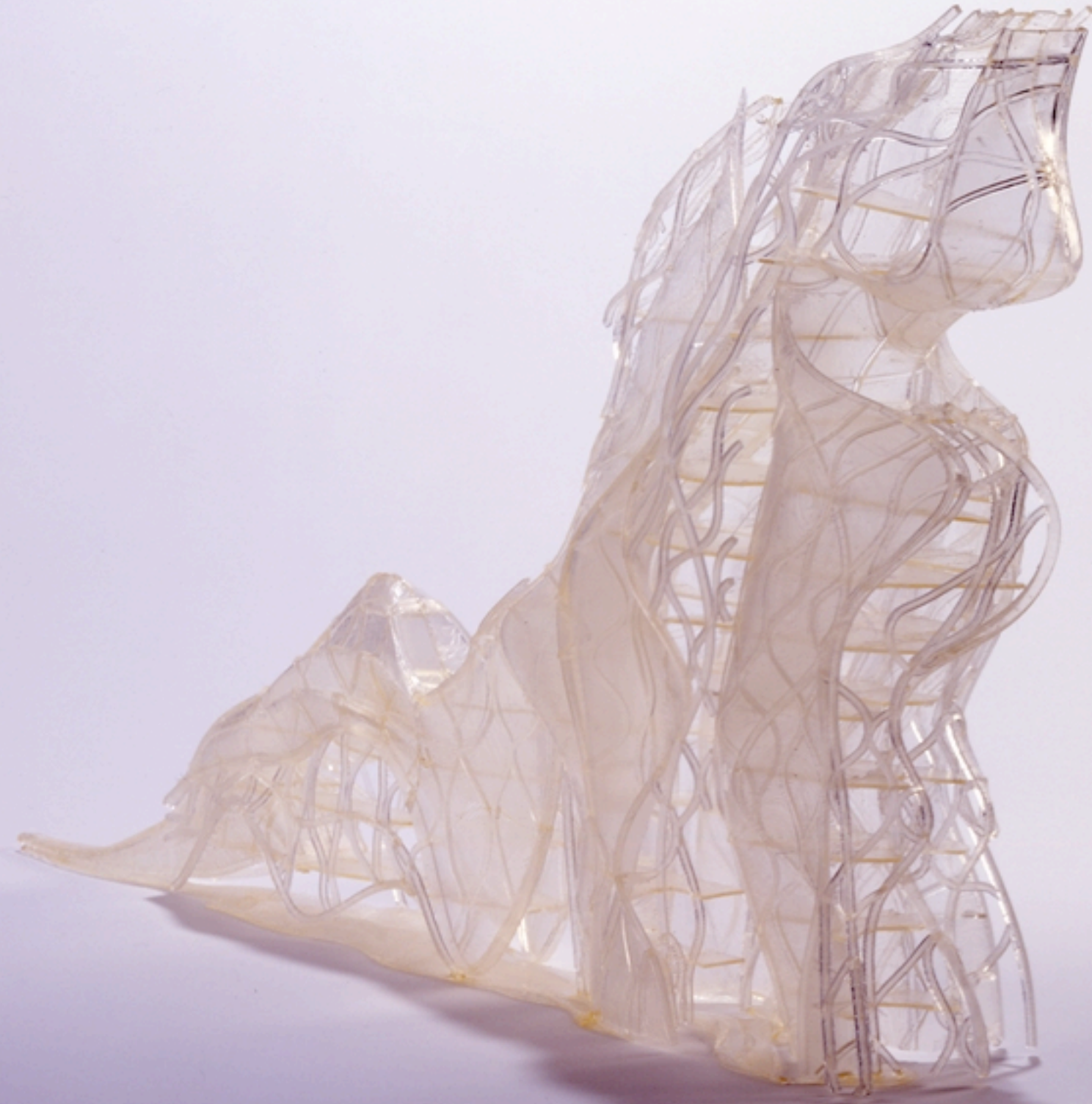
Some good reasons to choose stereolithography:

- Fast: Parts in as little as 2 days
- High level of accuracy and high surface quality
- Representative parts for visual testing
- Functional parts
- Small and large parts - from intricate switch component to car dashboard built in a single piece
- Wide range of finishing options
- Wide range of materials



<http://www.youtube.com/watch?v=ky87zxNy1oo>

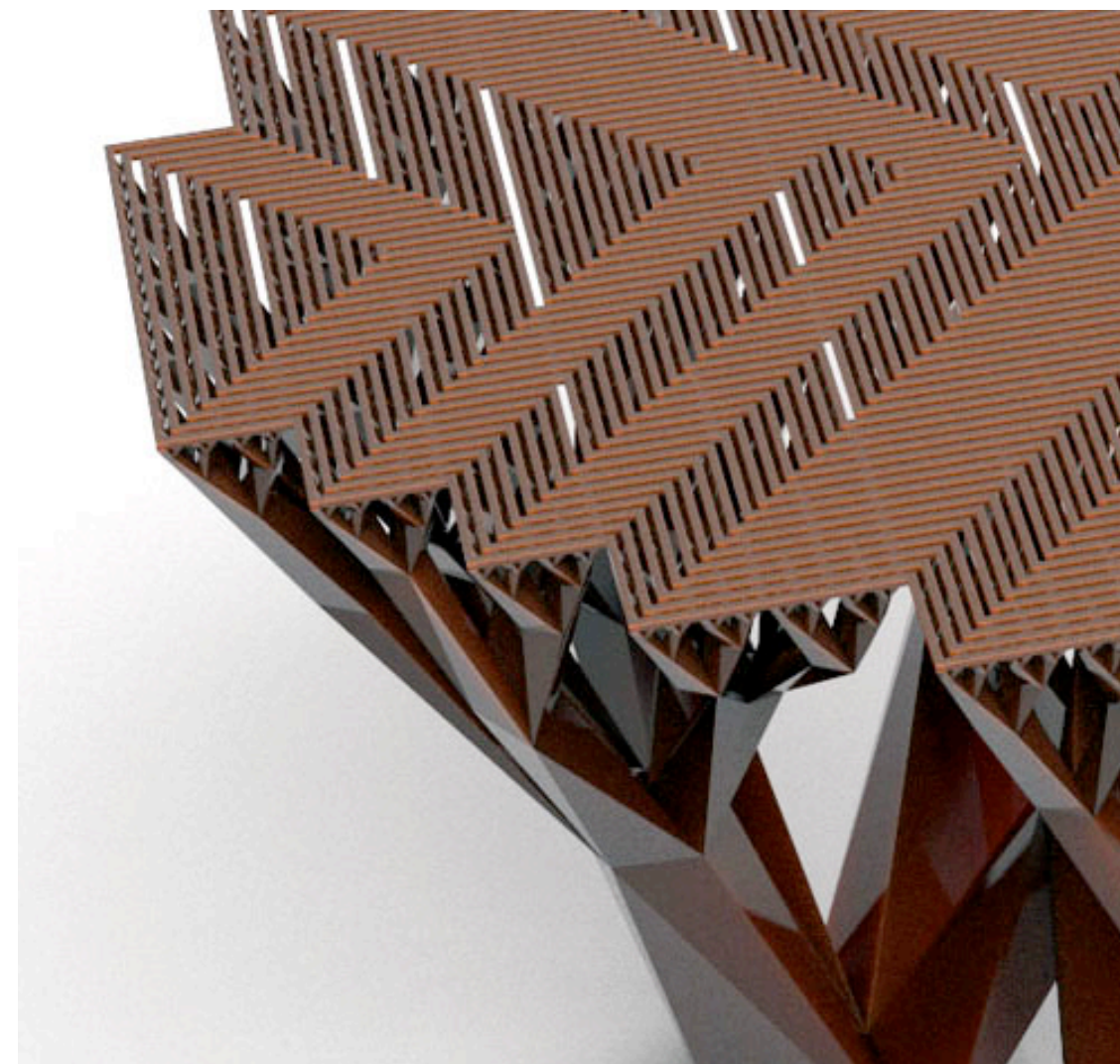




Hernan Diaz Alonso. 2002.



