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3D ADEPT MAG

NEWS

INNOVATIONS
BUSINESS
CREA

DOSSIER & TEST

Interview

Antonio Benedetti
CEO of Cycle Pharmaceuticals

N° FEBRUARY 2018

3D Adept Mag

ADDITIVE MANUFACTURING/ RAPID PROTOTYPING/
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Editorial

2018. A new year for companies and individuals to set goals, implement strategies and innovate. The 3D printing market is no exception. Ideas, news and actions keep arising.

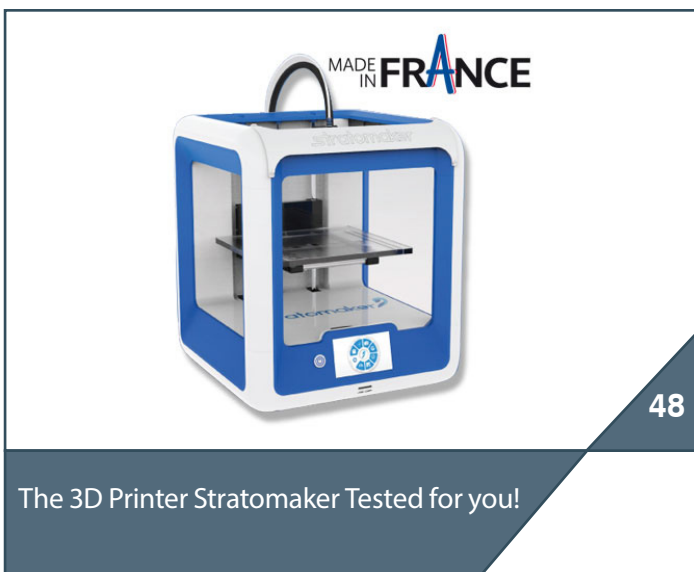
This first issue of the year will certainly give you an overview of these strategies and innovations. It may surprise you, inspire you or simply inform you. Anyway, it will definitely not leave you indifferent.

This first issue of the year is also the opportunity for 3D Adept to wish you a year full of technological innovations!

Marvelous year 2018!

The 3D Adept Team





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3D PRINTING TECHNOLOGY IN THE JEWELLERY SECTOR



Image Formlabs: 3D printed ring

3D printing enables users to achieve different stages of their project, from modeling to prototyping. Some of the key sectors that take advantage of the solutions offered by additive manufacturing include architecture, medicine, automotive, aerospace and jewellery. In general, 3D printing impacts 3 main elements in these sectors: production costs, time and the realization of complex shapes.

As far as jewellery is concerned, 3D printing is part of all stages of the manufacturing of jewels. This is due to the widespread adoption of CAD software by jewellery designers.

This dossier aims to highlight the impact of additive manufacturing in the jewellery sector. It will discuss the process of modeling to the final product, the importance in the choice of materials, the technologies used and characteristics specific to some companies. Last, it will bring out the advantages and disadvantages that emerged from this analysis.

In order to tackle this issue, 4

companies joined the 3D Adept team and shared their experience in the use of 3D printing in the manufacturing of jewels. They include Materialise, Sculpteo, Prodways – The Creations Division -, suppliers of 3D printing services, and Boltensern, jewellery maker.

1. 3D printing in the jewellery sector

This technology is mainly used for rapid prototyping of jewels after modeling, the creation of jewelry models for the manufacturing of moulds with lost wax, or the direct manufacturing of the jewel using metal 3D printing.

The 3D printing technology has proven itself in the production process of companies. It can be used both for mass production or one-off production hence the increasing interest it aroused in the jewellery industry.

A great number of manufacturers specialize in 3D printers designed for jewellery professionals. Prices

start at several thousand euro for an entry-level 3D desktop printer. For professional 3D printers, prices are higher and depend on the features, resolution offered and other settings (3D print volume, print speed etc.).

According to a research from the American firm SmarTech Markets Publishing entitled «*3D Printing Opportunities in the Jewelry Industry - 2017: An Opportunity Analysis and Ten-Year Forecast*», this market may reach **\$ 900 million in 2026**.

Speaking about the manufacturing process, the report reveals that: *“even in traditional jewelry manufacturing with vulcanized silicon molds, the initial model is often 3D printed using high-temperature resistant photopolymer resins. Jewelry prototyping for size and shape verification is complemented by the use of directly 3D printed wax and resin patterns for direct casting and serial manufacturing. The next evolutionary step is direct metal 3D printing.”*

Still in this context, the report lays emphasis on the increasing use of 3D printing by jewellery makers. The introduction of low-cost systems (sub \$5,000) and increasing high productivity systems may explain this use. They ensure the production of complex and customized parts in series. Acknowledged suppliers in this area include **Stratasys, 3D Systems, EOS, EnvisionTEC, DWS and Formlabs**.

1.1. 3D printed jewels: from manufacturing to the final product

1.1.1. The importance of the choice of materials

Materials are essential in the manufacturing; they give the jewel

all its quality.

First of all, it should be said that there are two main families of materials used for 3D printing: plastics (ABS, PLA, polyamide, etc.) and metal powders (gold, silver, steel, titanium, etc.). However, one can also print ceramics, wax, sand, glass and even wood.

Each material integrates unique mechanical properties; therefore, its limits are specific to the systems used and the creation of the jewel.

According to the same SmarTech report, precious metal alloy metal powders such as gold or platinum used in direct laser printing for the manufacturing of rings would have the greatest market potential.

Gold, the most frequently used material, may represent 86% of the market by 2022. Cooksongold, Legor, Progold and Hildebrand are some of the well-known precious metal powder providers.

In addition, new technologies provide the possibility to offer new precious-metal alloys and gold colors (such as green and blue). Furthermore, a manufacturing that integrates these materials cannot be carried out using conventional techniques. Indeed, once they are combined with 3D printing, the alloys allow the manufacturing of lightweight platinum jewelry which cannot be achieved using a traditional manufacturing process.

Apart from gold, silver, copper and rhodium can also be used by jewellery makers. The finishing with these materials can be brushed, polished, satin or matte.

1.1.2. Types of technologies

Just as each material has its own properties, each technique can only be used for a specific material.

The SLA (Stereolithography) and DLP (Digital Light Processing) technologies are the most frequently used technologies in this area. These 3D printing technologies require the use of liquid resins as printing material. They produce objects that are very smooth on the surface with very fine details, compared to FDM technology.

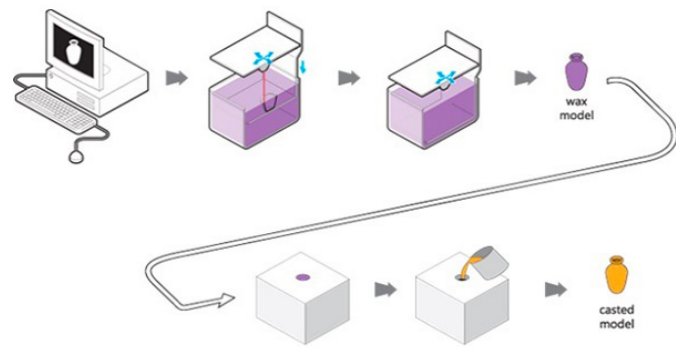
Given the fine details of the end-products in the manufacturing of jewels, the resolution of the 3D printer is a key factor to take into account. Smooth surfaces are required when 3D printing is used to create moulds using lost wax.

When 3D printing integrates moulding...

The manufacturing of jewellery is made from moulds, thanks to the technique of lost wax. The model of the jewel to manufacture with metal is 3D printed using a resin. The 3D printed jewel is thereafter cast in a resistant material similar to plaster. This mould is then heated to high temperature, which completely burns the thermosensitive resin (wax). The metal (gold, silver, platinum) can then be poured into the mould.

After the cooling of the metal, which has taken the

shape of the mould, the finishing stage must be carried out and if required, the precious stones can be added.



3D printing of jewelry with mold (source: i.materialise.com)

1.1.3. An insight into the manufacturing processes of companies

As a reminder, as part of this dossier, 4 companies shared their experience in the manufacturing of jewellery. Sculpteo, Prodways and Materialise specialize in 3D printing services. Boltensern is a family business that manufactures and sells jewellery.

Sculpteo

Clément Moreau, CEO of Sculpteo (a company that provides professional online 3D printing and laser cutting services) explains that the company mainly collaborates with designers. The latter designed objects that are either made in plastic (be it for finished products or prototypes), or in precious material (silver, bronze, gold plated ...): and these objects are manufactured



using lost wax.

For the co-founder of Sculpteo, the ability to manufacture in small series is the main advantage of 3D printing in this sector. Speaking of the materials used, Mr. Moreau explains: «*With lost wax, we can use all types of precious metals: gold, silver, nickel, platinum, etc. We print wax and we make the foundry in a conventional way.*»

Talking about manufacturing, the CEO explains that «*in an independent way, a designer can make a piece using lost wax without tooling and making wax by hand. Therefore, he saves time because once the design is carried out, he can produce one unit of the finished product. And [3D printing] is the only technology that can do that.*»



Clément Moreau, CEO of Sculpteo

Prodways

Prodways, specialist in industrial and professional 3D printing, integrates a division dedicated to luxury, art, design and architecture: Initial. **Catherine Gorgé, Managing Director of this unit**, explains that companies within the jewellery industry request their services both for prototyping and for the manufacturing of the finished product.



Speaking of materials, **Catherine Gorgé** highlights the titanium powder, the most compatible material with the EBM (Electron Beam Melting) technology, used in the division. This technology allows a direct printing of the finished product. Furthermore, there is a growing use of ceramics in this area.

PRODWAYS
GROUP

To mention a specific case, the Managing Director talks about **Inorganic Jewels**. *"We 3D printed the jewels with a Cast 200 resin on a L5000 3D printer. (The high definition resin is also called lost wax.) Thereafter, a foundry melted our wax models,"* she explains.



As far as prototyping is concerned, the division manufactures prototypes of necklaces with the sintering polyamide powder (pA2200) so that the creators (A + A Cooren) can validate their volumes.

Compared to traditional manufacturing techniques, 3D printing allows designers to avoid the mould making stage as they directly print with lost wax. Other advantages obviously include time saving and the capacity

to achieve complex shapes and geometries.

Lastly, if 3D printing is increasingly used for jewels made with titanium, therefore, "the price of this material should decrease in order to truly democratize the technology."

Materialise

Materialise, another provider of 3D printing technologies, collaborates both with designers and jewellery makers to manufacture accessories. In this field, the Belgian company offers the services of its software "Materialise Magics" to manufacturers. Jewellery makers could request the services of another provider for the printing.



Materialise explains the design process via a collaboration with Titan Company Ltd., watchmaker and jewelry manufacturer in India.

"The design gets put into a digital CAD file, which is then converted into a 3D-printable format with Materialise Magics software. The software converts file formats, edits object size and scale, fixes any conversion errors and adds support structure so the model doesn't drift away on the printer bed. The model is then printed out in resin on a Stereolithography printer and in the final production stage, the 3D print is used as the master part from which all finished pieces of jewelry can be cast."

The main advantages for Titan are the shortened lead times and the freedom of design. 3D printing therefore enables manufacturers to achieve a high level of intricacy, and to enhance their flexibility. Furthermore, products can be altered in size or easily multiplied in quantity.

Boltenstern

As for **Boltenstern**, the company directly 3D prints its jewels from gold powder, platinum powder and silver powder.



Marie Boltenstern

Marie Boltenstern, Managing Director explains us in an interview: *“the most important characteristic is that the product should be “unique”, especially in this sector. And that’s something that we can only achieve using 3D printing.”*

Furthermore, the technology requires a very good knowledge in 3D printing and a mastery of the 3D printer. The *“post-printing work is very important and must be mastered in order to obtain the expected result: smooth, shiny, etc.”*, she concludes.

1.2. Advantages and areas for improvement in the use of 3D printing for jewellery

The table below summarizes the advantages and the points to watch for regarding 3D printing in the jewellery sector.

Advantages	“Points to watch”
Customisation : This technology enables the creation of a unique and customizable jewel. Some jewellery shops provide their customers with simple, intuitive and easy-to-use software. This type of software does not require a fundamental knowledge of 3D.	A post-printing work is required in order to obtain the expected result Metal 3D printers are very expensive and require a good knowledge of the technology in order to master them.
3D printing enables to achieve complex shapes and geometries impossible to achieve using traditional manufacturing techniques	
Professionals of the jewellery industry can optimize the design and the manufacturing of the products	
Additive manufacturing and rapid prototyping enable to reduce the production time.	

