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Your **Guide** to Industrial 3D Printing

For model making, prototyping and production parts

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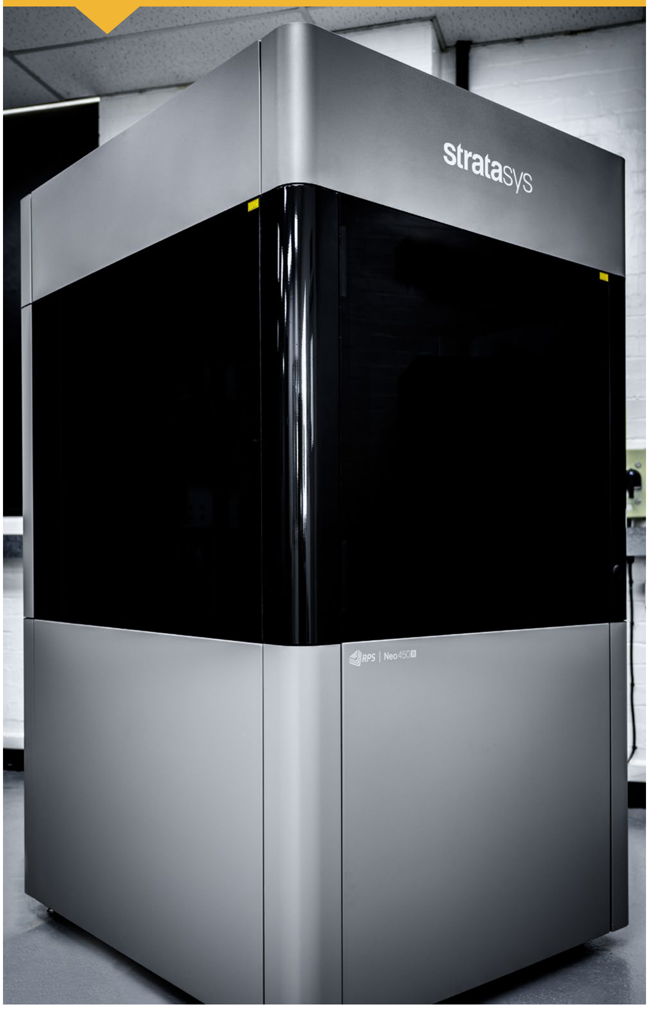
Overview

3D printing opens the door to so many possibilities for different sectors. From prototypes to end-use products, industries from medical and architecture to automotive, product design and film have all found the value of the process.

But it isn't a one-size-fits-all approach – different projects require different methods to ensure your vision is brought to life in the best way possible.

We've put together this whitepaper to introduce you to everything you need to know about polymer industrial 3D printing and the benefits, processes, materials, software and solutions needed to transform your next project.

Industrial SLA 3D printer – the Stratasys Neo 450s



What is industrial 3D printing?

Otherwise known as 'additive manufacturing', 3D printing has become big business in many different industries. Whatever term you recognise, it involves making 3D solid objects from computer-generated or digital files.

The fast-emerging technology is now widely used in many parts of the world and has revolutionised the way we produce physical objects and parts. The vast list of what can now be 3D printed is continuing to grow as technology becomes more sophisticated.

3D printing uses a range of different materials, depending on the selected process. These are predominantly thermoplastics, elastomers and metals. The process requires many print cycles, or layers, to produce the physical object, which is where the term 'additive manufacturing' comes from.

3D printing can produce anything from prototypes of simple toys and musical instruments through to end-use car, aeroplane and medical parts. It has helped to considerably reduce development times and the costs of bringing products to market. There is an expanding industry for research and development into the use of niche materials in the industrial 3D-printing process. The approach is even shaking up the medical profession with engineers routinely 3D printing prosthetic hands and surgical tools. The bioprinting of human tissue is also emerging fast and it has already shown the huge potential to transform medicine, with implications for organ transplants, cancer treatment and antibiotic development.

3D printing **opens the door** to so many possibilities for different sectors.

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The history of additive manufacturing

Although 3D printing is now mainstream, stereolithography (SLA) has been around since the 1980s. The introduction of SLA was hugely significant because, for the first time, it allowed designers to use digital data files to create a real, physical model. Ogle very quickly identified the huge potential that the process would have and began to focus on SLA.