Fractal.MGX table



SLS – Selective Laser Sintering

This technology was invented by Dr. Carl Deckard around the same time as SLA. The process is essentially fusing together small particles in powder form together using a laser.

Just below the powder this is a build platform which lowers to make room for the next layer. A wiper redistributes the powder over the platform and the next layer is fused by the laser.

This technology does need support material or structures. The powder functions as support. Using SLS several types of plastic, metal and ceramic/sand powders can be used. SLS systems are sold by EOS and 3D Systems.

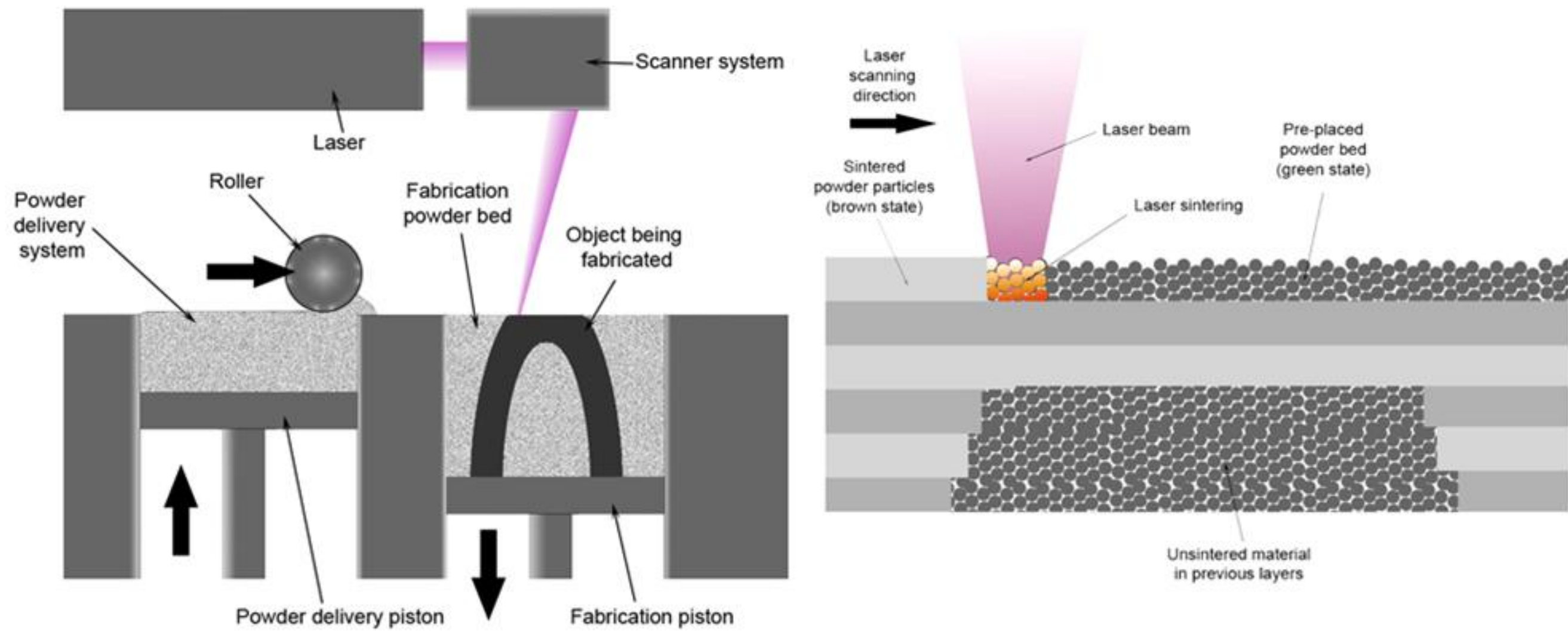
Why choose selective laser sintering?

Laser Sintering is the ideal solution for:

- Fully functional prototypes with mechanical properties comparable to those of injection moulded PA12 parts
- Series of small components as a cost-effective alternative to [injection moulding](#)
- Large and complex functional parts up to 700x380x580 mm in one piece
- Personalised Manufacturing, i.e. the production of unique, complex, personalised designs built as once-only products or in small batches.

Some good reasons to choose Laser Sintering:

- Fast
- Economical
- Durable and functional parts
- Large and complex parts
- Direct production of low volume projects
- Design freedom (no support structure necessary)
- Wide range of finishing degrees
- Can be sealed watertight