2. Last...

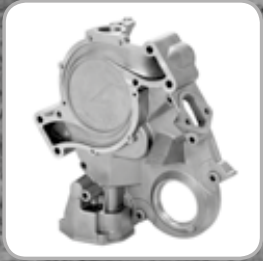
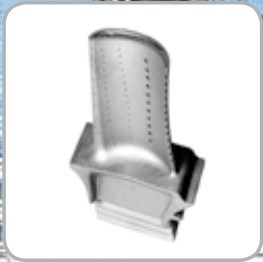
In the end, thanks to its potential and the creativity it arouses, 3D printing has proved to be an interesting tool to exploit by a number of jewelers and companies.

However, it should be remembered that if this manufacturing technique can be used by jewelers, the ultimate goal is not to replace them. If they suffer the consequences of a society marked by customization, they must keep in mind that additive manufacturing simply allows them to go further in their art and to gain in efficiency in the development, design and production stages.



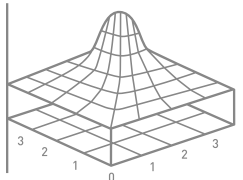
Image Formlabs: 3D printed ring

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business

3D printing Industry

New



"Techniplas Open Innovation Program", a very coveted program that creates a growth of opportunities within the 3D printing industry



Brooks Running Company will take advantage of HP's Fitstation Platform to manufacture its tailor-made footwear



\$200 million in Series D funding, to accelerate Digital 3D manufacturing



GE Additive opened Customer Experience Centre in Munich

New



Diogo Quental, New Global CEO of Raise3D

GE Additive opened Customer Experience Centre in Munich

GE Additive marked the end of 2017 by opening its first international Customer Experience Centre (CEC) in Munich.

The new 2,700 square meter centre, co-located with GE's European Technology Center, allows current and potential customers to experience every aspect of the additive manufacturing process from design to prototyping to operations.

The benefits that additive manufacturing will bring to business and industries

The CEC in Munich required an investment of \$15 million. It has hired over 50 GE Additive employees, including technicians and engineers specializing in additive design and production. Furthermore, 10 additive machines from Germany's Concept Laser and Sweden's Arcam EBM have been installed.

The centre will foster the adoption of additive in various businesses, regardless of where they are on their additive journey. It appears as the place to be for every customer in his/her additive manufacturing journey. In the centre, customers can start with a concept, design and build a prototype, and then move all the way through production, while enabling them to think through industrializing processes and helping improve their products and supply chain.

Divisions of the manufacturing services

Customers can interact with the CEC in various ways:

Machine Access – opens the doors of the latest metal additive machines (DMLM and EBM);





AddWorks – refers to the collaboration with GE’s additive experts on product identification, design, material selection and on additive facility setup. Users can build prototypes and see designs come to life. With the low rate initial production, it is possible to build multiple parts and develop operations process prior to full rate production.

The Additive Academy is a set of trainings from the GE team of additive experts in all aspects of additive manufacturing. Spare parts and powder – Access to GE’s team who can provide field service knowledge, spares and operational support to customers.

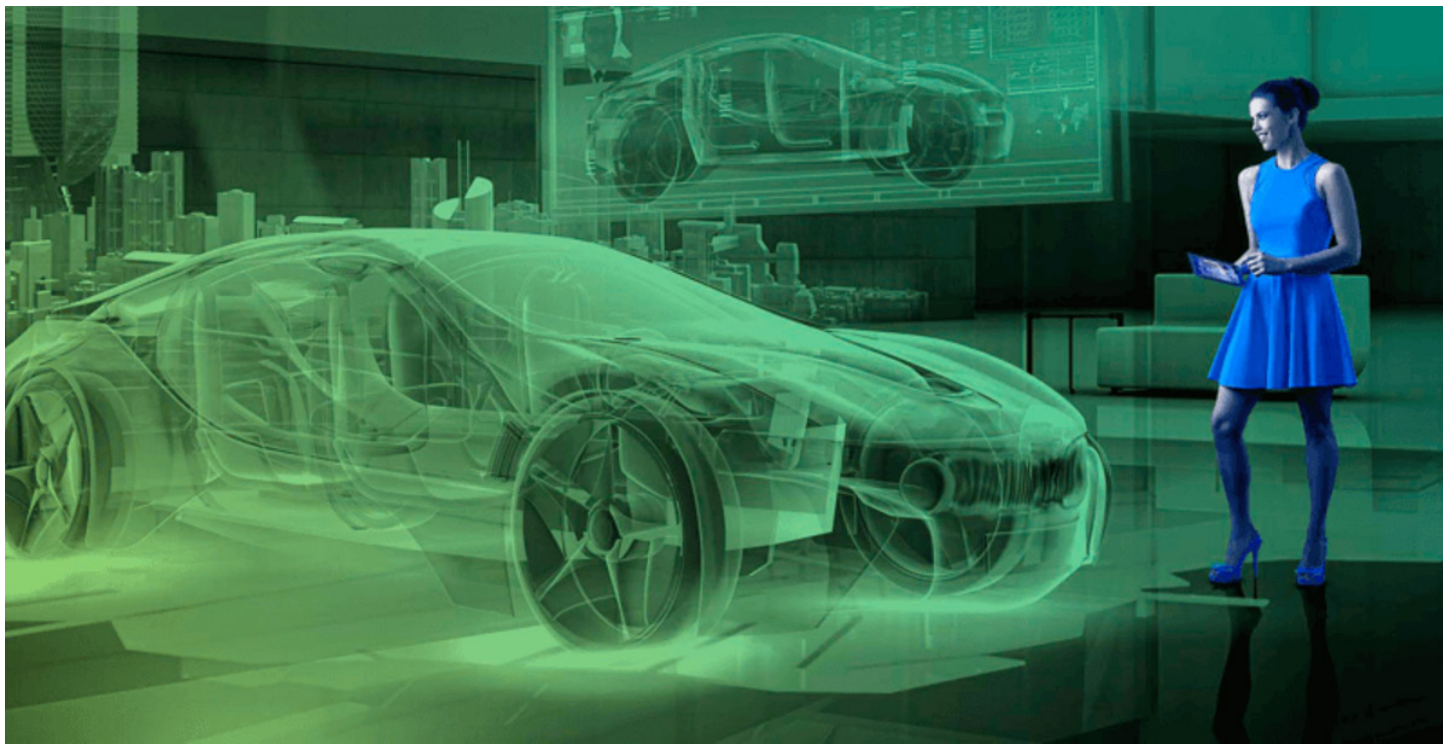
The presence of leading guests and dignitaries

More than 150 guests and dignitaries from business, politics and academia came to Munich for the opening, and got a chance to tour the facility after the ribbon cutting ceremony. Guests also heard from different speakers, including representatives from **BMW** and **Oerlikon**, on how they see the future of additive manufacturing.

“The opening of our Customer Experience Centre here in Munich marks a great milestone for us,” said Robert Griggs, Customer Success Leader at GE

Additive. “Germany is the global innovation hub for additive manufacturing. Right here, at the heart of the additive revolution, the centre will operate as the interface between customers and our teams, combining the strengths of Germany’s Concept Laser and Sweden’s Arcam, both leading providers of additive machines and services. We look forward to working closely with European companies and institutes, allowing them to fully realize the transformative potential that additive design and manufacturing can bring. We’re excited about the types of products they will design and the improvements they can make to their operations using additive.”

GE Additive’s Customer Experience Centers is an integral part of GE Additive’s strategy to accelerate the adoption rate of additive manufacturing with businesses worldwide. Still in the context of facilities, GE and Concept Laser laid the foundation for a new facility in Lichtenfels (Germany). Concept Laser will establish a new location for 3D metal printing in Lichtenfels and expand its activities in order to push the 3D printing market forward. Just like the CEC in Munich, this facility in Lichtenfels will also lead to big investments, the creation of new jobs as well as the rapid adoption of additive manufacturing in the region.



“Techniplas Open Innovation Program”, a very coveted program that creates a growth of opportunities within the 3D printing industry

Techniplas is a design and manufacturing provider of engineered products and services that are helping to shape the future of mobility. Since the launch of its Open Innovation Program last year, the company keeps attracting companies from a wide range of industries in order to help build and expand the automotive sector. This year at CES 2018, companies from specialized sectors mark their interest in bringing their strengths in the program.

Companies specialised in the software industry, 3D printed electronics, specific additive manufacturing technologies, makers of professional-grade 3D printers recently joined Techniplas Open Innovation Program.

ParaMatters from the software industry

Techniplas attracts lightweighting software innovator ParaMatters to its Open Innovation Program. The company specialises in autonomous topology optimization and generative lightweighting design.

ParaMatters brings its cognitive design platform to Techniplas. The platform can automatically generate additive manufacturing for high performance light weighted structures within aerospace, automotive and other mission critical applications.

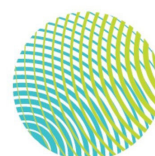
“With ParaMatters on board, we are bringing together some of the latest lightweighting and additive technology companies within Techniplas’ expanding network, which is fast becoming the preeminent hub for industry 4.0 collaboration”, said **Avi Reichental**, Vice-Chairman, Techniplas and CEO, Techniplas Digital.

In addition to speeding up the entire innovation cycle, ParaMatters advanced algorithms are designed to enhance the overall digital thread and additive manufacturing capabilities. This includes a new cloud-based,

generative design platform that automatically, on demand, compiles lightweight and metamaterial lattice structures based on size, weight, strength, style, materials and cost that can be specified by designers or engineers.

“We are excited to join the Techniplas open innovation program and bring to this vibrant ecosystem the ultimate generative design and lightweighting tool that the entire automotive industry has been waiting for,” said co-founder and CTO **Michael Bogomolny**. *“Together with Techniplas, we are transforming the entire design-to-manufacturing process by making it autonomous and automated to generate high-quality, optimized lightweighted designs.”*

The lightweighting design service, powered by ParaMatters, is already available for use and can be easily accessed via Techniplas Prime’s expanded digital manufacturing platform.



Techniplas

Nano Dimension, specialized in 3D printed electronics

The 3D printed electronics specialist aims at making available to the automotive industry, additive manufacturing of conductive components, encapsulated sensors and smart surfaces.

Techniplas' cognitive lighting technology and Nano Dimension's 3D printed electronics will be put together to deliver new ways of designing and manufacturing electronic conductive paths directly into the interior on the one hand, and to achieve surfaces of cars in a single step on the other hand.

As part of this partnership, the company will then bring its industrial DragonFly 2020 Pro 3D Printer into the Techniplas additive manufacturing Innovation Centre, and apply its extensive advanced inkjet engineering materials expertise to accelerate the development of next-generation cognitive connected vehicle parts, components, and systems.



"We are thrilled to welcome Nano Dimension as a member of our program which brings together today's best and most innovative players and technologies," said Techniplas founder and chairman **George Votis**. *"With Nano Dimension on board, we are the first to bring additive electronics capabilities to our automotive customers."*

"Techniplas' open innovation program is fast becoming the preeminent hub for innovative 3D printing companies to validate and mainstream their additive manufacturing solutions for the automotive industry," said Nano Dimension CEO **Amit Dror**. *"Together, we plan to lay the foundation for a new era of connected mobility and automotive products that are unencumbered by traditional design and manufacturing restrictions."*

A partnership with NXT Factory to explore additive manufacturing alternatives to injection molding

NXT Factory developed a technology called **Quantum Laser Sintering (QLS™)** which enables to additively manufacture thermoplastics at convincing speed and scale.

In this collaboration, Techniplas wants to discover how automotive products that are currently manufactured using injection molding can be produced better and faster using NXT Factory's technology.

The company is using proprietary deep-learning

algorithms to make real-time predictive and prescriptive choices that are designed to optimize the build performance and deliver the best available parameters. It is like cognitive mold-flow for injection molding but designed specifically for real-time, free-form additive manufacturing.



"Working together within this powerful ecosystem, we are bringing together some of the best and brightest minds in additive and generative technologies to enhance our company and accelerate the adoption of 3D printing by the automotive industry," said **George Votis**.

Techniplas Open Innovation Program will benefit from 3D Printer Maker Nexa3D

30 NXV 3D Printers will be deployed in Techniplas manufacturing facilities. As a reminder, Nexa3D is co-founded by Avi Reichental. Very active in the additive manufacturing technology, **XponentialWorks**, also founded by Avi R. supports Techniplas on this path.