Len Martin, Managing Director at Ogle, said: "I first saw SLA in 1994 or 1995 on the television programme Tomorrow's World. We all joked about it here at Ogle saying 'it won't affect us'. But I was convinced that this was the way to go. It was the future and if we didn't invest in this machine, we'd go bust. And within five years it absolutely transformed the business."

Back then, few could have predicted the potential the technology would have on the modern world, which is set to continue growing as research and findings become even more sophisticated.

The process has been refined considerably over the years and it was not until 1987 that the first ever SLA machine was produced. It was a game changer and meant that the design and development process took only a fraction of the time compared to more traditional methods.

That same year also saw the inception of the first selective laser sintering (SLS) machine which worked by aiming a laser at a powdered material rather than a liquid.

The technology still had a way to go as all too often objects would begin to warp when cooling or creep after time. The materials available were also extremely fragile. Nevertheless, this only made people more determined to refine the technologies.

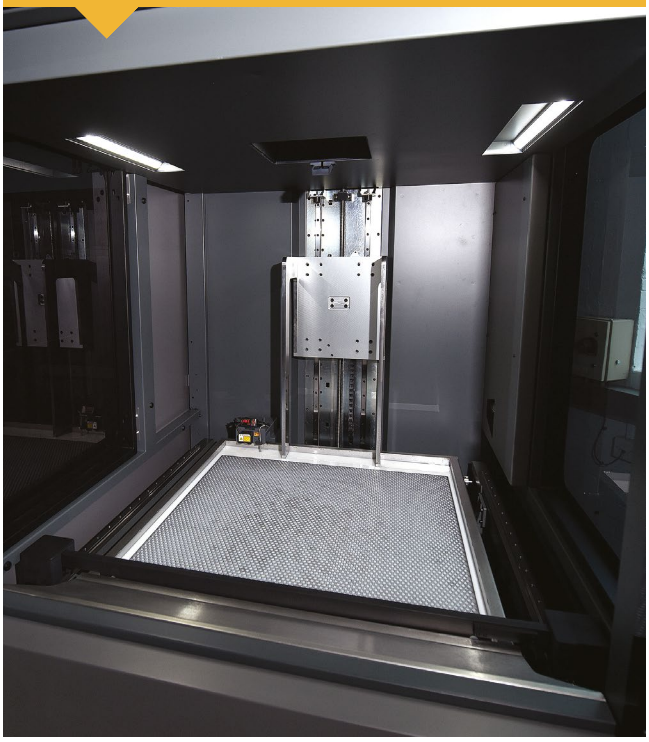
Suddenly 3D printing boomed, becoming commercially viable, and since then the industry has not looked back. The machines have become much more accurate with the development of new lasers and other working parts and material options are now vast and much more robust. Turnaround times continue to decrease while the maximum part size is forever increasing with larger machines and print times are reduced. Overall, these improvements combined to lower development lead times and costs. And things continue to evolve. In recent years, the demand for 3D printing has significantly increased because of its improved accuracy, speed and cost efficiency. Ogle has been involved in 3D printing from the very beginning and has worked hard to stay ahead of its competitors. The company continues to purchase the very latest, innovative technology available, so clients can be certain their product is going to be made from the very latest cutting-edge equipment.

Just like 3D-printer innovators, Ogle is continuing to push the envelope, striving for the next big thing and looking to keep the industry fresh, exciting and dynamic.

Where previously 3D printing was restricted to using only one or two types of plastic, now the list of materials that can be used is vast.

"I first saw SLA in 1994 or 1995 on the television programme Tomorrow's World. We all joked about it here at Ogle saying 'it won't affect us'. But **I was convinced** that this was the way to go."

Inside the Stratasys Neo800



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Software

The popularity and demand of 3D printing is not just down to the machinery, but also the advancement of software programs.

Some software packages are better than others in making good quality files which lead to a high-end quality product. Different software packages can help in different ways throughout each stage of the design process: from CAD to .stl file repair and preparation.

Their capabilities vary slightly, but most contain versions of basic solid modelling; plastic and mould design; weldments, sheet metal, piping and tubing design; and large assembly design.

Ogle likes to get involved from the beginning to fully understand the project and we can advise of any necessary amends once the file is received. In our experience getting involved in the development of the model or prototype as early as possible ensures our clients receive:

- Realistic advice on all options
- Guidance on processes, machines and materials
- Solutions for complex geometries
- Advice on paint and finishing options

Our Quote Engine can accept files up to 100MB; for those who have a larger file to submit, there is an upload tool that can be used.