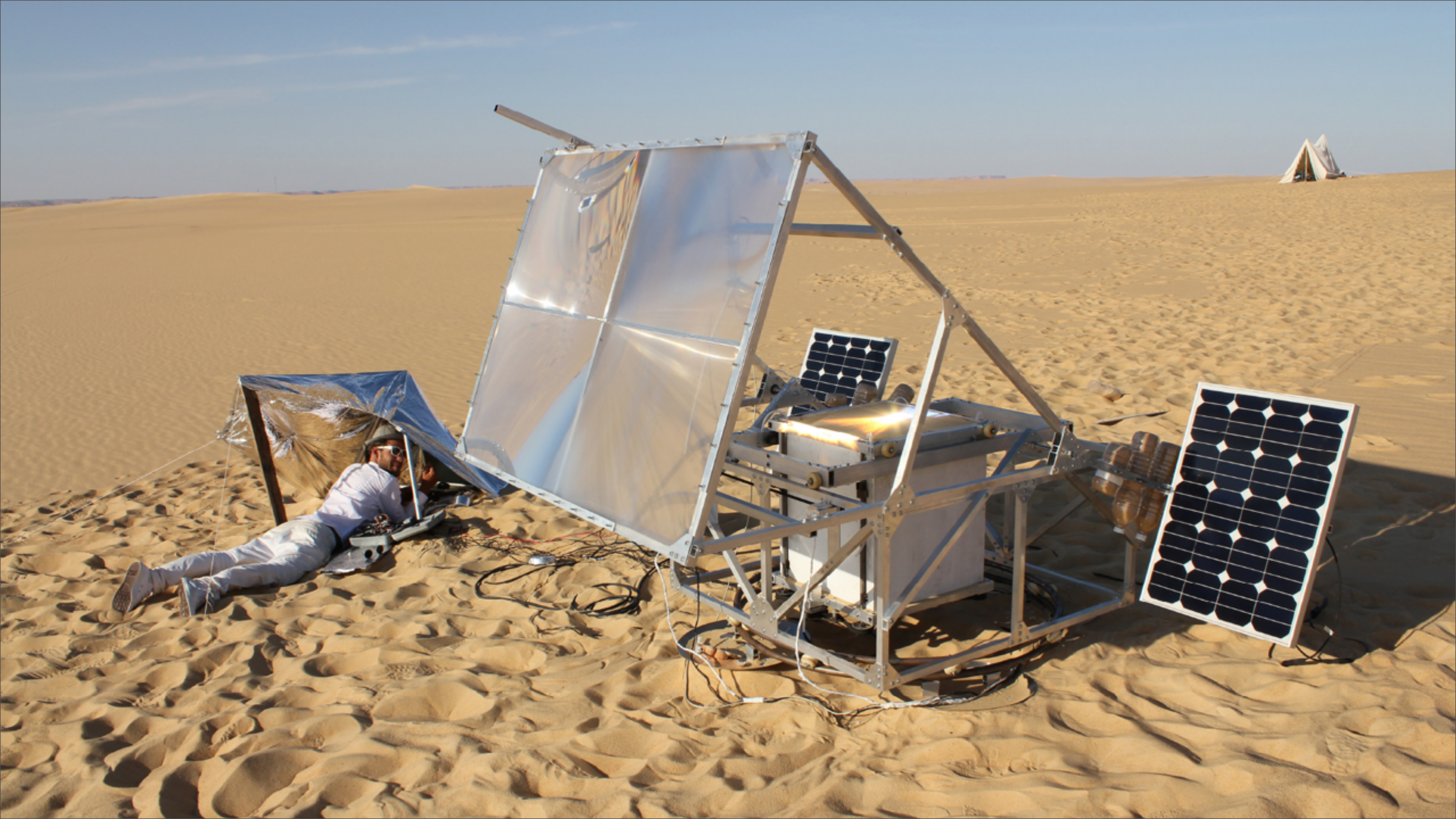


The One_Shot.MGX











FDM – Fused Deposition modeling

Scott Crump invented FDM in the late 80s and commercialized it through his company Stratasys in 1990. FDM printing works by extruding a material through a nozzle and move the nozzle over a build platform to “write” the part.

The next layer is added by lowering the build platform. Support structures or materials are necessary for this technology but not all manufacturers offer that option and thus limiting the usefulness of their FDM systems.

Common materials are plastics but other compound materials are used as well. FDM technology is employed by many lowcost hobbyist printers.

FDM systems are sold by [Stratasys](#), [Makerbot](#), [UP!](#), [Fab@Home](#) and others.

Why choose Fused Deposition Modelling?

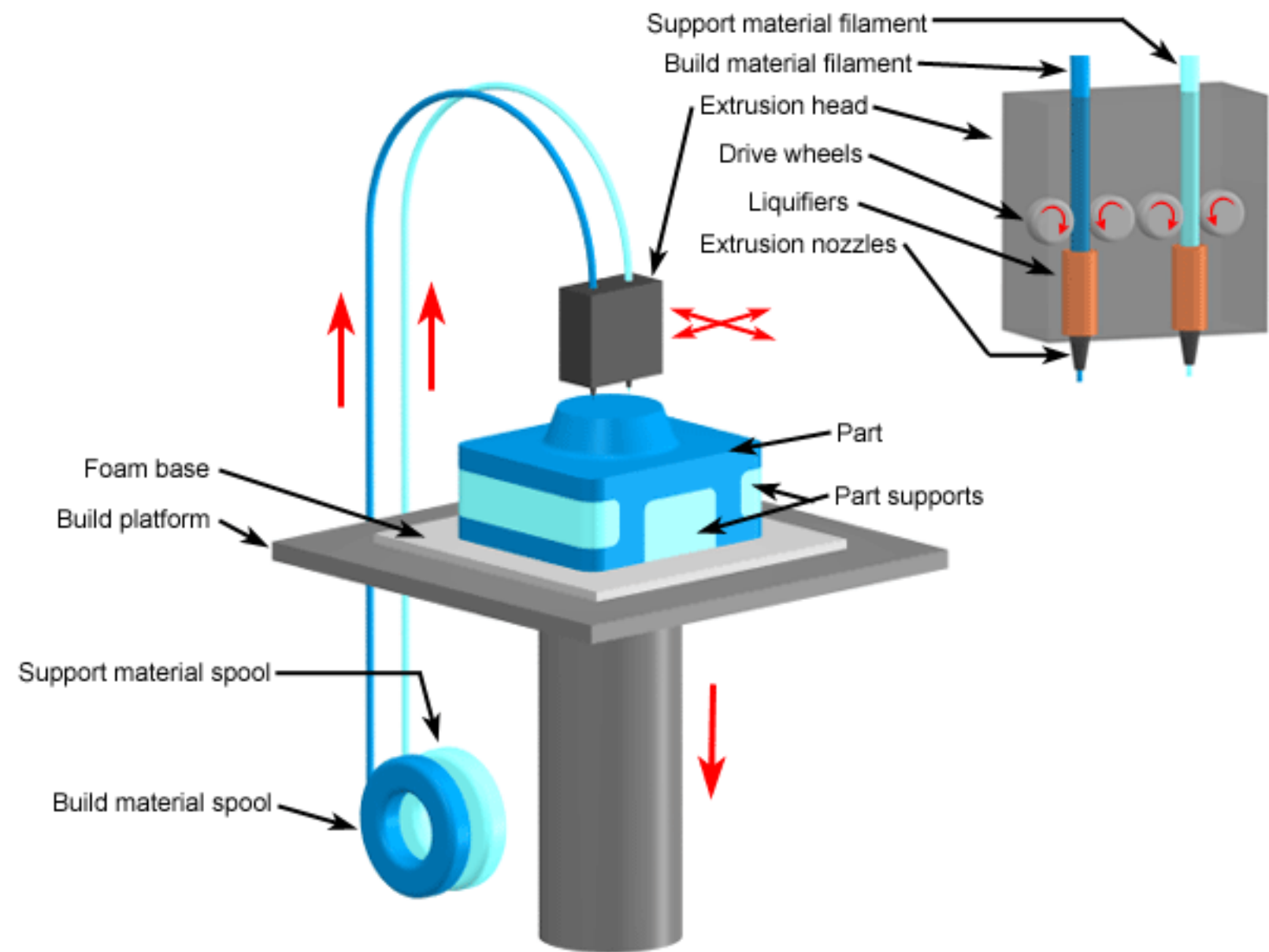
[Fused Deposition Modelling](#) (FDM) is a technology that produces superior rapid prototypes. The FDM system can build just about any geometry you have in mind. The great advantage of this technique is the durability of the material used, the stability of the mechanical properties over time and the quality of the parts. [FDM](#) products also offer new possibilities for direct printing of small production series.