The NXV is the first professional-grade 3D printer of Nexa3D. Nexa3D believes its technology is uniquely capable of achieving uniform high-speed and high-resolution printing at convincing injection molding properties, size and scale.



"We are excited and pleased to welcome Nexa3D as a full member of our program," said **George Votis**.

With regard to these partnerships, Techniplas positions its open innovation program as a provider of ecosystem-wide benefits from shared technologies with domain expertise that create new growth opportunities within the 3D printing industry.

Partners such as **DWS**, **Sharebot** and **Sicnova** are also part of the program and aim at pushing the traditional boundaries of automotive manufacturing forward.

Brooks Running Company will take advantage of HP's Fitstation Platform to manufacture its tailor-made footwear

Brooks Running Company signed a commercial agreement with HP Inc. and Superfeet to deliver a personalized running footwear.

Leveraging FitStation powered by HP and Brooks Run Signature, Brooks will introduce the first performance running shoe created based on an individual's unique biomechanics which will be available via special order through select retail partners from June 2018.

Brooks' focus on running

Brooks has developed a keen understanding of runner's specific biomechanics. The footwear company aims at providing unique experiences that improve the run for every individual. Over time, after several years of research, the company now has its Run Signature philosophy.

This philosophy relies on the fact that the best way to enhance comfort and improve performance is not to fix a runner's "flaws" but to instead create running footwear that works with the runner's natural motion path of his or her body.

The partnership with HP and Superfeet will take this philosophy to another level and deliver the most personalized running footwear.

"Brooks is committed to providing the fit, feel and ride each runner wants. The ability to give an individual a personalized shoe based on his or her unique biomechanics is a game changer. It is a compelling offering for the runner who is interested in tip-of-the-spear technology and a totally tuned experience," said Brooks CEO **Jim Weber**.

HP's FitStation platform

Launched in September 2017, HP aims at proposing individual shoe, insole recommendations and 3D printed insoles via its Fitstation platform. The platform combines 3D scanning with dynamic gait analysis as well as foot pressure measurements. With regard to the platform's offering, HP is probably the most appropriate partner to understand Brooks Running's vision.

How does it work?

HP captures 3D scans. The 3D scanning enables to measure the customer's foot length, width and volumetric data in order to determine the shoes that best fit him. FitStation carries out in-depth analysis including key motion zones to identify the unique motion path of the runner's body and information

about the desired running experience. Thereafter, a digital profile of the runner composed of the personalized fit, biomechanics and experience is created.

"FitStation by HP is changing what personalization means—from the in-store experience to the final product. In collaboration with Brooks and Superfeet, we are delivering truly made-to-measure footwear with a lot size of one," said **Ed Ponomarev**, general manager of FitStation and business development HP Inc. *"Digitalization of biometric data opens an opportunity to ultimate individualization with the speed and cost efficiency of mass production. HP brings deep experience in computing, scanning and technology integration at scale to deliver a revolutionary digital manufacturing platform, creating individualized products that are available to anyone—from casual runners to elite athletes."*

How is Superfeet involved?

Superfeet realizes the requirements sent by the FitStation platform for each shoe on a state-of-the-art DESMA polyurethane injection-molding machine. Through the 3D foot scans, the system determines the proper lasts which the shoes are built around, ensuring each shoe is tailored to the specific shape of the runner's foot.

Then, using a combination of variable PU injection with direct attach capabilities, the foot pressure measurements, movement analysis of the runner's joints, and their personal experience preferences are combined to create personalized midsole requirements with multiple tuned zones—all ensuring the runner stays in their preferred motion path and receives the running experience they desire.

"Having the leader in running footwear leverage FitStation and our U.S. manufacturing facilities to create the most individualized running shoe on the market is momentous," said **John Rauvola**, president and CEO of Superfeet. *"Not only will it change what people*





expect from their running experience, it is also an important step in making a positive difference in people's lives by delivering the best underfoot support possible. This is the beginning of the individualized fit revolution."

All customized footwear will be manufactured in the U.S. at Superfeet's world headquarters in Ferndale, Wash. Those running shoes will be available via special order through select retail partners from June 2018.



Diogo Quental, New Global CEO of Raise3D

Raise3D, the designer and manufacturer of 3D printers appointed **Diogo Quental**, as the new global CEO. Since January 1st, Diogo has been fulfilling Edward's former role as CEO.

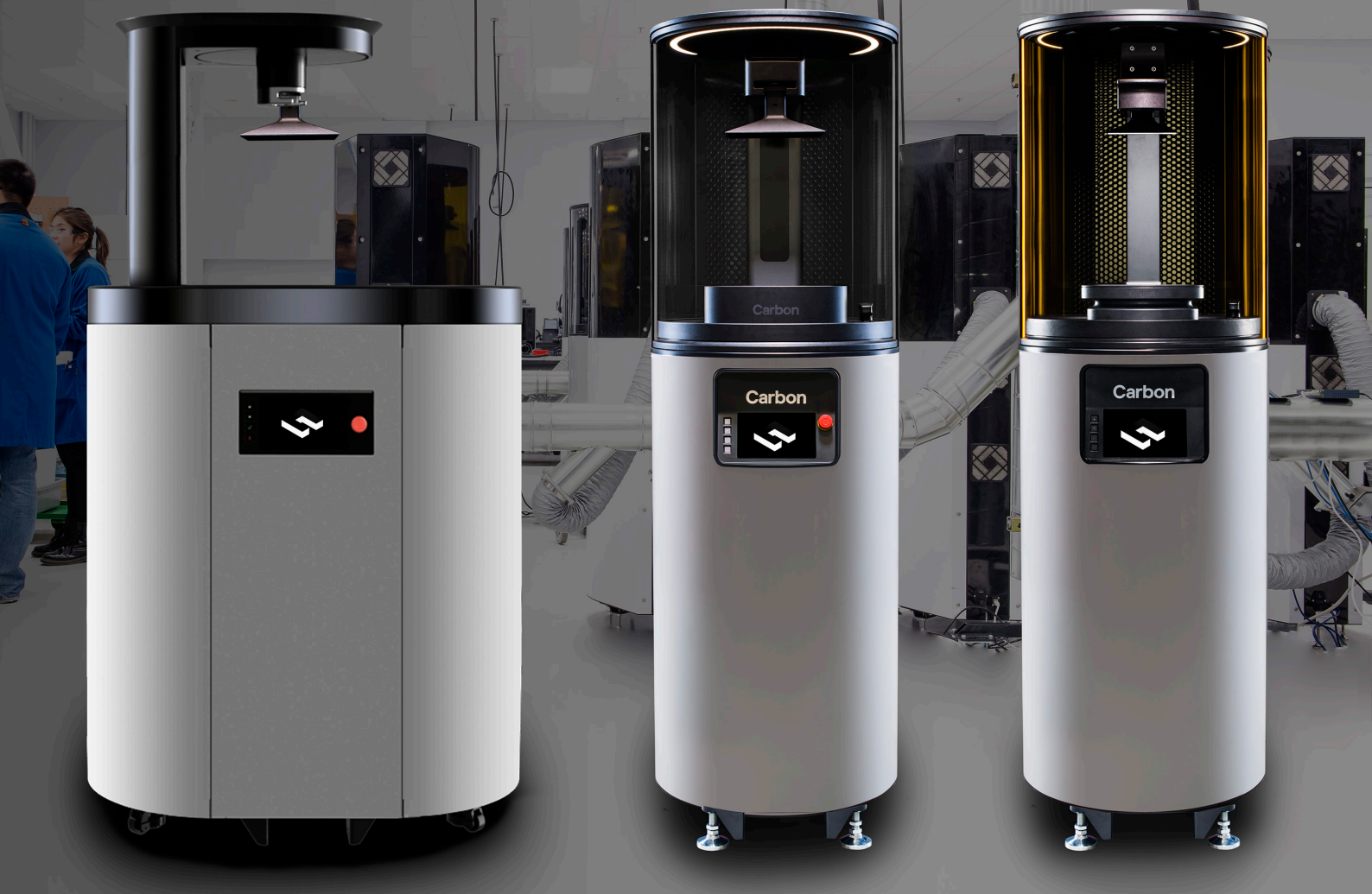
Two years ago, the manufacturer drew the public's attention with its N series of 3D printers launched on Kickstarter. A few times later, the 3D printer of the manufacturer has been nominated as a "top Prosumer 3D printer" in the 3D Hubs 2018 3D Printer Guide. Raise3D keeps growing and its development strategy also includes the way it is run today, hence the need of a new vision brought by Diogo Quental.

"This is the perfect time for Raise3D to do this change. We are proud for what we achieved so far with the current level of organization, but we needed a different type of governance to scale up the full operation", said Raise3D Ex-CEO **Edward Feng**. *"Our decision was to make a clear separation between the on-going operation that will be managed by Diogo, and the strategic direction of the company which will be coordinated by me."*

Active in the additive manufacturing industry since 2011, Diogo Quental has more than 25 years of experience in several different countries and cultures, structuring new businesses, managing people, and projects. He, indeed worked in 3 global offices, in 3 different cultures where he managed different people hence his capacity to raise the standards of Raise3D. It must be said that since September 2017, he had been working as VP for Strategy, Partnerships, and International Business Development at Raise3D.

With Edward Feng by his side, Diogo is aware there is a long road of improvements ahead: *"Despite having joined Raise3D only a few months ago, the experience of belonging to this team is one of the most rewarding I ever had."*, said Diogo Quental. *"I am very honoured with this new position and I do feel the responsibility of it."* The future CEO also affirms that he knows more comprehensive solutions still have to be offered to Corporate Customers.

Edward Feng, co-founder of the company, intends to dedicate his time to the strategic coordination of Raise3D, to support Diogo, and to engage closely with key Partners and Investors to ensure adequate support in the scale-up of the company globally.



\$200 million in Series D funding, to accelerate Digital 3D manufacturing

“The age of digital 3D Manufacturing is here, and this funding – with this incredible group of global financial investors, customers, and partners – validates our vision to fundamentally change how the world designs, engineers, makes and delivers products,” said Dr. Joseph DeSimone, Carbon’s CEO and co-founder.

Carbon, a digital 3D Manufacturing company, completed its first closing with a total raise of \$200 million in Series D funding. In order to deliver a scalable digital 3D Manufacturing platform for polymeric products, Carbon will use this capital to develop its momentum in disrupting traditional analog injection molding production techniques with connected, software-first, digitally-enabled design and fabrication capabilities.

In other terms, the specialist of digital 3D Manufacturing aims at developing its global expansion and range of products on the one hand and to reinforce its commitment in order to enable customers to move to mass digital production on the other hand.

Carbon, its 3D printing materials and its 3D printing suite software

Investors may have certainly realized the potential of Carbon’s range of products and services.

The 3D printing suite software of the company includes advanced auto supports, new fence supports as well as fast and secure simulations. It enables to design, engineer and make polymeric parts using Carbon’s Digital Light Synthesis™ (DLS) technology and resins.



Furthermore, the 3D printing materials program of the company offers some of its polymer resins via bulk packaging, which enables a price reduction of about 40% for manufacturers. The company's goal is to reduce the price to less than \$100/liter (€84.8) in 2018 in order to enhance the market for 3D manufactured parts.

A unique mix of investors

A number of international investors directly embraced Carbon's vision: financial institutions such as Baillie Gifford (Scotland), Fidelity Management & Research Company (U.S.), ARCHINA Capital (HK); strategic industry partners such as Hydra Ventures (the corporate venturing arm of adidas), GE Ventures, and JSR Corporation; and Emerson Elemental (the environmental practice of Emerson Collective). Current investors including Sequoia Capital, Silver Lake Kraftwerk, and Reinet Investments also supported Carbon's initiative. Another list of investors would be released in early 2018.

Some of these companies already express their satisfaction regarding this investment and above all the market of digital manufacturing.