Some software exports files in inches or other units, but Ogle's system will interpret these as millimetres, resulting in an incorrect price, so please ensure that .stl files use millimetres.

Commonly used programmes include:

SolidWorks (.sldprt)
Autodesk Inventor (.ipt)
AutoCAD (3D .dwg)
PTC ProE/Creo (.prt)
CATIA (.catpart)
Magics (.mgx)
SpaceClaim (.scdoc)

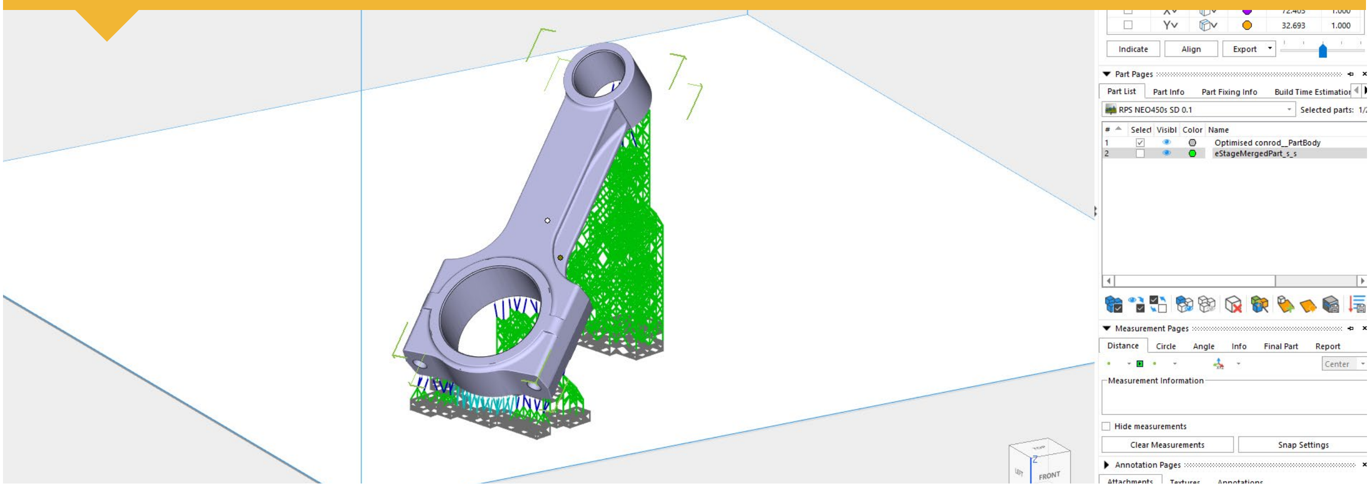
Additional neutral file formats that can be imported into and exported from most programs include:

IGES (.igs)
STEP (.stp)
ASIS (.sat)

Although .stl is the industry standard file format that all 3D printers use, Ogle can accept all major file types, including:

.step
.igs
.stl

Materialise Magics data and build preparation software



Types of prototypes

At Ogle, we want to know what your model or prototype will be used for before we begin; each process and material lends itself to a different use and solution. If your prototype will be taken to multiple exhibitions and needs to be handled by the general public, we will suggest a process and material to ensure it is robust.

Another example of the importance of putting the purpose of your project first is when seeking investment. We will need to consider the type of material we use to replicate the in-production qualities of that material as well as selecting a process to deliver the exacting dimensions required.

By approaching us early in the project, this ensures we fully understand your aims and objectives, including end use and the best processes to apply to help you achieve the results you need.

When visiting our 25,000-square foot facility, you will see that we have all the technology to bring your project to life. But, it is the highly experienced people here at Ogle who transform a 3D-printed part into a model or prototype worthy of an exhibition or investor's table. This often means coupling 3D technologies with CNC machining, paint and more traditional model-making techniques.

Form, fit and function prototypes

Replicating production materials and geometries during the early design development process will allow for any potential issues to be addressed. It also provides the opportunity to check that each part interacts correctly. For example, does that edge look right? Do those bolt holes line up? Are those hinges going to hold up?

Finally, function testing will assess performance features, the strength, fire resistance, flexibility and so on.

Engineering prototypes

The key difference between a form, fit and function prototype and an engineering prototype will be the use and testing of moving parts. You may also see engineering prototypes referred to as a breadboard. It is predominantly produced in the early design and development of mechanisms to provide a proof of concept and allow for performance to be compared or improved.