FDM is the ideal solution for:

- Prototypes for functional testing; you can install and run the parts in your production intent material for the best possible proof that your design really works
- Prototypes for form and fit testing
- Prototypes directly constructed in production materials
- Quality parts with a high stability
- Durable single piece parts up to 600 x 500 x 600 mm
- [Low volume production](#)

Some good reasons to choose FDM:

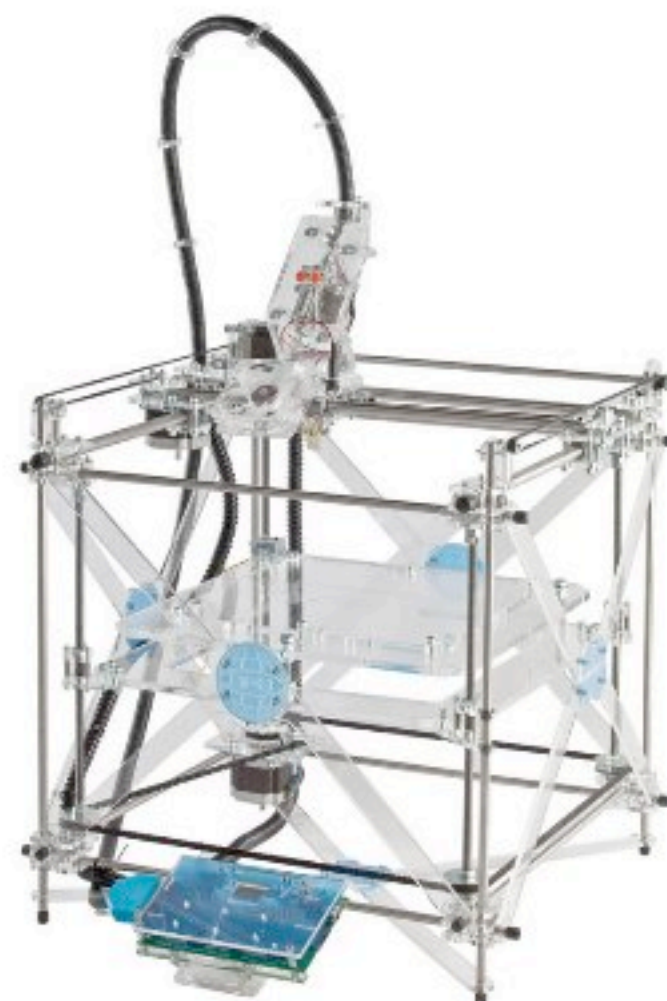
- High accuracy
- Functional parts
- Water-soluble support structure
- Production materials
- Durable parts with great stability
- Short throughput times thanks to large capacity



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3DP – Three Dimensional Printing

This technology comes out of MIT and was invented in 1993. It is commercialized by Z Corporation but others use the same technology as well. 3DP uses a powder as well in the printing process. The powder is “glued” together by binder on a build platform. The binder is deposited by a moving head. The next layer is added by lowering the build platform.

A wiper redistributes the powder. The powder acts as support so this technology does not need any support structures or material. The parts are very fragile after printing and need to be carefully cleaned and cured.

There is wide range of options for powder and ranges from plaster, ceramics, metals to glass. Unique to the commercial application of Z Corporation is the ability to color the parts during printing resulting in parts delivered in full color.

3DP systems are manufactured by Z Corporation, ExOne and Voxeljet.

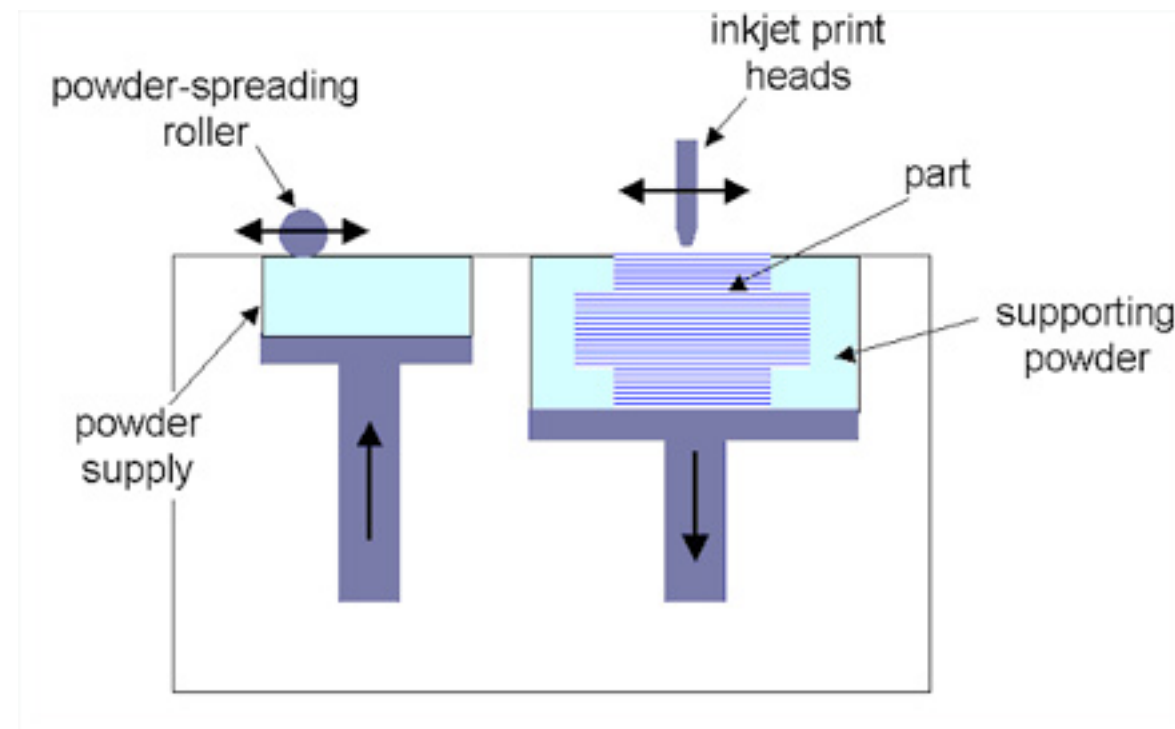
Why choose 3D Printing?

3D Printing is the ideal solution for:

- Architecture models: Leading architects, engineers and contractors use Z Corp models from conceptual design through construction. From massing models to iterations of detail components for a design study, [3D printing](#) offers a fast, cost effective solution to fabricate complex geometries in high definition colour.
- GIS-models: Using 3D landscape/cityscape models for education, situational analysis, and communication requires the conversion of geographic information systems (GIS) data to physical form. Traditional processes for building this type of models - hand made, CNC, or moulded - are slow and expensive. Our 3D printing machine can produce high-quality terrain, urban and subsurface maps in no time at low cost. The technology will enable you to analyse critical elements with easily reproducible 3D models.
- Concept models: With the 3D printing technology early stage concept models of any complexity can be created quickly. A typical part can be printed in less than three days. The colour option gives you the advantage of being able to analyse colour variations in an early stage without having to spend extra time and money to post-process painting.