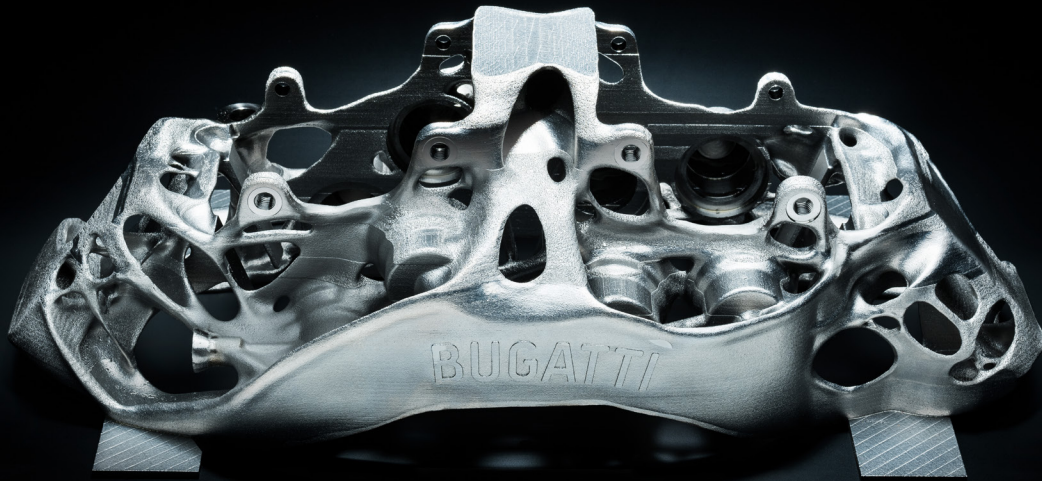
For **Peter Singlehurst**, Investment Manager at **Baillie Gifford**, **a combination of faster production times, lower costs**, and a wider range of materials makes it possible for Carbon to keep its promise regarding additive manufacturing.

Andy Karsner, Managing Partner of Emerson Elemental is inspired by Carbon's commitment. The company is

committed to innovating environmentally sustainable supply chains, dematerializing and minimizing waste streams, while scaling engines of additive manufacturing that can support economic growth in communities. *"We see the potential to enable a new class of workers and tools for 21st century opportunities that strengthen our communities and the environment. This investment gives us an opportunity to support Carbon's growth and continued industry leadership, while measurably transitioning to more natural materials, more precisely and efficiently applied, for a more thriving world"*, said A. Karnser.

Others see in the technology the biggest opportunity for the Asian region. Nobu Koshiba, President of JSR Corporation, *"we believe Carbon's digital light synthesis technology will play a crucial role in transforming manufacturing in multiple industrial sectors, especially in Japan and the Asia Pacific region more generally. We are looking forward to continuing this momentum together."*

Last, *"at Silver Lake Kraftwerk, we are thrilled to support Carbon as they continue to bring their vision of on-demand manufacturing to fruition,"* said Adam Grosser, Group Head and Managing Director, Silver Lake Kraftwerk. *"We believe their breakthrough polymers and processes will fundamentally change the way products are designed, built, and brought to market. The strategic participation in this round demonstrates the value we believe Carbon brings to this ecosystem."*



The world's largest 3D printed titanium Brake Caliper manufactured by Bugatti

With its Veyron and Chiron super sports cars, Bugatti has established a strong position for new technical developments and innovations in the automotive industry over the past few decades and has set breathtaking performance data and records. Now the Development Department of the French luxury brand has achieved a new coup. For the first time, the Bugatti developers have succeeded in designing a brake caliper that can be produced by 3D printing. While the main material used for the additive production of vehicle components to date has been aluminium, the new brake caliper is made from titanium.

This new milestone in the development of 3D printing was reached in cooperation with Laser Zentrum Nord of Hamburg, an institute that has formed part of the Fraunhofer research organization since the beginning of the year. With this world debut, Bugatti has underlined its lighthouse function for 3D printing within the Volkswagen Group and its role as an innovation driver in the international automotive industry. Vehicle trials for the use of the 3-D titanium brake caliper in series production are to start in the first half of the year.

*"Vehicle development is a never-ending process. This is particularly true at Bugatti," says **Frank Götzke, Head of New Technologies in the Technical Development Department of Bugatti Automobiles S.A.S.** "In our continuing development efforts, we are always considering how new materials and processes can be used to make our current model even better and how future vehicles of our brand could be designed."*

"As our performance data are often at the physical limits, we are especially demanding," adds the 48-year-old machine tool and production technician, who holds

a degree in engineering.

Development of the brake calipers

Bugatti currently uses the most powerful brakes in the world on the new Chiron. The brake calipers were an entirely new development. They are forged from a block of high-strength aluminium alloy. With eight titanium pistons on each of the front calipers and six on each of the rear units, these are also the largest brake calipers currently installed on a production vehicle. The brake calipers of the Chiron are produced using bionic principles on the basis of a natural model. The new architecture combines minimum weight with maximum stiffness. The inspiration for the design and mode of operation of the brakes was taken from motorsports.

With the newly developed titanium brake caliper from the 3D printer, Bugatti is now going one step further and breaking new ground. This particular titanium alloy, with the scientific designation of Ti6Al4V, is mainly used in the aerospace industry, for example for highly stressed undercarriage and wing components or in aircraft and rocket engines. The material offers considerably higher performance than aluminium.

For example, even as a 3D printed component, it has a tensile strength of 1,250 N/mm². This means that a force of slightly more than 125 kg can be exerted on a square millimetre of this titanium alloy without the material rupturing. The new titanium brake caliper, which is 41 cm long, 21 cm wide and 13.6 cm high, weighs only 2.9 kg. In comparison with the aluminium component currently used, which weighs 4.9 kg, Bugatti could therefore reduce the weight of the brake caliper by about 40% while ensuring even higher strength by using the new part.

To date, this approach was not feasible because it is extremely difficult or even impossible to mill or forge components from a titanium block as is normal practice with aluminium due to the extremely high strength of the material. This problem has now been solved using an extremely high-performance 3D printer, which also opens up the possibility of generating even more complex structures which are significantly stiffer and stronger than would be possible with any conventional production process. Frank Götzke found the selective laser melting units required in Hamburg, at Laser Zentrum Nord.

“Cooperation with Bugatti is a key lighthouse project for us,” says **Prof. Dr.-Ing. Claus Emmelmann**. Prof. Emmelmann Head of the Fraunhofer Institute for Additive Production Technologies (Fraunhofer IAPT) since Laser Zentrum Nord was incorporated in the Fraunhofer research organization. *“We were thrilled to be contacted by Bugatti. I do not know any other carmaker which makes such extreme demands of its products. We were pleased to face up to this challenge.”*

Development time

The development time for the 3D printed titanium brake

caliper was very short. From the first idea to the first printed component, it only took about three months. The basic concept, the strength and stiffness simulations and calculations and the design drawings were sent to Laser Zentrum Nord by Bugatti as a complete data package. The institute then carried out process simulation, the design of the supporting structures, actual printing and the treatment of the component. Bugatti was responsible for the finishing touches.

The special 3D printer at Laser Zentrum Nord, which was the largest printer in the world suitable for titanium at the start of the project, is equipped with four 400-watt lasers.

It takes a total of 45 hours to print a brake caliper. During this time, titanium powder is deposited layer by layer. With each layer, the four lasers melt the titanium powder into the shape defined for the brake caliper. The material cools immediately and the brake caliper take shape. The total number of layers required is 2,213.

Following the completion of the final layer, the remaining titanium powder which had not melted is removed from the chamber, cleaned and preserved for reuse in a closed loop. What remains in the chamber is a completed brake caliper with supporting structure which maintains its shape until it has received stabilizing heat treatment and reached its final strength.

What remains in the chamber is a brake caliper complete with supporting structure which maintains its shape until it has received stabilizing heat treatment and reached its final strength.



Frank Götzke, Head of New Technologies in the Technical Development Department of Bugatti Automobiles S.A.S.



Heat treatment is carried out in a furnace where the brake caliper is exposed to an initial temperature of 700°C, falling to 100°C in the course of the process, in order to eliminate residual stress and to ensure dimensional stability. Finally, the supporting structures are removed and the component is separated from the tray. In the next production stage, the surface is smoothed in a combined mechanical, physical and chemical process which drastically improves its fatigue strength, i.e. the long-term durability of the component in later vehicle operation. Finally, the contours of functional surfaces, such as the piston contact surfaces or threads, are

machined in a five-axis milling machine which takes another 11 hours to complete its work.

The result

The result is a delicately shaped component with wall thicknesses between a minimum of only one millimetre and a maximum of four millimetres.

"It was a very moving moment for the team when we held our first titanium brake caliper from the 3D printer in our hands," Frank Götzke remembers. "In terms of volume, this is the largest functional component produced from titanium by additive manufacturing methods. Everyone who looks at the part is surprised at how light it is – despite its large size. Technically, this is an extremely impressive brake caliper, and it also looks great."

The first trials for use in production vehicles are due to be held in the first half of the year; the time schedule is still to be finalized. At that stage, the engineer promises that it will be possible to considerably shorten production times, especially for machining.

The 3D printed titanium brake caliper is only one example of Bugatti's current research and development work. The board only weighs 0.4 kg, half the weight of a conventional die-cast lightweight aluminium board, without any reduction in rigidity. But that is another story.



Prof. Dr.-Ing. Claus Emmelmann, formerly Managing Director of Laser Zentrum Nord and now, after its incorporation in the Fraunhofer research organization, Head of the Fraunhofer Institute for Additive Production Technologies (Fraunhofer IAPT)

Automotive

3D printing Industry

New



What if you add 3D printed customized accessories to your MINI?

New



Local Motors will improve the development of its 3D printed autonomous "Olli" shuttle by raising over \$1 billion



BMW's new i8 Roadster, the new "Coupe" that integrates tons of metal 3D printed parts

What if you add 3D printed customized accessories to your MINI?

New year, new offering and...new look for the consumer's car. The BMW Group will launch unique 3D printed personalisation upgrades. Called MINI Yours Customised, the service will enable customers to customize their Mini model using the latest technologies.

It's been more than 10 years that MINI has been innovating in the area of vehicle personalisation by offering customers choice from a huge range of style, comfort, convenience and technology options, enabling them to create a car which truly reflects their personality and lifestyle.

This year, MINI Yours Customised will reach another level using 3D printing and laser lettering.

MINI Yours Customised: the concept



Side scuttles, interior trim, illuminated door sills and LED door projectors will be custom manufactured in a design created by customers online. A new website will be available to customers for them to order their accessories.

3D printing and laser lettering as part of the new production techniques

These production processes enable precise recreation of the customer's designs and will be delivered within the space of just a few weeks. Customers will be able to easily fit items to their vehicle themselves, or by a MINI retailer of their choosing. They could select between different colours, patterns, surface finishes and icons

The best part is that upgraded items will be removable, allowing for customised MINIs to stay on-trend with future additional upgrades or that they can be restored to their original specification for resale.

MINI wants to position itself as a pioneer for individualisation, digitalisation and 3D printing

Individualisation has always been highly valued by the worldwide MINI community as evidenced by the large and diverse range of existing special equipment MINI

accessories. Customers could integrate their own text and even their personal signature into various design, bringing out by this way their individual style and creativity.

MINI is committed to digitalisation and innovative production methods for creating new personalised products. Alongside the new web store, a completely new distribution chain has been created for direct sales of MINI Yours Customised products to customers.

As for the 3D printing process, it has also been specially tailored to the production of individual products in large numbers. The 3D printers used in this new process have been precisely configured by BMW Group and strategic partnerships with Hewlett-Packard Inc., Carbon Inc. and EOS GmbH. All MINI Yours Customised products conform to the same high form, functionality and safety standards as the factory supplied components in the original MINI accessories range.

Main features of accessories

As a reminder, side scuttles, interior trim, illuminated door sills and LED door projectors can be customized by the customer.

MINI Side Scuttles: wide choice of colours, finishes, patterns, icons and lettering.

The rims for the side indicator inlays known as side scuttles are 3D printed and then painted in a colour shade selected by the customer from a choice of Aspen White matt, Chili Red matt, Jet Black matt, Melting Silver matt or White Silver matt.

A choice of scalable surface finishes and patterns are available alongside four icon designs and a text entry field for an added personal message. It is possible to produce the side scuttle with different designs for the left and right side of the vehicle – for example the name of the driver and passenger.



The MINI Yours Customised Side Scuttles are supplied in pairs with white direction indicators. These are available for current-generation MINI 3-Door Hatch, MINI 5-Door Hatch and the MINI Convertible. A clip mechanism is used for attaching them onto the vehicle, allowing them to be removed and swapped in the future.

MINI Interior Trim



This part is manufactured using the same additive manufacturing technology used for scuttles.

This upgrade is also available for current MINI 3-Door Hatch, MINI 5-Door Hatch and MINI Convertible models. The trim is precisely integrated into the dashboard on the passenger side where it replaces the factory-mounted trim. If necessary, the trim can be changed at any time with another individually designed version or the original factory accessory. Customers wishing to make use of this upgrade option must order the appropriate interior trim preparation at the time of ordering their vehicle.