Aesthetic and concept models

This provides designers with an opportunity to critically analyse and improve the aesthetics of a part. From simple concept models to highly accurate aesthetic models, this is a time to prove the idea works and ensure it meets the specifics of the design. This is also an opportunity to assess the look and feel of the part. Exploring and deciding on the right colours and finishes at this stage, can significantly improve the perceived quality and overall feel of your product when released to market.

Marketing and exhibition models

Producing a high-end marketing or exhibition model requires the expertise, knowledge and skill of the 3D-printing and model-making service you commission. Using models on exhibition stands is a great way to showcase products and capabilities. The visual impact of your model will boost interest in the stand and entice more visitors. Models are often coupled with graphics, or even virtual and augmented reality, to better explain and sell your product or service. If you have a particularly large or heavy product that is difficult to transport, it can be scaled down to fit on an exhibition stand or made from lightweight materials for ease of handling. Conversely a small or complex product can be scaled up to provide additional clarity which gets you noticed.

Scale models

In our workshop, there has been a 1:20 train carriage model through to a full-scale model of a helicopter and even a scale model of a single decker bus, complete with lighting and controls. A scale model can also involve a cutaway to reveal a certain aspect of design, the layout and flow of plant equipment on a factory floor, or a working mechanism. For designers, this is an opportunity to work closely with your prototyping bureau as they resize the model to the scale required, ensuring that all detail is kept and key features are correctly represented.

Test parts and assemblies

Just before heading down the expensive route of production and the associated investment in tooling, design teams may want to produce test parts or low volume production parts. Similar to a functional prototype, test parts and assemblies will provide you with the opportunity to verify key components and ensure mechanisms are functioning correctly. If you have not quite reached production stage, this will also allow you to inspect parts and address any concerns or issues with the design which can prove very costly if not noticed or ignored until a later stage. Initial pre-production parts can also be produced and used to test in the field as a final check or to get your product out there while waiting for parts to come off the production line which can take months.

1:4 Scale model – The Airo Car by Heatherwick Studio

Additive manufacturing vs traditional manufacturing for production

Although the concept of 3D printing has been around for a while, many are still questioning what the advantages are of choosing industrial printing in favour of some of the more traditional ways to manufacture.

Additive manufacturing operates by building layers of material together to make an object, while the more traditional approach involves either removing parts of a block of material (subtractive manufacturing) in order to create the desired shape or using hard tooling, such as injection moulding.

Production

Industrial 3D printing does not require any new or special tooling when a prototype is commissioned. This can save a lot of time, money and effort that would normally be spent on tooling the production line and getting an assembly process set up.

If the prototype suggests more work is needed on the design, those changes can be implemented very quickly by updating the CAD and producing another part, while traditional assembly methods would require more time and incur greater costs.

You will have heard the hype around the possibilities of 3D printing for end-use manufacture. Quite frankly, the process is not yet refined sufficiently to be the most cost-effective option for most applications. Also, for consistently larger quantities, lead times will often be longer and costs higher when using 3D printing compared to traditional manufacture. Tooling is required to support the traditional manufacture process, and this is where 3D printing can fill the void, to avoid delays, while awaiting tooling. It becomes exceptionally viable when the quantity of parts required is relatively low and the product itself is high value, extremely complex, customised to each customer or where additive manufacturing is the only physical way to make the part (internal lattice structures for example).

Large-scale production

Once the prototyping phase has been signed off, the next stage is usually producing the parts at speed and volume. The additive manufacturing process is generally less efficient and reliable than other, more traditional methods of making parts, with a much higher unit cost.

While 3D printers might not need to be retooled in between production runs, the speed at which a 3D printer can deliver an object often pales in comparison to the traditional assembly line.

3D printing requires each object to be assembled one layer at a time, with each new layer being directly placed on top of the previous one. Even with a "fast" 3D printer, some small objects can take hours to make. Speed can be achieved when parts can be produced in large batches, making use of the whole available build area, and can be dispatched straight off the machine without the need for much post processing.

Injection moulding plastic parts and assembling them in a traditional production line would allow for thousands of identical parts to be completed quickly. 3D printing can be used in the design and manufacture process here, but only to create and verify the prototypes that would later be injection moulded.