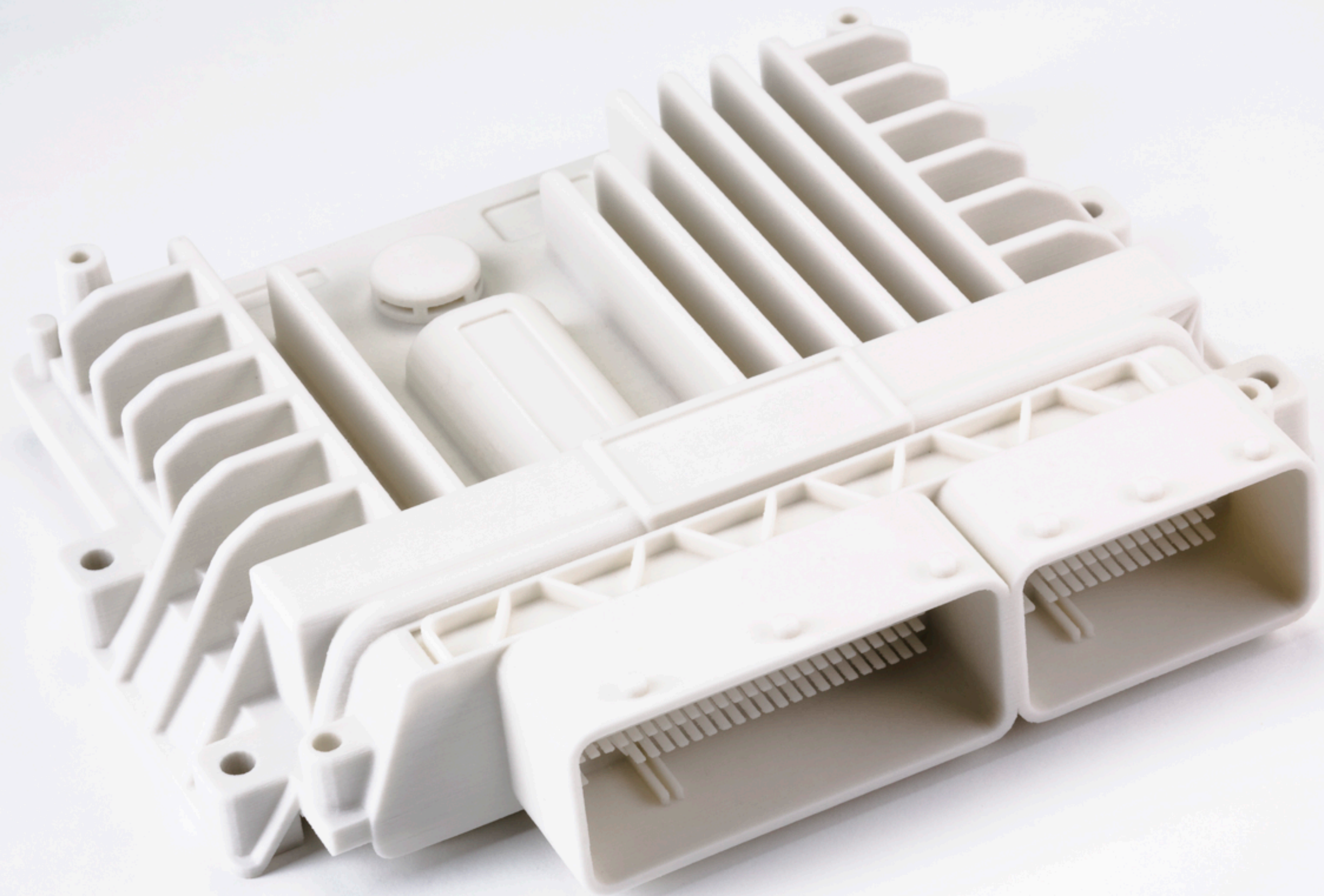
Some good reasons to choose 3D printing:

- Fast: standard lead time of 3 working days
- Colour: Parts are printed directly in colour, which reduces lead times.
- Economical: Compared to conventional model making processes for building similar models, where turnaround can take weeks and cost thousands of euros, the 3D printing process offers an affordable solution.



<http://www.youtube.com/watch?v=07QxFQ3uUFw=76R9QIG1WBw>











Polyjet Matrix Printing

This technology is specific for Objet Geometries. The process builds parts by extruding or jetting very small droplets of material onto a build platform. The head can drop multiple droplets at the same time – hence the name matrix. After depositing the material the material is cured using UV light. The next layer is deposited on top of the previous layer. This technology uses support material during building.

The material used in this process are polymers. Unique to this process is that it can use two distinct materials to build a part including mixing these two materials in different variations.

Polyjet matrix systems are manufactured by Objet.

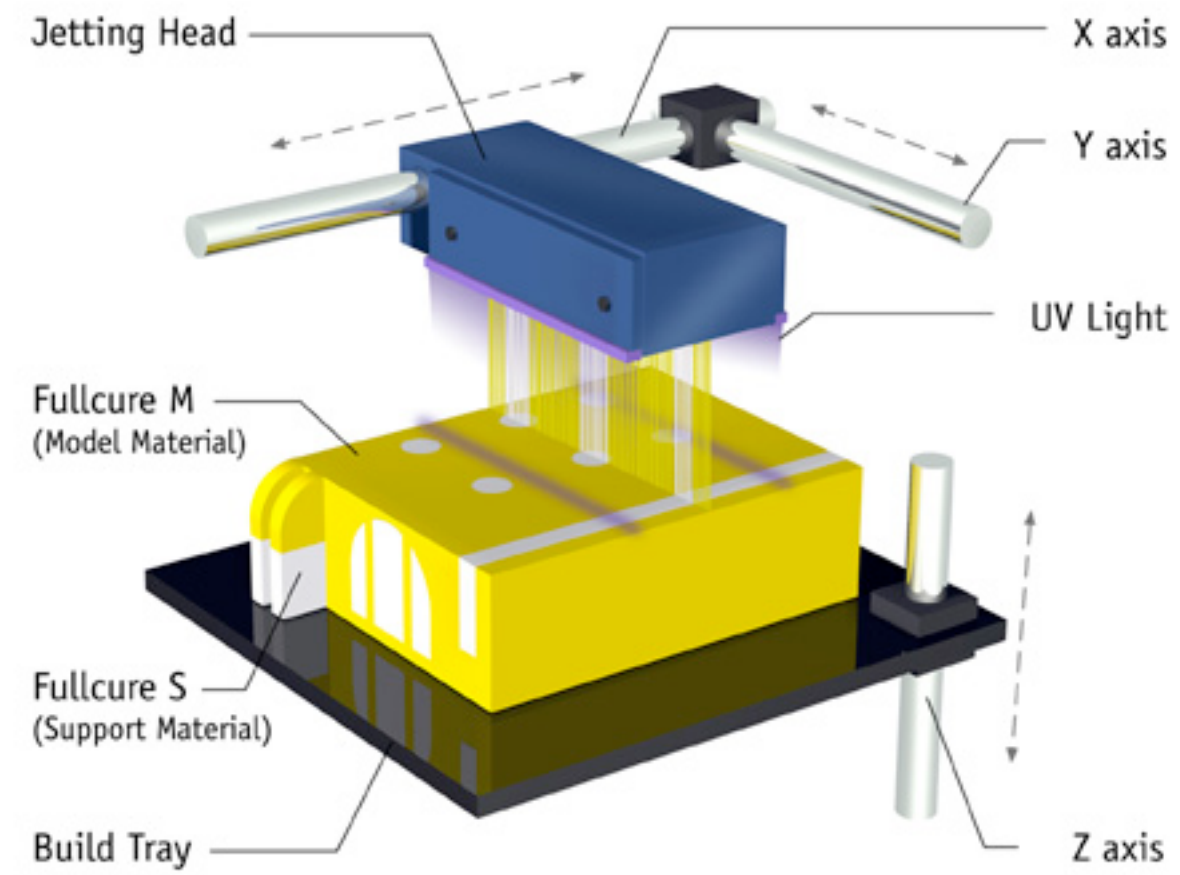
Why choose PolyJet?

PolyJet is the ideal solution for...

Objet machines have a capability to build very precise mechanical components. Objet technology creates a lot of added value for customers in terms of shorter time to market thanks to high quality prototypes. Models produced on the Eden500V™ have smooth and durable surfaces, with exceptionally fine details and an outstanding surface finish.