A wide choice of colours will be offered, including Aspen White matt, Chili Red matt, Starlight Blue matt, Moonwalk Grey matt and Jet Black matt. A large selection of surface finishes, graphic patterns and icons create additional opportunities for further individual styling. Customers can also add their own text to the trim which, as with the icons, can be freely configured in any size on the panel.

MINI LED Door Trims



The design created by the customer is inscribed using laser technology. Individually configurable door sills are supplied to match the specific vehicle for the MINI 3-Door Hatch and the MINI Convertible – or the MINI 5-Door Hatch and the MINI Clubman.

They can be precisely fixed to the entry area with the

adhesive pads supplied. The MINI LED door trims customised for the driver and passenger doors have LED illumination without any wiring. The door trims for the rear are not illuminated. During the configuration process, the customer has the option of designing each of the two or four door trims independently if they wish.



MINI LED Door Projector

The door projectors create an illumination that can be individually designed. The illumination is projected onto the floor by an LED light source when the driver and passenger doors are opened. The diameter of the projection is between 40 and 50 centimetres.

Several patterns and colour choices are available, with colour options including Chili Red, Starlight Blue and Black combined with White. The customer can further enhance the individual character of the product by adding icons, text or their own signature. There is also an option for configuring a different design for the driver and passenger side of the vehicle.



The LED door projectors from the MINI Yours Customised programme can be installed in current and previous generation models. The prerequisite for selecting this upgrade is that their vehicle must already have door projectors or door entry lights. If a customer's vehicle is fitted with door projectors, the existing slides can simply be swapped with the MINI Yours Customised products.

For all other vehicles, the package includes slides and projectors to replace the factory fit door entry lights. In both cases, assembly can be carried out in a few simple steps.

For now, we already know that UK customers will be the first to benefit from this service.



Local Motors

will improve the development of its 3D printed autonomous “Olli shuttle” by raising over \$1 billion

Local Motors is a ground mobility company focused on shaping the future of transport. The company began low volume vehicle manufacturing of open-source designs using multiple micro-factories. However, since inception, it has debuted the world's first 3D-printed car, self-driving, cognitive and electric vehicle, Olli. For the company, Olli is the answer to a sustainable, accessible transportation solution for all.

Local Motors collaborated with Elite Parking Services, and Texas-based Xcelerate to secure third party operational support as well as vehicle financing for their autonomous shuttle, Olli.

Customers who have existing relationships with transit companies will have the ability to finance just the vehicle with Xcelerate for up to 84 months and continue to work with their existing operations and monitoring partners.

The solution of EPS to support the development of Olli consists in a routine maintenance, warranty service, insurance, monitoring, management, operations and many more. For these customers who engage EPS's services, EPS is also offering up to \$1 billion in financing.

In addition to funding from EPS, Xcelerate has agreed to provide up to \$20 million in Olli Vehicle financing.

Investors attracted by manufacturing and innovation?

Olli is an autonomous 3D printed transit vehicle. Its production is different from conventional automobile

manufacturing. Indeed, traditional cars require deep investments in tools and production facilities especially for a unique design whereas in this case, the method allows flexibility in the design.

Regarding for instance a University campus' needs, the manufacturers explain that “the large automaker can't alter their vehicle, but [we], Local Motors can simply change the file, and print a batch of Ollis that fits best with the campus' needs.” Its components are created by a Cincinnati Inc BAAM printer and a digital design file which varies according to the specific demand of each client.

Improvements still need to be made by the manufacturer which is looking forward to implement smart features so that users with reduced mobility, sight, cognitive or hearing disabilities could get a better access.

First trials of the company were carried out at the beginning of the year in Germany (Berlin) through a collaboration with Deutsche Bahn. The driverless vehicle then transports passengers from work to the nearest Deutsche Bahn rail station.



BMW's new i8 Roadster, the new "Coupe" that integrates tons of metal 3D printed parts

The new BMW i8 Roadster, also called the sports car of the future is available in two body variants. The car was launched for the first time at the Los Angeles Auto Show in December 2017 and the official launch on the market will be on May 2018. The manufacturer created hype among cars' fans, while innovating in terms of manufacturing.

The new BMW i8 Roadster is an elegant car with a "stretched silhouette" that features BMW eDrive technology, enabling longer range and more time in pure-electric mode.

The car takes the i8's combination of locally emission-free mobility and high-calibre performance and sprinkles the drop-top driving experience into the mix. The eDrive button enables silent and locally emission-free driving at up to 120 km/h.

The BMW i8 Roadster also benefits from a low-weight construction, complete with low centre of gravity and even weight distribution. The aerodynamically optimised exterior – with model-specific gullwing doors and a soft-top roof that also displays great visual lightness – is a fine exponent of the signature BMW design language.

Two-seater boasting a distinctive and elegantly stretched silhouette

The electric operation installed in the car enables the roof to open or close in an almost silent hush, within 15 seconds and while travelling at up to 50 km/h, if required. The broad, wide-opening lid guarantees an "emotionally-engaging driving experience".

The BMW i8 Roadster is the only one to offer owners a fabric soft-top which stows away into a perpendicular position in the rear when opened and therefore takes up very little space.



The three segments of the roof fold vertically in a Z. And between the roof box and the seats for the driver and front passenger is around 100 litres of additional storage space. Together with the load area in the rear, which can accommodate 88 litres of cargo, the rear compartment helps to ensure the open-top version of the plug-in hybrid sports car is also as well equipped as possible for everyday use and trips away.

3D printing in the construction of the soft top

Intelligent lightweight design and additive manufacturing technology also play a key role in the construction of the soft-top. Aluminium elements connecting the roof mechanism with the body of the new BMW i8 Roadster are produced in a new 3D printing process. This manufacturing method for aluminium components breaks new ground in the automotive industry and “allows the topologically optimised bracings to be produced in a geometric form, which would not be possible using conventional casting techniques and ensures an optimum balance between component rigidity and weight.”

BMW eDrive technology: more power, increased range; electric driving experience raised another notch.

BMW eDrive technology powers both the BMW i8 Roadster and new BMW i8 Coupe. The number of driving situations where the electric motor is solely responsible for powering the car has been significantly increased. By contrast, the combustion engine is only brought into play when accelerating hard, and is switched off again far more frequently with a

measured driving style.

Underpinning this new level of locally emission-free electric mobility is the updated version of the lithium-ion battery developed for the BMW i8. The high-voltage unit is located centrally in the car's underbody and its cell capacity is up from 20 to 34 Ah. All of which means the electric motor has more energy at its disposal. Plus, the cell configuration allows a 9 kW/12 hp increase in peak output to 105 kW/143 hp, lacing quick sprints on pure electric power with an even sharper streak of dynamism.

The electric range of the i8 has also been increased. The new BMW i8 Roadster can now cover up to 53 kilometres (33 miles) with zero local emissions in the NEDC test cycle and the new BMW i8 Coupe up to 55 kilometres (34 miles). And that broadens the reach of all-electric mobility well beyond the city limits.



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medicine

3D printing Industry

New

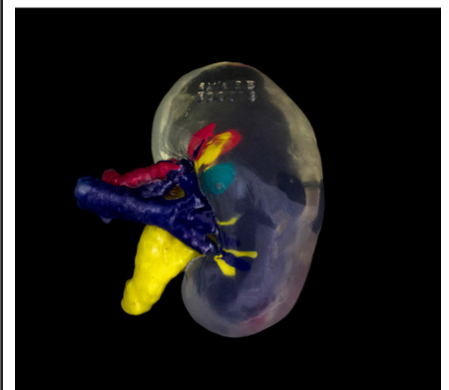
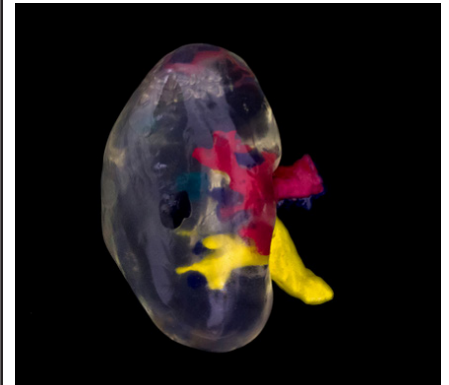


A 3D printed anti-pollution mask for children

New



SprintRay and Patterson Dental will distribute resin 3D printing technologies to dental practices



How does 3D printing enable doctors to achieve a kidney transplant?

A 3D PRINTED anti-pollution mask for children

In heavily polluted cities, children are very exposed to a number of diseases. Adults can easily find stylish protective masks to protect themselves from pollution. However, very few are available for children. Autodesk, Sinterit and Bartłomiej Gaczorek, 3D designer, wanted to address this issue hence their collaboration to create a protective mask for young children.

The aim of the team was to create a low-weight mask. The key challenge was to protect the filters without increasing the volume of the mask, as children are highly mobile and have a tendency to fall. Furthermore, in order to encourage children to wear the mask, the team wanted to make a colorful product. Creating such a structure manually would require a lot of time, and would almost certainly lead to mistakes that would not be 3D printable.

The manufacturing of the mask

After designing the mask, Autodesk Netfabb analyzed and detected problems, repaired meshes, and therefore, shortened the printing time even further. In the case of the “brifo,” Netfabb made it possible to properly prepare the design before printing. The software created internal lattices to slim-down the design with a complicated, organic structure. The latticing allowed for a lightweight model with no loss of functionality or durability.

The team used the Sinterit Lisa printer that integrates SLS technology to manufacture the mask. The printer has the ability to print permanent, targeted elements that could be treated and painted to create a final product, not just a prototype. In addition, it can print durable components (PA12 nylon) as well as flexible ones (TPU), making it possible to print both rigid sections of the mask and an anatomically adjustable section for the face.

As far as materials are concerned, PA12 and Flexa Black were used since they make the mask both durable and comfortable.

“A solid piece can be hollowed and filled with crystal-like lattice structures and vents for removing unsintered powder can be added in few simple steps. This reduces the final weight and material consumption by 50 per cent as compared to a solid part.”



SPRINTRAY AND PATTERSON DENTAL WILL DISTRIBUTE RESIN 3D PRINTING TECHNOLOGIES TO DENTAL PRACTICES

Commercial Agreement to distribute SprintRay's advanced resin 3D printing technologies for dental practices.



Since November 2017, SprintRay and Patterson Dental bring high-resolution desktop 3D printers, resins, and accessories to dental practices throughout the USA and Canada. Patterson Dental, the business unit of Patterson Companies will distribute a wide range of SprintRay's solutions including the MoonRay desktop 3D printer, as well as a variety of **resins**, and **accessories**.

For those who do not know both companies...

SprintRay is a Los Angeles-based company which manufactures professional-grade and affordable 3D printers with resins for a variety of industries and applications including dentistry, engineering, prototyping, art, and design.

As for Patterson Companies, it is a distributor of products on the dental and animal health markets. On the dental market, the company provides dental products, equipment and software, turnkey digital solutions and value-added services to dentists and dental laboratories throughout North America. On the animal health market, products, services and technologies to both the production and companion animal health markets in North America and the U.K are provided.

Digital dentistry

As the name implies, this practice refers to the use of specialised technologies to carry out dental procedures

rather than using mechanical or electrical tools. According to the journal dental economics, in order to understand the future of dental technology, it is important to understand how new technologies function in other industries and how those technologies can be integrated into dentistry.

This field requires a modern 3D printing solution to provide doctors and patients with a helpful experience. "That is why we are so excited to be working with Patterson Dental," said Amir Mansouri, CEO of SprintRay. "The company has a proven track record for bringing the most innovative and influential technologies to the dental market."

Josh Killian, Vice President of Marketing for Patterson Dental expresses the company's contentment to work with Patterson Dental: "We are pleased to bring SprintRay's technology to our customers looking to further their endeavors in digital dentistry. High-resolution desktop 3D printing appliances and models in house is a key part of the next evolution in dentistry."