Complex geometries and cost

When the correct materials can be sourced and the cost point is right for the quantities needed, additive manufacturing can become a viable process for manufacture. Once this is realised, the design can be optimised to further suit the process. 3D printing can dramatically reduce the number of components and assemblies required, which ultimately drives down the cost. It can also give greater design flexibility when envisaging complex geometries and detailing without increasing costs.

3D printing can also reduce the overall weight of the product, an extremely popular approach in the aerospace sector because, instead of using a solid block of metal, it can be hollow with a lattice or honeycomb structure inside. Additive manufacturing will 'access' each layer as it is building, so can work to increase strength from the inside without adding unnecessary weight.

3D-print process considerations and design pitfalls

3D-printing offers greater flexibility than traditional manufacturing, which is key to bear when you are designing for production. For example, a part that has been 3D printed may require the design to be revised when entering the production and manufacturing stage. Processes such as injection moulding may increase the constraints on your design, which would be applicable for no draft angles and undercuts.

Materials and their properties may differ from prototyping to production, so any functional testing will need to take this into account. This is where other processes, such as vacuum casting, can come into play – using a wide range of polyurethane resins, which are designed to simulate production plastics, or CNC machining where the actual production material can be used.

Most common 3D-printing processes:

Stereolithography (SLA)

This is a high-accuracy process, capable of producing crisp detailing with a wide range of available materials. The ability to print clear parts makes SLA an ideal technology for prototyping optics and transparent covers for a range of industries. SLA is a good choice for aesthetic models, fit and form prototypes and silicone mould masters for the vacuum casting process. With the consistent development of niche materials, this process is always expanding its capabilities to serve wider industries and applications.

Selective laser sintering (SLS)

The SLS process produces strong and durable parts that are well suited to functional prototypes and, due to the lack of support structure, complex or challenging geometries can be achieved with relative ease. The lack of support structure within SLS parts means they can be produced more efficiently by stacking more parts in the build chamber.

SLS also delivers exceptional results for end-use parts, complex architectural and fluid dynamics models, and also general quick proof-of-concept models.

Fused deposition modelling (FDM)

FDM is the more controlled and industrial sister to fused filament fabrication (FFF), which is more associated with desktop printers. FDM is great if you require 'real' engineering materials – suited for end-use applications. It delivers a lower resolution and accuracy, as well as being susceptible to delamination. FDM does not deliver complex geometries or parts with intricate detailing.

Polyjet

Polyjet, also known as material jetting, is a process that can print multiple parts and materials simultaneously and delivers a smooth surface finish. Infinite colours are available with this technology. However, the mechanical properties are poor and often highly vulnerable to heat and sunlight, losing strength over time.

Multi Jet Fusion (MJF)

A process developed in 2016, MJF delivers high production speed and strength as well as a high level of post-process automation. It is a powder-based technology, where a fusing agent is deposited on the powder bed, which absorbs infrared energy, fusing the powder. The current disadvantages of this technology include the lack of material options (although plenty are in development), high up-front investment costs and a small build chamber compared to other processes. MJF can be used for prototypes, low volume production and is perceived as the first real competitor to injection moulding for manufacture.

Selective Absorption Fusion (SAF)

SAF is another powder-based process, where a fluid with high energy absorption is accurately deposited across the powder bed where needed. A powerful infrared light heats up this fluid, fusing the powder in that area to form solid. Lower build temperatures, with tighter thermal control, give a more reliable operation, quicker turnaround time and greater part consistency. Like the SLS and MJF processes, parts can be stacked or 'nested' in a build volume, for greater efficiency of large batches.

Digital light processing (DLP)

This relatively new process has SLA as its predecessor. Similar to SLA, DLP is a form of vat polymerisation, coupled with the use of light source technology to cure the resin. This projection of light across the whole layer at once reduces build times considerably. The materials available are close to production plastics, with some very favourable properties, making this process suitable for producing end-use parts. The downside at the moment is the build volume. Ultimately, this technique can aid the production of parts within a reduced timeframe.

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Machine capability

Size, available materials, complexity, accuracy and speed are key considerations for selecting your 3D-printing process. Industrial 3D printers usually have bigger build areas allowing for greater throughput, reduced lead times and larger parts to be kept whole.