Some good reasons to choose PolyJet:

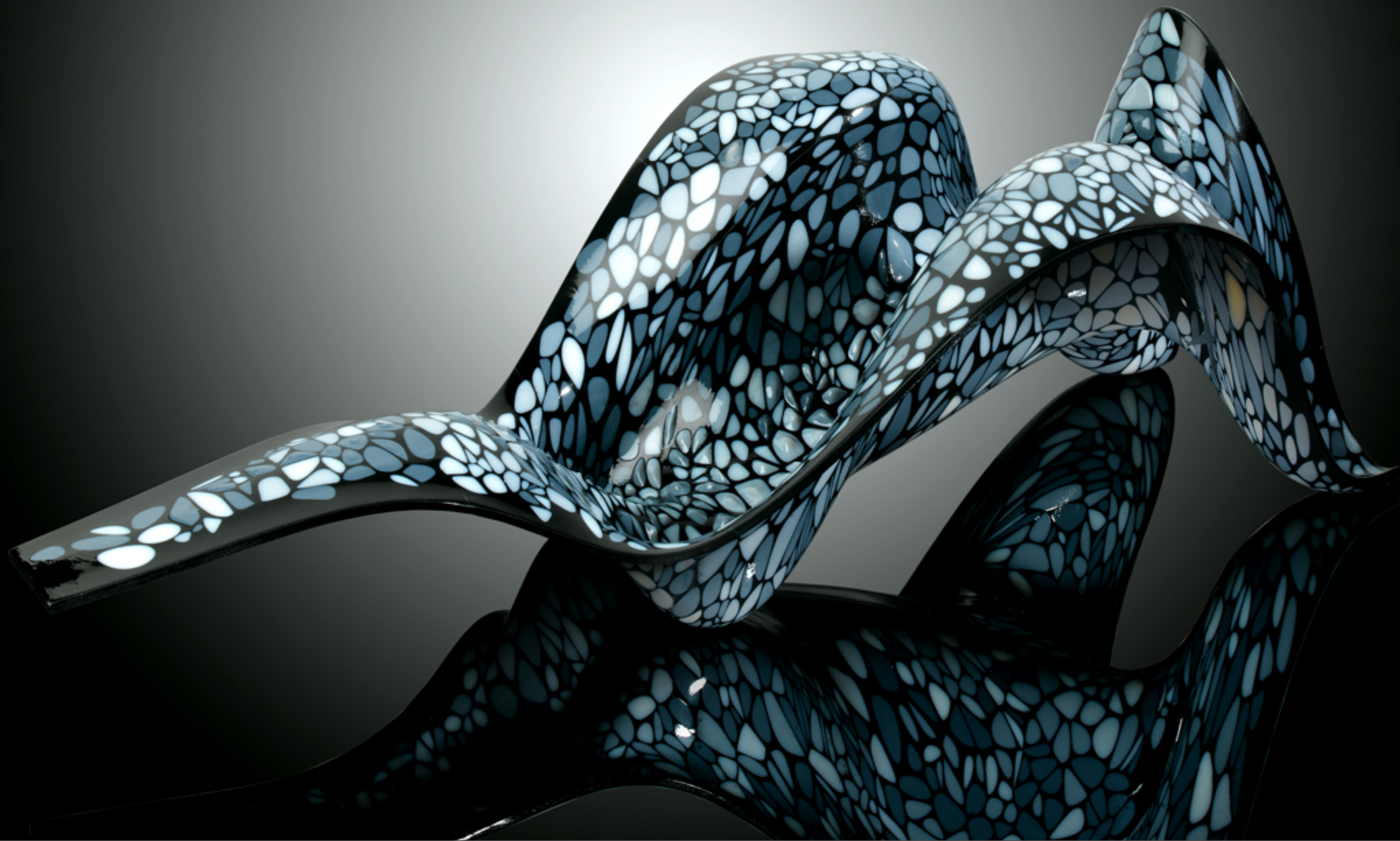
- Visual models with fine details & smooth surfaces
- Rubber-like prototypes
- Multi-material parts
- Parts to match specific Shore A values
- Masters for copying techniques (vacuum casting)



The Objet PolyJet Process







EBM – Electronic Beam Melting

This printing process is developed by Arcam which was founded in 1997. This process uses a powder which is fused together on a build platform by an electronic beam. By lowering the build platform and redistributing the powder using a wiper the next layer can be build. The process is similar to SLS but using an electronic beam instead of a laser.

The powders are always metals with different types of alloys. The build chamber is a vacuum and heated up until 700 – 1000C.

EBM systems are manufactures by [Arcam](#)

Why choose Electron Beam Melting?

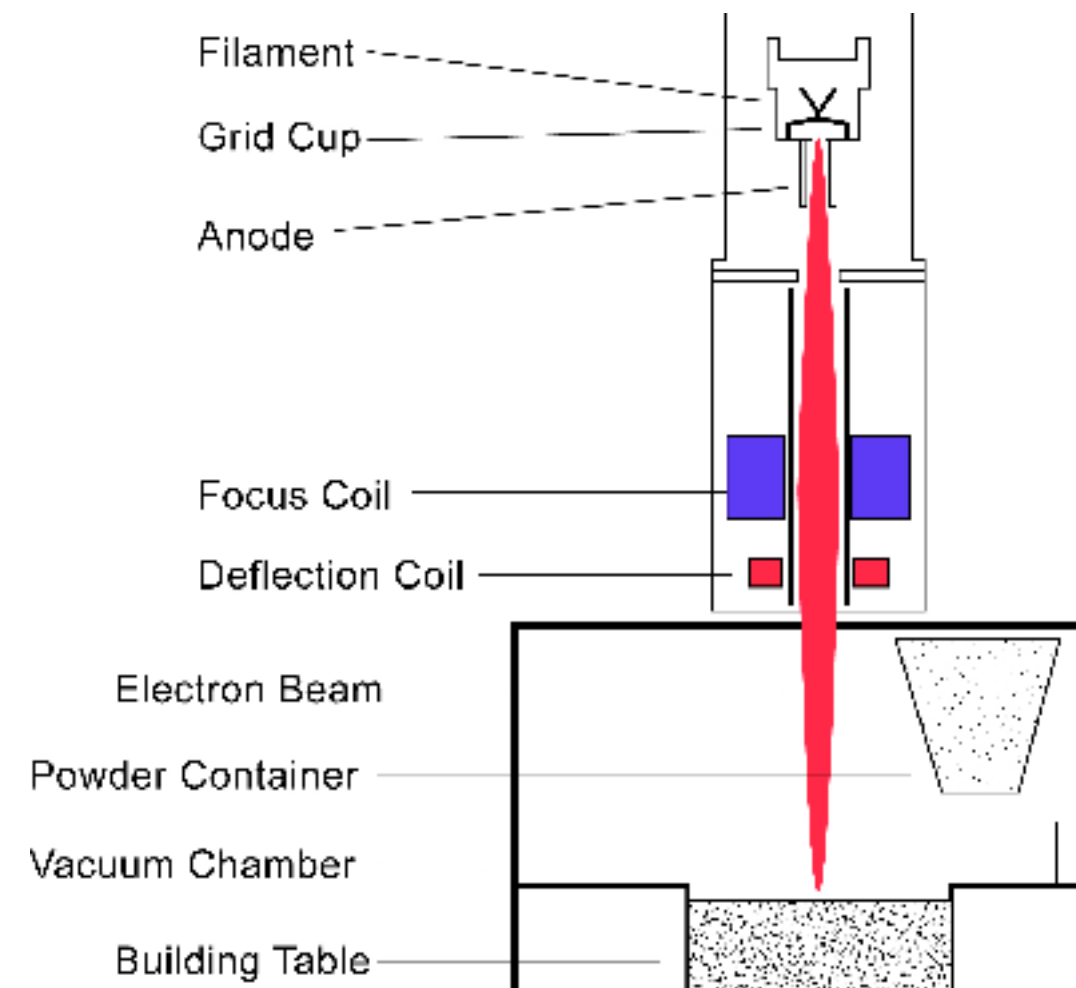
Electron Beam Melting is the ideal solution for...