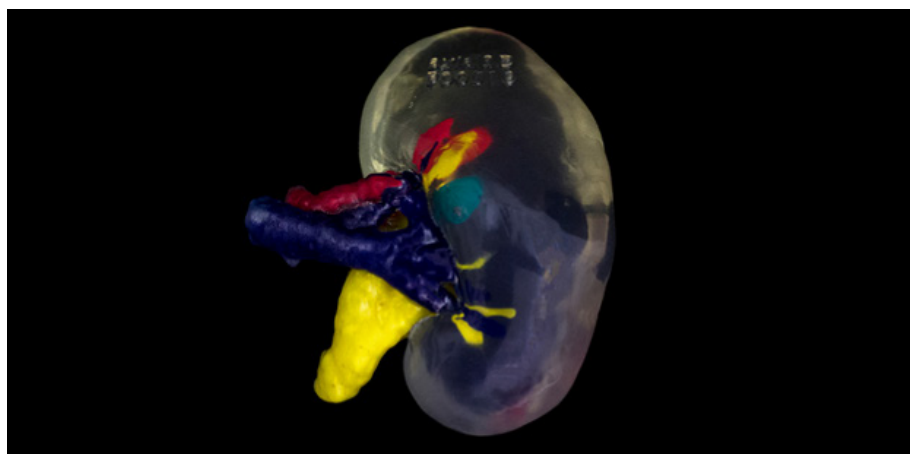
SprintRay


PATTERSON
DENTAL



How does 3D printing enable doctors to achieve a kidney transplant?

Recently in Belfast (Ireland), surgeons used a 3D printed model of a kidney to carry out a complex transplant operation on a young mother. It was a premiere in the complete excision of a Bosniak 2F renal cyst from a donor kidney without the requirement of revision surgery.



Pauline Fenton, 22, was living with end stage kidney disease and was wholly reliant on dialysis. Her 45-year-old father, William was confirmed to be a suitable living donor, unfortunately, he was blood group incompatible.

In addition, doctors discovered the father's donor kidney was potentially cancerous, which added another level of complexity in the procedure that was already complex. As the cyst would first require treatment before the incompatible transplant could proceed, surgeons at Belfast City Hospital decided to use a 3D printed replica model of the donor kidney (printed exactly from his CT scans).

How did the surgeons carry out the treatment?

The team firstly verified the size and placement of the tumour and cyst thanks to the 3D printed replica model. Thereafter, they planned and prepared for the surgery to remove the cyst and transplant the kidney to Pauline.

Technically speaking, the physical 1:1 scale model of the father's donor kidney with existing Bosniak 2F renal cyst, was used in guiding a partial nephrectomy and living donor

allotransplantation into Pauline's body.

Consultant Transplant Surgeon Tim Brown explained: *"in this case, our donor's kidney was the best possible option for his daughter's life saving transplant, so we had to ensure precise and complete excision of the cyst to retrieve maximum healthy tissue for transplantation".* The consultant explained that they planned and rehearsed the surgery precisely, using an exact replica of the donor's kidney containing the size and position of cyst, so they knew the precise procedure required in the operating theatre.

As far as results are concerned, the team completely removed the Bosniak 2F cyst from the donor kidney, confirmed margin clearance from the pathologist in real time and subsequently completed an ABO incompatible transplant to the donor's daughter. The recipient kidney achieved primary graft minutes after transplantation and kidney function remains excellent to date.

This level of insight is not achievable with conventional pre-operative imaging. Furthermore, for the consultant, 3D printing played a key role in helping them to give Pauline

an improved quality of life and the opportunity to see her child grow up. Indeed, the 3D printing technology enables an extra level of understanding that isn't possible with 2D or 3D images on screen.

Advantages in terms of costs

In this case, using of 3D printing helped to plan the surgery in detail, considering the best approach, as well as the potential problems, before stepping into the operating room. Furthermore, as far as costs are concerned, the average cost for a patient on dialysis is over £30,000 per year. This cost has been reduced to £5000 per year in post-transplant management costs. By exploiting tools such as 3D printing, complex transplants are now possible and a great number of people's lives can be saved.

Daniel Crawford, founder of **axial3D**, the company which produced the model for Mr Brown said: "now that 3D prints are available via the NHS in Northern Ireland, we look forward to supporting more surgeons and patients with this technology." The company aims at working with surgeons with the aim to improve patient outcomes; reduce operating times and ultimately help advance surgical education and planning for the future.



Consultant Transplant Surgeon Tim Brown



CES 2018: another year of surprising innovations

CES (Consumer Technology Association) has proven itself in the world of technologies. The leading event of Las Vegas has become a catalyst of innovation. This year, 5G, smart cities, AI, IoT, AR and VR shined at annual innovation event.

More than 3,900 exhibitors showcased world-changing technologies that spanned more than 2.75 million net square feet of exhibit space across Las Vegas. From major international brands to the more than 900 startups participating in Eureka Park (home for CES startups), CES offered thousand ways to make people dream about the future, and companies achieved business objectives.

“Large and small companies from around the globe came to Las Vegas to launch technologies that will change our world,” said Gary Shapiro, President and CEO, Consumer Technology Association (CTA). “From 5G to smart cities, digital health, AI, VR/AR, [3D printing] and more, the technologies that will shape the future of our planet and lives for the better were on display across the show floor. CES is the global platform where you can see the critical ingredient technologies and understand better how they interconnect, providing both a clear snapshot of today’s breakthrough innovations and a vision of the road ahead.”

A range of groundbreaking technologies were introduced, explored and analyzed during the event, demonstrating how our world is heading towards a more connected future. Smart Cities at CES spotlighted many of these innovative technologies, including 5G, AI and IoT.

As part of the CES conference program, more than 900 speakers, including 240 women, across some

200 conference sessions took the floor. Smart Cities Marketplace for instance, offered multiple conference sessions that highlighted policymakers, city officials, industry innovators and more. Furthermore, hundred government leaders attend the show including one cabinet official, 10 members of congress and six international ministers.

“CES 2018 will be remembered as the year where the wattage of innovation was so huge that it caused a blackout!” said **Bridget Karlin**, CTO and VP, IBM. “CES 2018 once again demonstrated that this is the world’s premiere showcase for technology innovation with unparalleled diversity from international public officials to industry leaders to entrepreneurs.”

How was 3D printing portrayed at CES?

3D printing companies did not miss the chance to show the potential of 3D printing. The fast-growing technology was at the heart of many discussions, on the companies’ side as well as on the attendees’ side.

Some of the announcements, already featured in this issue, laid emphasis on partnerships between companies, launches of new products (3D printers, 3D scanners and materials) and crowdfunding campaigns.

As far as other announcements are concerned...

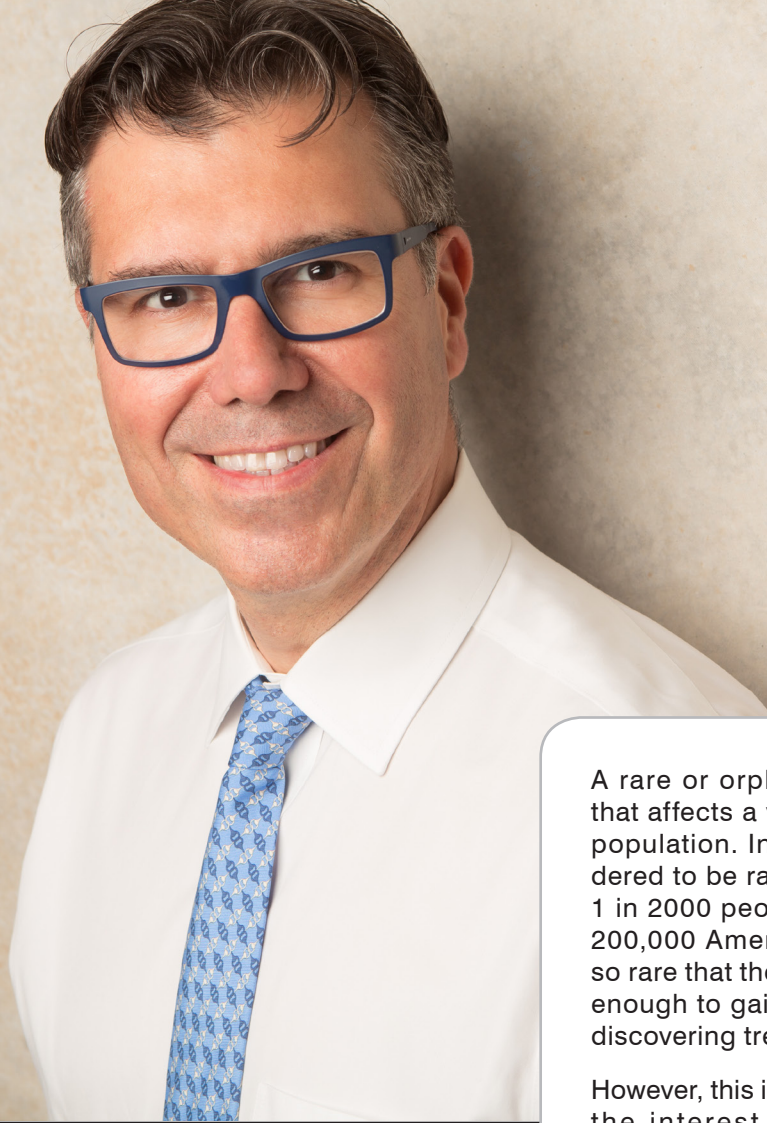
HP for instance, drew attention with its Z 3D camera which can capture

a full 3D image. The usable files created so quickly using the system of the camera are high quality and immediately workable. Operation is intuitive, with easy prompts to ensure accurate capture of every angle of detailed objects.

Formlabs launched new materials and customized 3D printed earbuds. LulzBot brought a set of nine 3D printers that were 3D printing parts in a demonstration. CRP Group showcased 3D printing for drones, motorcycles, satellites, motorsports. XYZprinting showcased full-color 3D printing and more.

“CES is by far the world’s preeminent technology showcase and innovation catalyst. At CES, companies, both large and small, along with a powerfully diverse set of entrepreneurs from around the globe come together to define the technologies, products and services that will help address society’s most pressing needs,” said **John Penny**, EVP, consumer business development & partnership, Twentieth Century Fox.

Last, CES really demonstrated that it can be a connection system for the global community of innovations, their companies, and countries.



INTERVIEW

How can 3D printed orphan drugs improve life of patients?

The point of view of
Antonio Benedetti,
CEO of Cycle
Pharmaceuticals

A rare or orphan disease is any disease that affects a very small percentage of the population. In Europe a disease is considered to be rare when it affects fewer than 1 in 2000 people; in the US as fewer than 200,000 American at any given time. It is so rare that there is a lack of a market large enough to gain support and resources for discovering treatments for it.

However, this issue of rare diseases arouses the interest of some pharmaceutical companies such as Cycle Pharmaceuticals which has made it its core business. Founded 6 years ago by James Harrison (now Executive Chairman of the Board of Directors), it is run by Antonio Benedetti, CEO.

Accompanied by Steve Fuller, Business Development Director of Cycle, Antonio Benedetti talked about the difficulties faced by patients who suffer from rare diseases today, but above all, one of the solutions that the company proposes to reduce these obstacles and improve the quality of life of patients.

This solution which results from a partnership with Aprelia Pharmaceuticals, a company specialized in the 3D Printing (3DP) of drugs, explores the possibilities offered to patients with rare diseases. Possibilities that can drastically improve their quality of life and raise the interest of the healthcare industry.

Aprelia, expects to use its ZipDose® Technology to transform the way people take medicine. ZipDose® Technology can be combined with a wide variety of active pharmaceutical ingredients to create rapidly disintegrating oral dosage forms that are easy to take and easy to administer.



Tell us more about Cycle Pharmaceuticals

Cycle is mainly focused on three business areas:

- **Improving drugs** - optimising an existing drug. A patient can take a treatment for a limited amount of time, dealing many times with suboptimal formulations (due to big capsules or constant injections). This can be handled if it is for a short amount of time, but if the patients have to deal with a life-long treatment and have to take the medication many times per day for all their lives (from childhood to adulthood), then any improvement that we can bring on that formulation can improve their quality of life. We look at improving formulations to address patient's unmet needs.

- **Repurposing drugs** - creating a new indication for an already existing drug. We are working very closely with academics and Ivy League universities, focusing on various scientific and technological projects.

- **Generics** - reinstating generic drugs, previously available in the market, improving market accessibility

These three areas of focus are underpinned by **formulation technology** - creating new drug delivery technologies to improve the efficacy and effectiveness of drugs, allowing Cycle to give patients a greater freedom and choice.



What about the partnership with Aprecia?

The partnership with Aprecia aims at bringing a novel technology, such as 3DP, in our Improving Drugs business area, focusing in rare diseases.

Aprecia has developed a first class 3DP technology (called ZipDose®), the first approved by the FDA, that offers two valuable attributes for treating rare diseases: a tablet that is fast melting (desintegrating in seconds) and the ability to include a large amount of drug in a single tablet, with Aprecia being the only company that can include such high doses of API in one tablet using this novel technology.