Size, available materials, complexity, accuracy and speed are **key considerations.**

Machines available at Ogle Models and Prototypes

Maximum Part Size - Industrial 3D Printing					
Process	Machines	Build Layers	X mm	Y mm	Z mm
Laser Sintering (SLS)	P770	0.12mm	679	368	567
Laser Sintering (SLS)	P730	0.12mm	679	368	567
Laser Sintering (SLS)	P100	0.1mm	194	242	322
Stereolithography (SLA)	Neo 800	0.1mm	800	800	600
Stereolithography (SLA)	Neo 800	0.1mm	800	800	600
Stereolithography (SLA)	Ipro 8000	0.1mm	650	750	550
Stereolithography (SLA)	Neo 450s	0.05-0.1mm	450	450	400

Maximum Bed Size - General Equipment				
Process	Machines	X mm	Y mm	Z mm
Machining (CNC - 5 axis)	Belotti FLA	4000	2600	1300
Machining (CNC - 4 axis - high speed)	Fanuc Alpha D2ILiA5	700	400	330
Machining (CNC)	Correa	2500	800	800
Machining (CNC)	Hurco VM30i	1270	508	508
Machining (CNC)	Hurco VM30i	1270	508	508
Machining (CNC)	Bridgeport 1000C	1020	610	610
Machining (CNC)	Bridgeport 1000	1020	610	610
Machining (CNC)	Bridgeport 600	600	410	520
Vac Casting (VC)	Sancron	900	580	500
Vac Casting (VC)	Sancron	420	420	350
Vac Casting (VC)	Sancron	420	420	350
Paint/Finishing Booth	Haltec	6250	3900	2500

The differences between desktop and industrial 3D printing

Desktop vs industrial, consumer vs professional, whichever way you like to describe it, the 3D-printing market can be split based on cost, capabilities and applications.

There are pros and cons when it comes to relying on desktop 3D printing. Here, we look at the benefits and drawbacks of desktop 3D printing compared with using industrial 3D- printing services.

Desktop can be beneficial for quick 'look to see' parts and initial iterations. However, when precision and quality are of paramount importance, industrial 3D printing will always deliver the ultimate solution.

Desktop 3D printing

With costs steadily reducing, desktop 3D-printing technology is now widely available. Desktop printers have surged in popularity as the software has improved and the applications have widened. The typical technology employed for desktop 3D printers is FFF or FDM. A few machines are bridging the gap with 'professional desktop' machines from suppliers such as Formlabs and Ultimaker.

Speed and accuracy: Most desktop 3D printers do not deliver when it comes to speed or accuracy for rapid prototyping in industrial applications. The process is still extremely slow and complex geometries are difficult to achieve due to rudimentary support structures (if any). Although accuracy is improving all the time with new machines entering the marketplace, there are still limits with the complexity and reliability of parts that can be printed.

Software: The target market has predominantly been for home users, which means most software is extremely user friendly. In a professional setting, the ease of use increases with those familiar with industrial 3D-printing processes.

Bed size: Desktop 3D printers work well for smaller parts as the footprint or bed size is significantly smaller than an industrial machine.

Cost: The machines and materials required for desktop 3D printing are relatively low and require little-to-no ongoing maintenance.

Iterations: As this technology has become widely available, a lot of designers choose to employ this technology on a professional level in-house. It allows for multiple design iterations at a lower cost. Previously those iterations would have passed through our workshop; however the market has changed to reflect the advent of this new technology. We will now predominantly work on the final two or three parts that need to be carefully produced and finely tuned.

Industrial 3D printing

Using this technology requires greater investment, while delivering the qualities and efficiencies that cannot be achieved through the desktop printing process.

Size and volume: Professional 3D printers have a larger bed size to not only allow for larger parts to be produced, but also to produce multiple parts at the same time.

Software: Due to the demands on this technology, the power of the associated software is far greater when used for industrial 3D printing. Complex functions and parameter modifications can also be implemented.

Cost: The cost of purchasing an industrial 3D printer can run in to hundreds of thousands of pounds. Associated costs can be seen in the space required to house the machine, the post-processing equipment, specialist materials and on-going maintenance. By outsourcing to a specialist bureau, the costs are dramatically reduced for the end user or customer as the associated costs mentioned above are split between hundreds of customers. This makes the technology accessible to a greater number of businesses.

Accuracy: The resolution and accuracy that industrial 3D printing can achieve are typically greater. This, combined with the superior surface quality, delivers greater intricacies and a wide variety of materials and post processing options.

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Materials for 3D printing

As we have already discussed, while it is great to have an idea of the type of material properties you would like your model or prototype to possess, it is vital that this is not put before the end-use application. Working closely with your prototyping bureau, they will assess the purpose of your part before recommending a process or material.