This solid freeform fabrication method produces fully dense metal parts directly from metal powder with characteristics of the target material. EBM can produce titanium alloys with excellent mechanical and physical properties. Used for medical implants and in the aerospace and defense industries.

Some good reasons to choose EBM:

- Patient-specific porous materials for implants
- Complex metal geometries
- Light-weight designs
- Good surface finishes
- When production volumes are low









LOM – Laminated Object Manufacturing

This technology is developed by Helisys. it uses thin sheets of material which is cut by either a laser or a knife according to the outline of the part. Next the sheet is glued on top of the previous cut sheet of material. After printing the excess material is “broken” off and you are left with the printed parts.

LOM printers mostly use paper but there are also other materials – mostly various plastics.

LOM systems are today only manufactured by [Mcor technologies](#).

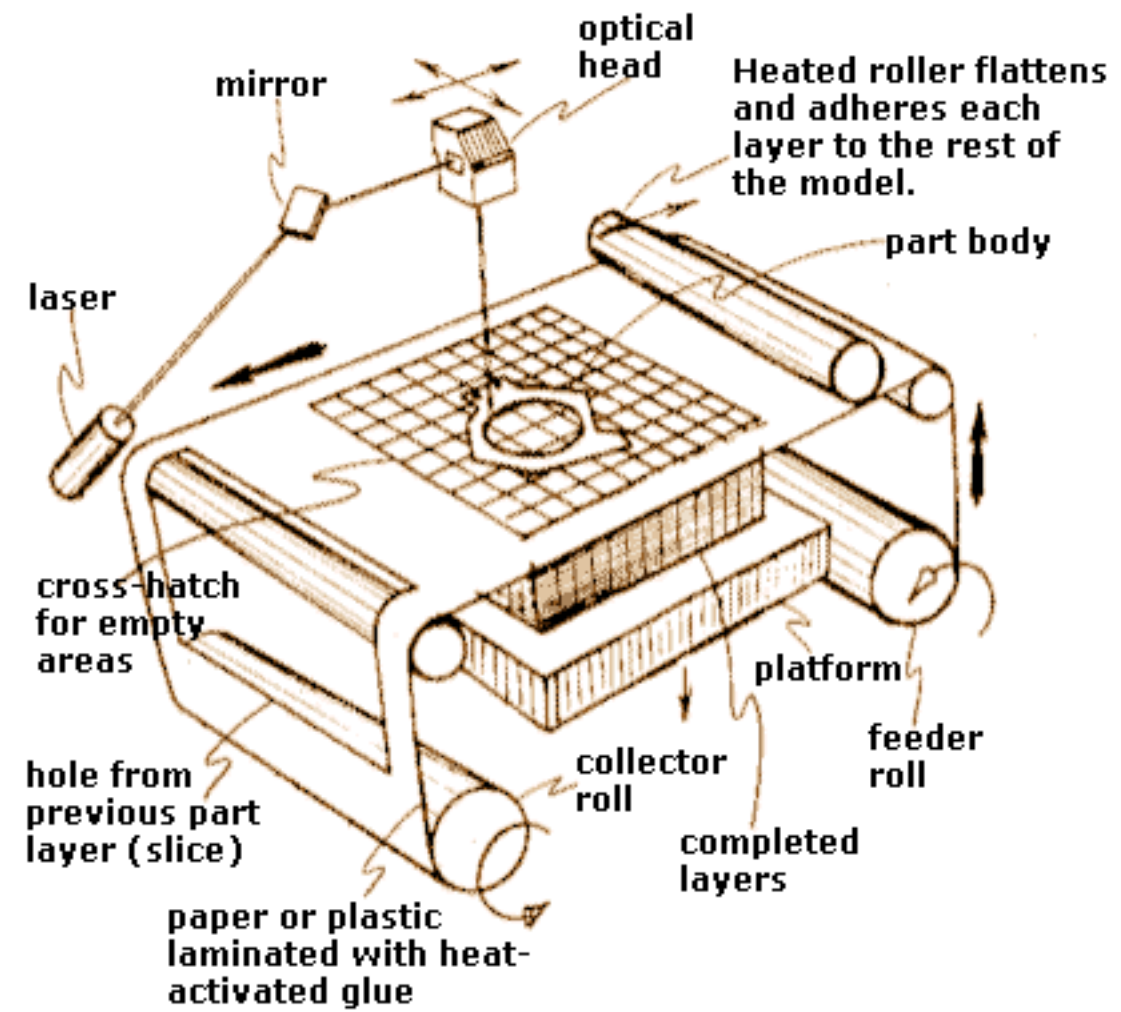
Why choose Laminated Object Manufacturing?

Laminated Object Manufacturing is the ideal solution for...

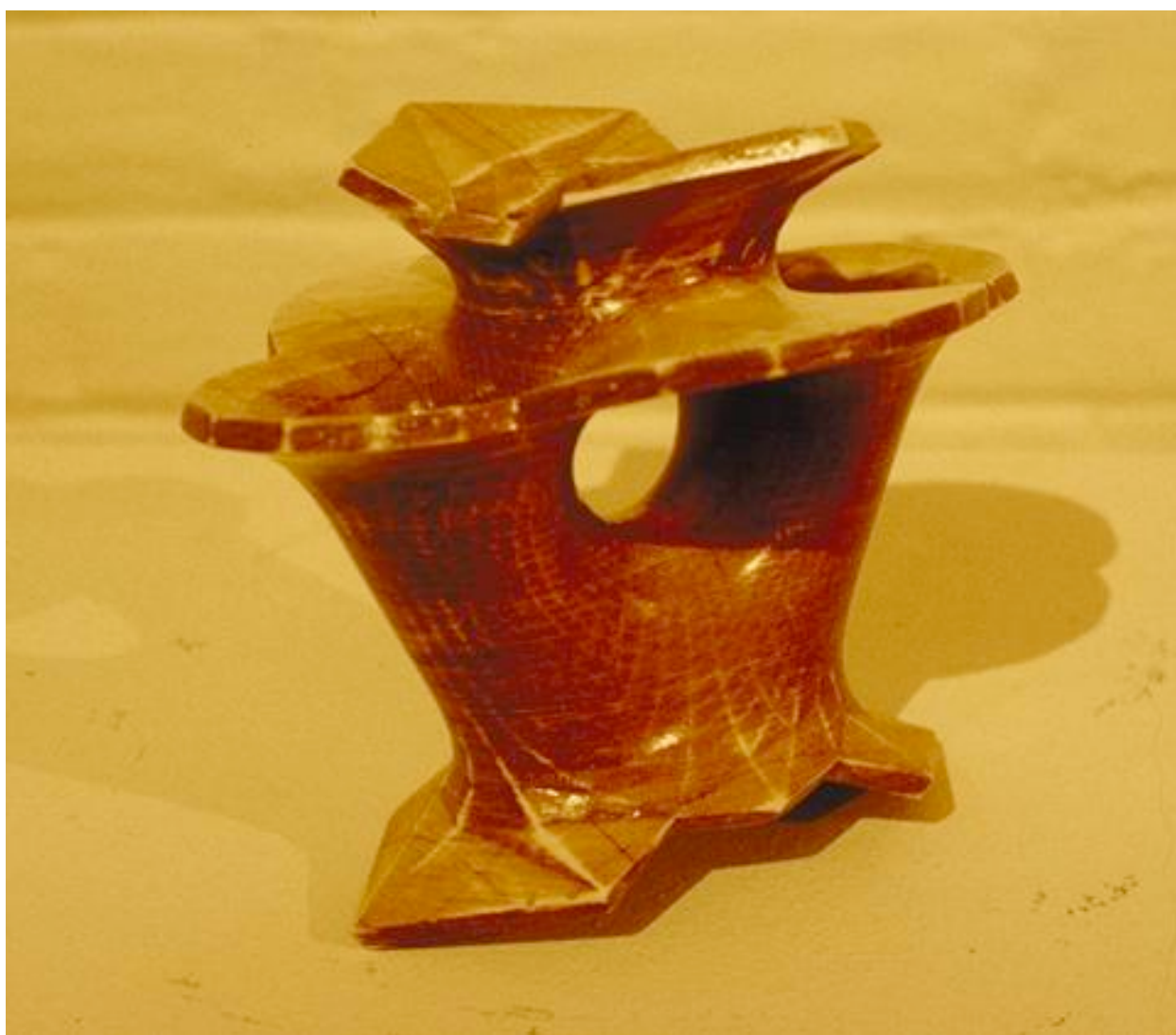
Material costs are very low and objects have the look and feel of wood and can be worked and finished in the same manner. Good for making patterns and sand castings. Materials include plastics, composites, ceramics and metals.