In other words, you can have more than one thousand milligrams in one single tablet that you can put on your tongue and with a little bit of water, it will melt in a matter of seconds.

We can then address two main issues:

- The first one is to reduce the number of tablets per day (pill burden). For example, instead of taking 10 tablets of 300mg each of a specific medicine, they could be taking only 3 fast melting and easy-to-swallow tablets.

- For all the patients who suffer from dysphagia (difficulty to swallow), it becomes much easier to take a drug which melts fast in the mouth.

We have already triggered the first development with Aprecia and we look forward for it to being by our patients in 2 or 3 years.

We are going to develop other products with Aprecia, so this product is the first of a long and promising line.



What are the main challenges you may encounter in this collaboration?

We are partnering with a top-class company, so we expect more excitement than challenges.



Where do you commercialize your drugs?

We are a global company and we are already commercialising and distributing our products around the world.

However, with regard to Aprecia's partnership, we will first start in the US and Europe. These continents are our main objective.



What do you think about the use of the 3D printing technology in the manufacturing process of these orphan drugs?

The 3DP technology being used here allows us to produce an oral tablet that disperses much faster than other technologies and can have much more drug per tablet. These properties are very important in the orphan drug world where patients often have to take lots of tablets every day, and often from a young age where swallowing is a problem.

The Aprecia 3DP manufacturing process is the only one approved by the FDA, and has shown none of the control problems that are a concern in other 3DP methods.



What are your prospects of development?

Cycle is a fast-growing company. We have already launched our first two drugs:

Nityr™ (nitisinone tablets), a new treatment option with an improved formulation for patients with tyrosinemia type 1, an ultra-rare condition and, **Ketorolac Tromethamine Injection**, a non-steroidal anti-inflammatory drug and the first in our generic pipeline, brought to the market to address shortages currently preventing patients from receiving essential treatment.

We have a strong pipeline with new launches expected in 2018.



Where do you commercialize your drugs?

We have a lot of work to do, the most exciting part is yet to come. We are confident about partnering with a global leader such as Aprecia Pharmaceuticals.

UNIZ unveiled 5 new products with UDP technology

3D printing company UNIZ released a new printing technology called uni-directional peel (UDP) and 53 exciting new products at this year's CES event in Las Vegas (January 9th, 2018).



UNIZ first drew the public's attention in 2016 when they launched the SLASH, a high performance, affordable, LCD-SLA 3D Printer at CES. Released via Kickstarter, it is a desktop printer that stands out by its speed and details. Indeed, SLASH is capable of reaching printing speeds of 1000 cc/hr while maintaining incredible details, with resolutions on the Y and X axis as fine as 2560 x 1600, 339 ppi and 75 μ m utilizing ultra-fast LCD Stereolithography (SLA light-curing) technology. When it was released to the public via Kickstarter, they achieved more than 10 times their funding goal and raised over USD \$500,000 dollars in a month.

3 desktop 3D printers and 2 new industrial 3D printers

Once again, the manufacturer chose the Las Vegas event to debut the new suite of products, which includes the new UDP printing technology and the five incredible new printers: SLASH+, SLASH OL, SLASH PRO, zSLTV15 and zSLTV23.

SLASH+

As a follow up to the first 3D printer, the SLASH+ LCD SLA 3D printer is an upgraded version for prosumers, hobbyists, educators and artists. The "plus" model is equipped with uni-directional peel (UDP) technology, which minimizes the peel time of conventional layered SLA process, and achieving an astonishing printing speed of 360mm/hr in z-axis build speed (8300cc/hr build envelope speed), for example, 6 full-arch dental models can be printed in less than 5 minutes. This new technology is challenging conventional injection molding in production speed, and this approach to 3D printing makes it easier and faster than ever for professionals and enthusiasts to dream, design and create.

SLASH OL

Consumers who are looking for a more affordable technology can rely on the SLASH Online (OL) 3D printer. Its XY resolution is software limited to 150 μ m. Also equipped with the same UDP technology, this 3D printer is the ideal solution for consumers in the sub \$1000 FDM market, who are not satisfied with the FDM's printing quality, slow speed, and low reliability. The UDP's 8300cc/hr build envelope speed is 500x faster

than any FDM printer, which is a real game-changer in the market.

SLASH PRO

This is the PRO version of SLASH which has doubled z-axis build envelope, with the newly equipped UDP technology, this printer is capable of outputting a full size adult outer-sole in less than 60 mins. This 3D printer is recommended to professionals who needed the extended build envelope in a desktop setup.

SLTV15

This is one of the two 3D printers intended for professionals and industry applications. The SLTV15 uses the same revolutionary LCD photo curing 3D process as the SLASH and is equipped with UDP. This system has 89 μ m XY resolution, 3x build area (330x190mm XY), 8x the build envelope (410mm Z) compared to SLASH, and a blistering fast printing speed of up to 2,800 cc/hr solid output speed and 24000cc/hr build envelope speed. For example, 20 full-arch dental models can be printed in less than 5 mins.

SLTV23

The big brother of SLTV15, equipped with 147 μ m XY resolution, 7x build area (521x293mm XY), 25x build envelope (650mm Z) compared to SLASH. With UDP, this printer is capable of handling a much larger build volume and higher speed than any other 3D printers. The SLTV23 model further increases printing speed up to 7,000 cc/hr solid and 56000cc/hr envelope speed, making it a fast SLA 3D printer.

UDP Technology

UNIZ uses proprietary technology to achieve industrial level quality and lightning-fast speeds for prototyping, tooling, manufacturing and more. Their advanced systems deliver results that rival other printers costing hundreds of thousands of dollars more. This performance will offer great benefits to companies looking to accelerate design, R&D, manufacturing and production.

The suite of UNIZ 3D printer solutions sets new benchmarks for speed, quality and price for consumers and professionals alike.



A 3D PRINTER AND A 3D SCANNER **MARK KODAK'S** arrival in the 3D printing industry



Kodak is among the technology companies that recently joined the 3D printing market. The specialist of photography signed a commercial agreement with Smart International and Twindom to ensure the introduction in appropriate and required conditions of its 3D printer and 3D scanner on the market.

Smart International, an agreement which expands Kodak's brand licensing program to the dynamic 3D printing space.

"Professional 3D printing is a fast-evolving growth category Kodak has had its eye on for a while. We are happy to add a strong and innovative licensee like Smart International to our portfolio of brand licensees," said **Joel Satin**, VP Director of Brand Licensing.

Smart International has developed an ecosystem of solutions for professional 3D printing. The agreement signed with the supplier of solutions in the field of technology enables Kodak to introduce KODAK Portrait 3D Printer, a dual extrusion desktop machine designed for professional and educational markets.



The 3D Printer features beautiful designs that will fit in the most exacting architectural studio, creative workspace or classroom. Furthermore, KODAK 3D Printing Filament has industry-leading low moisture content, high melt flow index and precise diameter and roundness for quality prints.

"We are excited to take the Kodak brand into 3D printing and pioneer a best in class series of desktop printers and materials designed specifically for creative professionals," said Roberto Gawianski, CEO, Smart International.

A look at the technical features

In order to recall its business core, Kodak named the machine the Portrait. The 3D printer incorporates a fully-enclosed steel frame, 200 x 200 x 250 mm build platform, LED indicators, filament sensors, touch screen and on-board camera.

As for the materials, Kodak offers ABS, PLA, Nylon 6, Nylon 12, HIPS, PLA+ and PLA. However, according to the company, the 3D printer could be used with any other filament available on the market.

THE KODAK FULL BODY 3D SCANNER



The Eastman Kodak Company and its brand licensee, Twindom, unveiled the KODAK Full Body 3D Scanner, a simple, powerful and mobile solution designed for the 3D printed figurine market.

Twindom's hybrid 3D scanning technology is capable to produce high resolution 3D scans that in turn are made into 3D printed figurines on a full color 3D printer. A cloud service makes it easy to manage by automatically processing the 3D scans from the KODAK Full Body 3D Scanner and routing them to a full color 3D printing facility.

Each 3D printed figurine is shipped to a customer's home address 1-2 weeks after being ordered. The KODAK Full Body 3D Scanner is well suited to be set up in a variety of locations, including at events with heavy foot traffic.

«We're delighted to be working with Kodak to bring 3D body scanning and 3D printing to customers everywhere,» said Will Drevno, co-founder of Twindom.

«The 3D market is a dynamic and growing category,» said **Joel Satin**, VP Brand Licensing, Kodak. *«3D scanning and 3D figurines are important sectors to us. The KODAK Full Body 3D Scanner's ease of operation, mobility and competitive pricing positions it as an incredibly exciting and fun application for both professional and consumer applications.»*

NXV, Nexa3D' first professional 3D printer

Co-founded by **Avi Reichental**, Ex-CEO of 3D Systems, Nexa3D is the maker of Stereolithography professional-grade 3D printers. NXV, the first professional 3D printer of the company has been showcased at CES 2018 among other leading technologies.

The NXV is capable of printing 30-micron XY resolutions. It is a large, fast and accurate 3D printer in its category. The NXV is ideal for functional prototyping, production tooling and manufacturing of end-use parts. The machine integrates both cognitive software and integrated sensors that optimize manufacturing part performance, provide detailed diagnostics and offer continuous monitoring.

Based on deep machine learning algorithms, the printer is designed to optimize and adaptively compile complex geometries at uniform speed and high-resolution. The NXV can function using both on-board and cloud controls for in-situ and remote operations of a single printer, or a full factory of printers to enable mass production of customized parts.

"3D printing is an unstoppable force of change in every industry and within it, high-speed 3D printing is the next frontier in additive manufacturing and one that is highly valued by end-users, strategic partners, resellers and investors alike," said Nexa3D co-founder and executive chairman Avi Reichental.

Last, the company explained that its printers are powered by its proprietary *"Lubricant Sublayer Photocuring (LSPc) technology and a patented structured light matrix capable of reaching top speeds of 1 cm per minute, which can drastically cut down 3D printing cycles, from hours to minutes."*



On its way to develop its 3D printers' market in digital dentistry

As part of the leading event CES, the maker signed a partnership with BEGO, provider of digital and traditional dental materials and XYZprinting, the manufacturer of desktop 3D printers. The partnership aims at transforming digital dentistry.

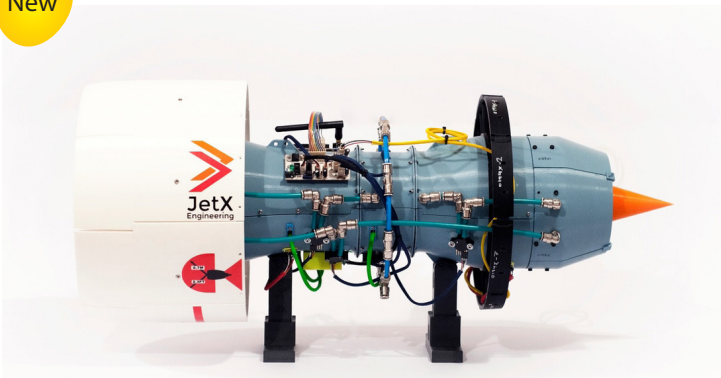
Under the agreement, BEGO will exclusively market and sell, under its own label, a special purpose high-speed Nexa3D dental printer that will be solely manufactured by XYZprinting. Nexa3D will exclusively develop the required technology and products for the partnership.