For some industries, the properties required will determine the process used. For example, ULTEM 9085, a fire-retardant thermoplastic, is often preferred by designers in the aerospace industry as it mimics production-like properties.

We have listed below a selection of popular materials associated with the most popular processes outlined. However, this list is not representative of the hundreds of materials available for 3D printing.

Working closely with your prototyping bureau, they will **assess the purpose** of your part before recommending a process or material.

MATERIALS FOR THE FDM PROCESS

Features, benefits and applications of production grade thermoplastics such as **ASA-UV, PC-ISO and ULTEM 9085:**

- Each material displays unique properties, giving you greater choice and allowing for a wider range of end uses for your products
- The materials allow for fully functional parts, ideal for advanced prototypes or end use

An SLS part being broken out of the powder, post print

MATERIALS FOR THE SLA PROCESS

MPC12

Features, benefits and applications of MPC12

- Clear material with excellent clarity
- Ideal for functional prototypes
- Great for snap fits and assemblies
- Water resistant
- Low differential shrinkage
- Excellent sidewall quality
- Suitable for flow visualisation applications
- Available on Neo800 SLA machine at Ogle.

EVOLVE 128

Features, benefits and applications of EvoLVe 128

- High strength and durability
- Accurate and dimensionally stable
- High detail and great surface finish
- Ideal for snap fits, assemblies and demanding applications
- Available on Neo800 and Neo450s SLA machines at Ogle

CLEARVUE

Features, benefits and applications of ClearVue

- Clear material with excellent clarity, great when used for transparent assemblies including headlamps and bottles
- Rigid and tough, ideal for functional prototypes
- Suitable for flow visualisation applications
- Excellent humidity/moisture resistance
- Capable of meeting USP Class VI
- Available on iPro 8000 SLA machine at Ogle

XTREME WHITE

Features, benefits and applications of Xtreme White

- Exceptionally tough and durable
- Resists breakage and handles challenging functional assemblies
- Great for snap fits, assemblies and demanding applications
- Ideal for master patterns for vacuum casting

XTREME GREY

Features, benefits and applications of Xtreme Grey:

- Form, fit and function prototypes
- Durable assemblies – snap fit, tough enclosures and consumer electronic components
- Outstanding durability and impact resistance
- Thermal resistance over 60°C – without distortion

MATERIALS FOR THE SLS PROCESS

PA 2200

Features, benefits and applications of Polyamide PA 2200

- Ideal for functional prototypes and end-use parts
- Non-porous, so eliminating the need to seal the surface in components used with liquids
- For a more attractive and smoother surface texture, use Ogle's Vibro finishing service
- Available on P100, P730 & P770 SLS machines at Ogle

PA 2210 FR

Features, benefits and applications of PA 2210 FR (Fire Retardant)

- Perfect for manufacture of flame-resistant parts capable of meeting UL94 V0 with high mechanical properties
- Contains a chemical flame retardant free of halogens
- In case of fire, carbonating coating arises at surface of part, isolating plastic below
- Available on P100 SLS machine at Ogle

PA 3200

Features, benefits and applications of Glass-Filled Fine Polyamide PA 3200

- Ideal for housings and thermally stressed parts
- More rigid than PA2200 for more demanding applications
- For a more attractive and smoother surface texture, use Ogle's Vibro finishing service
- Available on P100 SLS machine at Ogle

Why outsource 3D printing?

The popularity and necessity of 3D printing has become significant within the workplace in recent years. It helps companies validate designs, perform functional tests and bring products to market more quickly.

Creating 3D-printed prototypes can help communicate conceptual ideas to stakeholders, prove functionality and test aesthetics; all of which can speed up decision making, while ensuring everyone has the same understanding of the projects.

A 3D-printing bureau provides a suite of machinery, giving you the luxury of choosing the right process for your part.

There are huge benefits to outsourcing 3D printing to Ogle, including:

Cost

Seeking Ogle's help means there is no need to invest in in-house machinery or training. Although the cost of desktop 3D printers has reduced considerably in recent years, many SMEs may not be able to afford the outlay or the large investment in industrial machines. It is not just the cost of purchasing the machine that needs to be considered. There are additional considerations such as the cost of labour to skilfully operate the machine, the space required to house the machines and post-processing equipment, as well as the ongoing maintenance costs and investment in materials.