Some good reasons to choose LOM:

- Low cost: Raw material is readily available
- No chemical reaction involved
- Large parts
- Good surface finishes
- When production volumes are low













ARCHITECTURE?

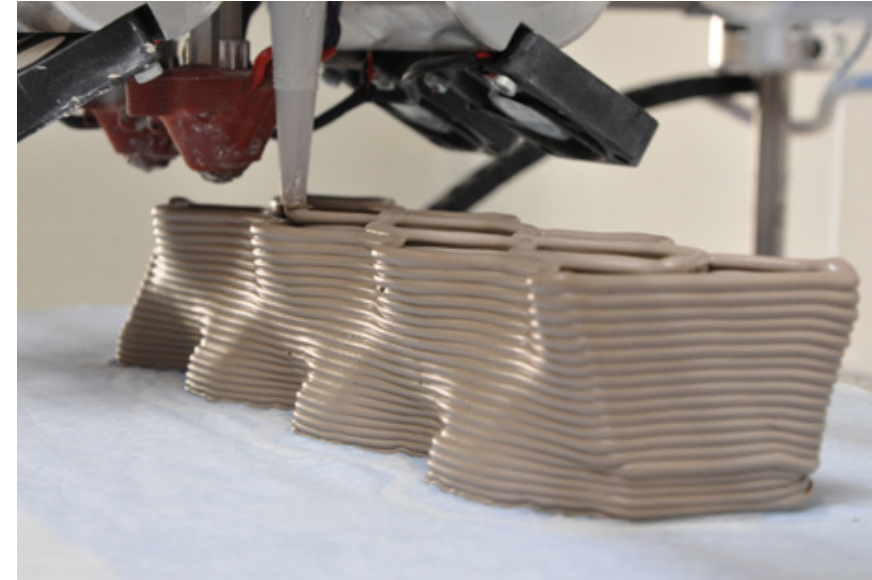
speculation







ceramics



plastic







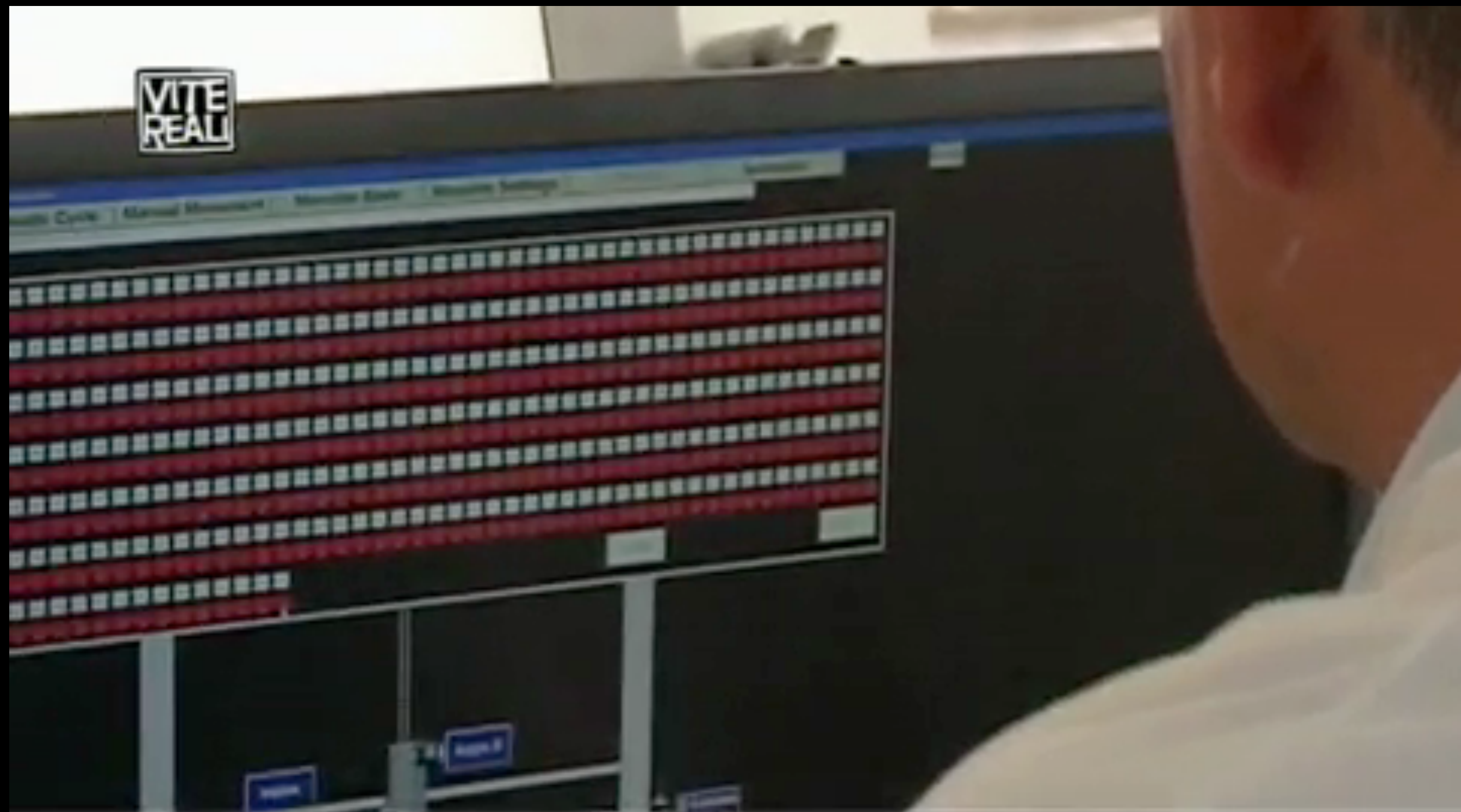
zachary schoch
botlaboratory.com





sand









cement



<http://www.youtube.com/watch?v=EfbhdZKPHro>

