3D Printing: When you can make anything you need, what do you need to make?

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With the ability to 3D print anything from a house to a bionic arm it's difficult to know when, why and how to best utilise 3D printing, and although the idea of 3D printing has been around for over 30 years there is still the sense that it has not yet reached its full potential.

When?

3D printing is typically associated with design development, and with good reason.

With the advancements of CAD renderings and virtual reality simulations, there is still no better way to initially assess a design than to have it in your hands. Design and development is typically associated with product, and this can be extended to jigs & fixtures, marketing materials, scaled models and equipment spares. How much have you spent on jigs for them to be left on the side in production? How Much have you spent on spare parts that take weeks to arrive?

3D printing is now also advanced enough to produce finished goods, with several warehouses filled with 3D printing farms that produce on demand and just in time to reduce storage space and wasted materials. 3D printers will soon be advanced enough to 3D print organic tissues, are already used for surgical jigs and surgeons can now practice on tactile accurate 3D printed human organs. Due to the production times for 3D printing, it is typically only suitable for low volume (~50 Units Max) production.

The key to knowing when to use 3D printing is knowing which 3D printing method is most beneficial for your application. Mi3 have found great value in not only providing a printed component, but also the full package of knowledge around this work. You don't want to spend extra cash on selective laser sintering (SLS) of a nylon product if you are developing a single use flexible gasket seal. There is also great value in understanding the critical differences between prototype and finished device, and whilst you can 3D print anything, you can't (and most likely don't want to) transfer any design to mass production.

Why?

Money. Time. Product Quality.

Money: Whilst obtaining your own 3D printing equipment can be a costly exercise, and I would advise you carefully look at the business case for doing so given some of astronomical cost for 3D printers if this is your preferred route, the cost of producing goods by 3D printing compared to alternative CNC, aluminium injection moulding tooling or metal casting is vastly reduced. The scale of this saving is largely affected by the size of the component produced; however outsourcing 3D printing production allows for the removal of any initial equipment/ tooling capital expenditure (~£££££) and brings the price down to that of the component alone (~ ££ - £££).

Time: 3D printing components can take several hours (generally no longer than 48 hours) compared to the several weeks of lead time for equipment and tooling for alternative production methods. This means a quicker development time, more time to iterate designs and a reduced overall cost.

Product Quality: Mi3 have found iterating designs quickly and without breaking the bank allows for improved product development, and ultimately a better quality of product to provide your customer. These iterations may be significant geometrical changes, minor tweaks or material changes with relatively little impact on production times.

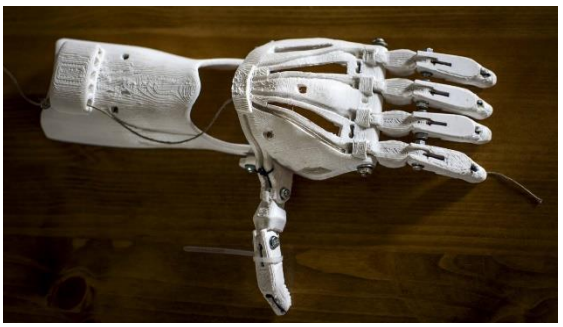
If you need a high quality product in a short timeframe without blowing your budget, you may need to consider 3D printing.

How?

<u>Bureau vs SME vs Insourcing;</u>

The rise in 3D printing bureaus (large scale 3D printing suppliers) has become a tempting route for most developers, with quick automated quotes and fast turnaround of product. However many locally based SME's such as Mi3 have 3D printing services that can be utilised with far greater design feedback and knowledge of how to transfer the 3D print to a manufacturable part (they likely use the 3D printing to design parts themselves).

There is also the risk of IP and confidentiality when outsourcing production, which can be discussed with an SME and not dictated by company wide T&C's of larger businesses.



Printing Methods;

There are many methods for 3D printing (10+) all built around additive manufacturing (building product by adding layers, opposed to subtractive manufacturing where material is removed such as CNC). This typically takes the form of a raw material (powder/liquid/coil) applied to a print bed or bath that is cured by laser, light source or cooling. 3D printing method is directly linked to application, and it is therefore critical that the application alongside the CAD geometry is provided to prospective suppliers.

SLS (Selective Laser Sintering):

Produce durable products from limited material range (Nylon or metal) with high detail and relatively smooth (sometimes “dusty”) surface finish. Compared to FDM and SLA this is a relatively costly production method due to the energy use of the machine, material cost, production times and sand blasting post production. A bath of powder is cured by a laser source, with the powder acting as the support material where geometry overhangs the previous layer. The entire bath is then removed, and typically up to 50% of material can be re-used.

SLA (Stereolithography):

Produce intricate designs with smooth surface finish, with reduction in strength compared to SLS and longer production time when compared to FDM. SLA also requires support material to be produced from the same material as the component material. This can limit designs due to the post processing need to remove these supports (eg. if producing a long cylinder it would be difficult to reach the furthest internal supports). Material choice is much greater than SLS, however this varies between 3D printer manufacturers who typically supply the resins. A liquid resin in a bath is cured by a laser source onto a metal print bed, and little material is wasted as the baths can be topped up with resin to the required level.

FDM (Fused Deposition Modelling):

FDM has the largest range of materials available from strong nylon to flexible TPU, and composite materials with metal pigments mixed with standard 3D printing materials. It is a quicker method of production than SLA, and when combined with dual nozzle extrusion support material is easier to remove than SLA. Dissolvable support completely removes design limitations for 3D printing. FDM is typically the cheapest 3D printing method, with relatively strong parts but reduced surface smoothness compared to SLA & SLS production. To counteract the reduced surface finish, chemical treatment of surfaces or electroplating surfaces with metal can be introduced in post processing. FDM extrudes a plastic wire through a nozzle to apply a layer of plastic in the required geometry on each layer.

The combination of different printing methods allows for easy production of virtually any design, however producing the right design, at the right time, for the most benefit to your company is a whole lot harder

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3D printing is a designer’s all you can eat buffet, but you don’t want to eat the entire menu.

So, what do you need to make?

About the Author:
Mark Holme, AMIMechE MEng, is a medical product design engineer responsible for introducing new single use medical devices at Mi3, with experience of prototyping, CAD Design, injection moulding, project management and validation activities.

Following his MEng Medical Engineering degree at the University of Leeds, Mark has experience with sheet metal design, teaching and medical devices, and is currently working towards CEng status.

About Mi3:
Mi3 are the experts in designing, developing and manufacturing end-to-end advanced medical and surgical solutions – providing specialist knowledge in thermoplastic engineering, tubing systems, and regulatory compliance.

We take your product ideas from consultation to concept to production, and work alongside you to bring medical innovations to life.

Visit our website at www.mi-3.co.uk to learn more about our services design, development and manufacturing services or contact us directly by clicking here to discuss your requirements.