Experience

There are many different technologies to choose from, and each has its own pros and cons depending on the specific application. Ogle is the leading specialist and will be able to advise on the best printing approach for your needs. Not only that, but the team are also highly experienced machine operators and technicians; to have them on your payroll would be costly.

Design and detail

If a specific part is complex and requires a special build style or unique materials, outsourcing makes complete sense. In-house operations may be restricted and would not be able to fulfil the desired look, feel or function. Using a specialist 3D-printing service means the finish and detail would be of the highest quality, without sacrificing strength or integrity.

Speed

3D-printing specialists can manufacture parts within hours, which in turn speeds up the prototyping process. When compared to machining prototypes, 3D printing is inexpensive and quicker as the part can be finished in hours, allowing for each design modification to be completed at a much more efficient rate. Larger, industrial 3D printers also allow more parts to be built at once, further reducing lead times.

Advanced equipment and materials

Specialist 3D printing companies will have access to the very latest technologies and materials across multiple processes. Using their services allows you to explore new 3D printing technologies that might not be available otherwise. Specifically, specialist additive materials are not an in-house possibility for most businesses due to cost, material handling and technical requirements.

Sustainability

Using experts within the industry will mean fewer mistakes are made, resulting in less waste material throughout the product development process.

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Our work

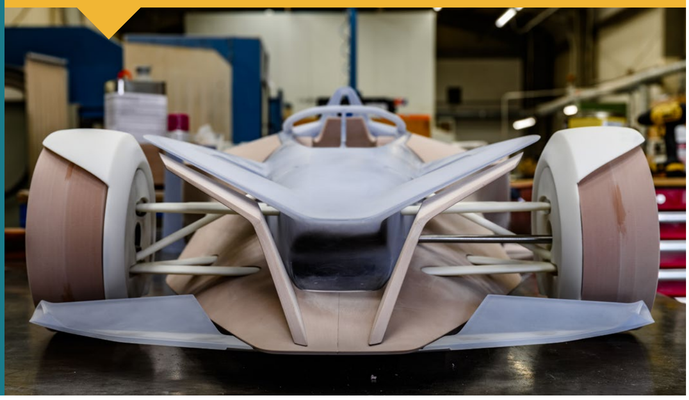
We've seen first-hand the difference industrial 3D printing can make when the right technologies are employed, at the right stage by an experienced team. Here's a range of projects completed at Ogle using a variety of the processes and materials we've mentioned, to meet various requirements.

Concept all-electric vehicle

Client: Heatherwick Studio
Sector: Automotive & Environmental
Purpose: Aesthetic and concept model
Process: SLA, paint and finishing

Single-seater concept car

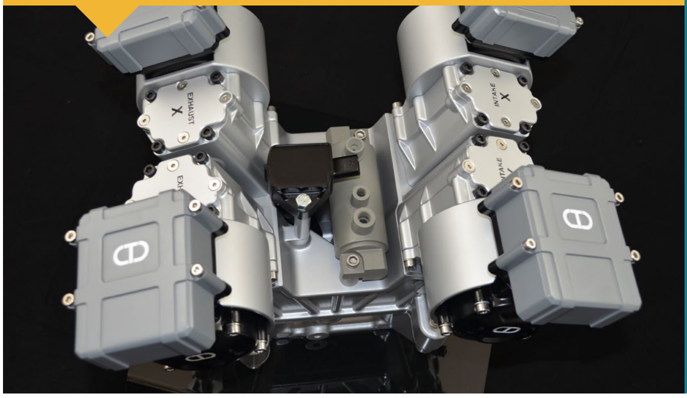
Client: Nissan
Sector: Automotive
Purpose: Display model
Process: CNC/SLA



Unmanned aircraft system

Client: University College London
Sector: Aerospace
Purpose: Wind tunnel testing
Process: SLA

Digital valvetrain



Client: Camcon Automotive
Sector: Automotive
Purpose: Exhibition model
Process: SLA, SLS, paint and finishing

Unmanned surface vessel

Client: AutoNaut
Sector: Marine
Purpose: Functional testing
Process: SLS

Action camera travel tripod

Client: Nu Bear
Sector: Product design
Purpose: Proof of concept model and verification prototypes
Process: SLA

If you'd like to discuss your next project, call our team on **01462 682 661** or email **info@oglemodels.com**.

To progress your project and receive a quote, visit our website.

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