Crea

3D printing Industry

New



X-plorer, the reactor with over 515 3D printed parts

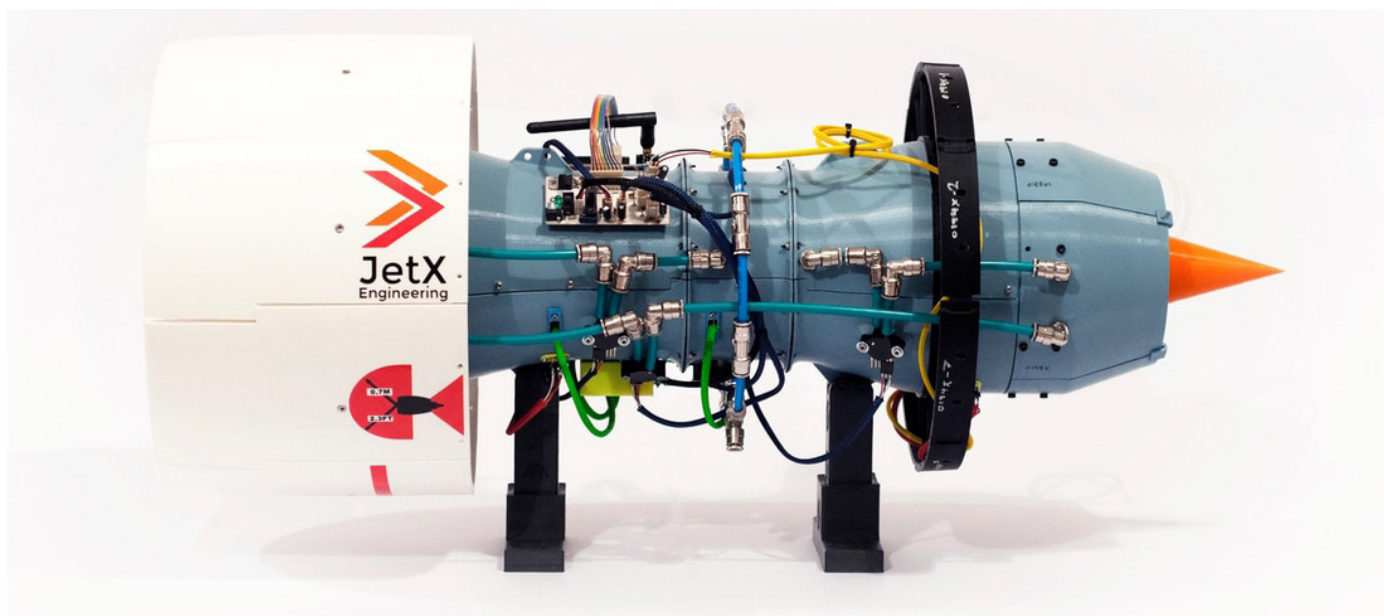
New



VESPER, Neri Oxman's series of 3D printed death mask



How 3D technology enabled to capture Chinese traditional culture



X-plorer, the reactor with over 515 3D printed parts

The X-Plorer 1 is the first jet engine model of its kind to feature an integrated monitoring system, providing crucial, real-time data on performance.

X-plorer is the result of a project developed by JetX, a team of aerospace engineering students from the University of Glasgow whose goal is to revolutionize aerospace education. This year, the X-plorer 1 has been developed in collaboration with Rolls Royce which helped with the technical side of the project.

The aim of the team of engineering students was to create a very functional 3D printed jet engine model that would provide instant design feedback on the one hand, on the other hand, enable engineering students to be immersed in practical aspects of their training.

Prototyping began in October 2016, following the completion of the testing phase which brought 150 parts from design to reality. 3D printing was required for all the necessary parts which took an estimated 1800 printing hours and almost 3km of filament!

to be defined by the team. The team of engineering students used a high-bypass turbofan, the bypass ratio of 5.0:1 precisely. The team explains that it was an advisory limitation for the maximum core diameter and was to facilitate practical manufacturing given the building capacity of their 3D printer. However, the design team could exceed that if necessary.

They constructed a theoretical model for the compressor, turbine and exhaust sections. Often these models assumed combustion taking place, later attempting to exclude this effect to predict the behaviour of the prototype. Some of the specifications of the X-Plorer 1 are:

- Axial flow turbofan
- 5.0:1 bypass ratio
- Double-spool
- 26.15cm fan diameter
- 72cm total length
- 3 LPC stages, 5 HPC stages

Solidworks was used for all 3D models and to construct the visual assemblies.

Electronics

The design of the electronics system and the core design were done simultaneously since it was essential that it fitted and worked around the rest of the machine. Furthermore, it was simpler to do both at the same time because of the modifications that needed to be done on other parts to accommodate electronics.

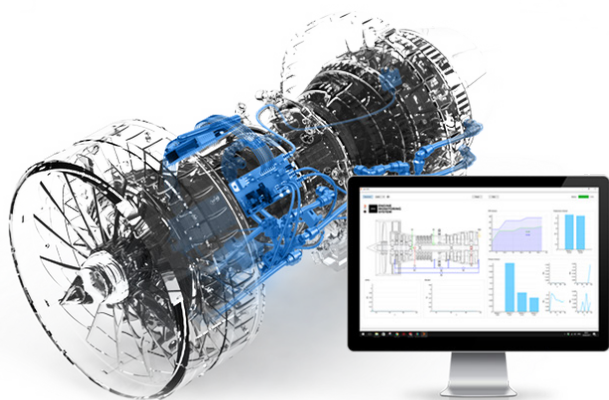


Design

This part combined intensive theoretical and modelling work. The engine's thrust is one of the first elements

The students thus developed the whole Engine Monitoring System (EMS): from the design of the traces for the Printed Circuit Boards (PCBs) to the software and user interface. The EMS consists of:

- 2 mbed micro-controllers
- Wireless (RF) transceivers
- 3 PCBs on the engine
- 2 IR temperature sensors
- 4 differential pressure sensors
- 2 LED rotational speed sensors
- 1 vibration sensor
- 1 airspeed sensor



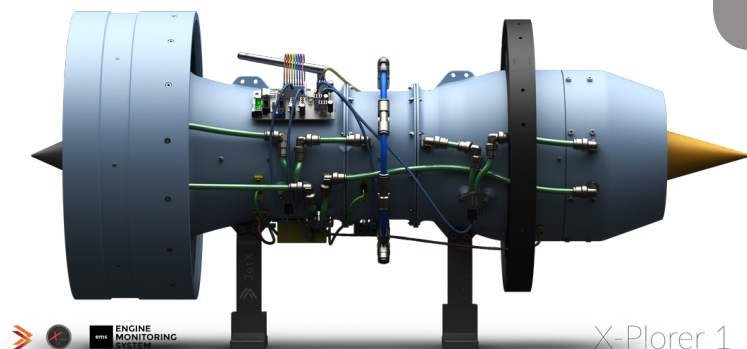
Analysis

In order to optimize the design, the students first performed computational analysis to find out how the flow changes throughout the engine, as well as the impact that specific forces and loading conditions have on the parts. When several designs are available for one part, CFD analyses are performed with tools that include Solidworks Flow Simulation, ANSYS Fluent & Star CCM+ on single stators, rotors or multi-stage segments to assess which one performs the best.

FEA (Finite Element Analysis) were to discover high stress concentrations and assess whether failure is

likely under different loading conditions. Centrifugal forces are also important on a model of this size and failure scenarios are also modelled to assess if an impact would be contained.

“Our team is working to develop more advanced models that are able to simulate the complex behaviour of additively-manufactured parts”, said the students.



X-Plorer 1

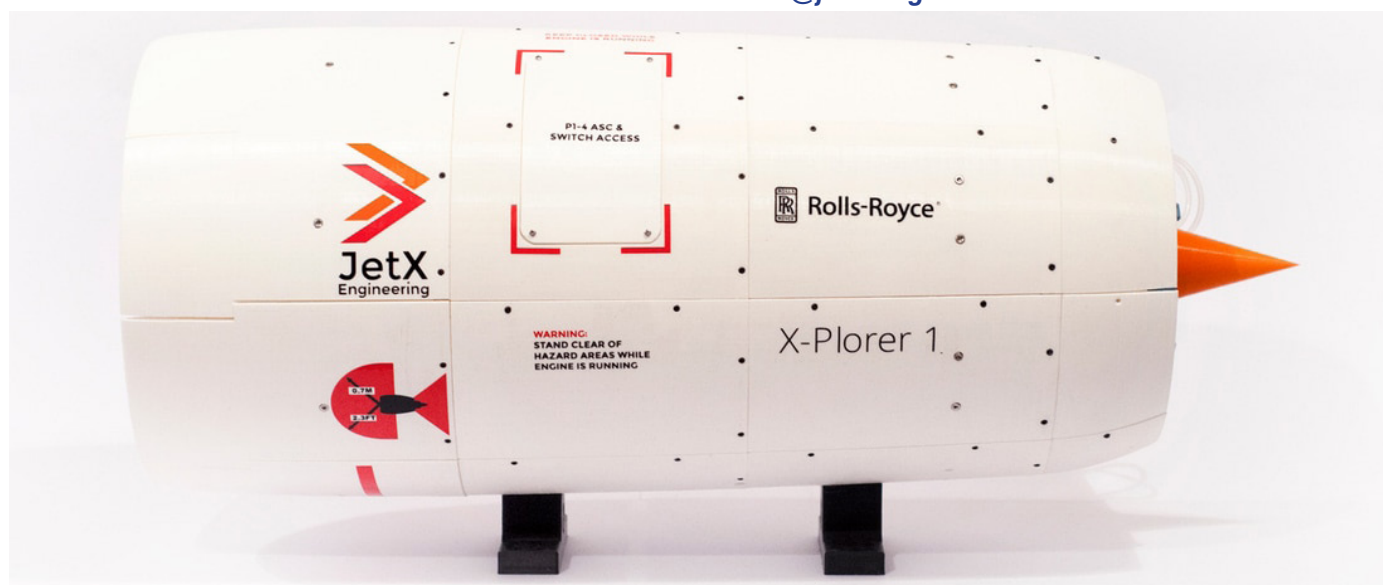
3D Printing

As far as 3D printing is concerned, they used a DreamMaker OverLord Pro, often at full capacity. PLA, ABS, nylon, PETG and more were the materials used for tests. FFF was the only 3D printing technology used for the X-Plorer 1 and throughout the testing phase, they tried to optimise the process for the printer and plastic used to achieve a major increase in success rates.

“The shorted print lasted for just 7 minutes, prototyping both brackets for securing the temperature sensors in their position. The main part of the PCU casing took 58 hours and 30 minutes non-stop to complete, consuming 105m of filament in the making. Loose tolerances can be a major issue in engineering assemblies, which is why testing and altering the design for the process is essential.”

Already a step ahead, the X-Plorer 2 will bring a better, bigger and more efficient engine to life.

For further information, contact JetX Engineering, info@jet-x.org



VESPER, NERI OXMAN'S SERIES OF 3D PRINTED DEATH MASK



"Vespers is the most sophisticated expression of our design approach so far, demonstrating that we can seamlessly vary the physical properties of materials in extremely high resolution that matches, and ultimately transcends, the scales of nature."

Neri Oxman has collaborated with Stratasys to design and 3D printed a series of death masks showcased at the National Gallery of Victoria in Melbourne, Australia. The museum hosts the 'NGV Triennial 2017' exhibition until 15 April 2018 – where the death masks will premiere.

The NGV Triennial celebrates contemporary art and design practices, highlighting the work of over 100 artists and designers from 32 countries. These works present the art of creators such as from **Yayoi Kusama, Xu Zhen, Guo Pei, Ron Mueck** and **Iris van Herpen**.

Selected for their diversity and dynamism of practice, these authors **embraced technologies, from 3D printing to robotics**. Highlighting some of the pressing issues being explored by artists and designers today, visitors will have an opportunity to contemplate the social, cultural, scientific and physiological questions of our contemporary world.

VESPERS

"For a Triennial that sets out to explore the interface between art, design, architecture, science, ecology and technology – Neri Oxman's work could not be more fitting," comments **Ewan McEoin**, Senior Curator of Contemporary Design and Architecture at the National Gallery of Victoria.

For the Senior Curator, the 15 complex objects combine

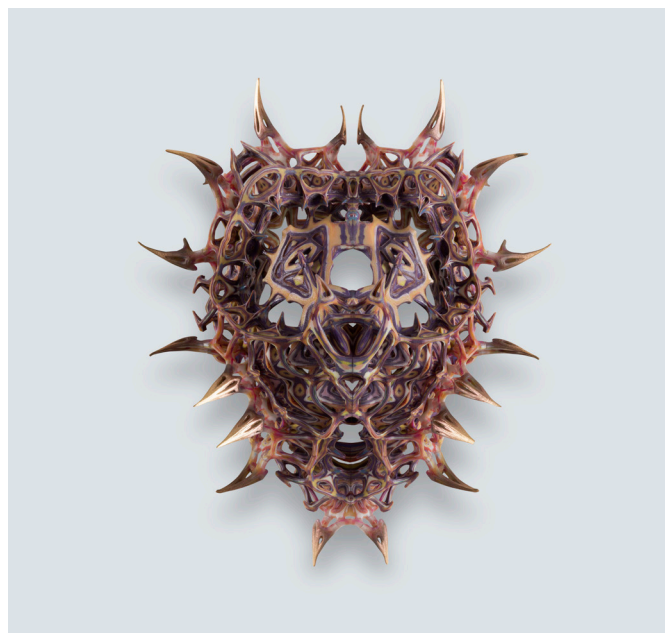
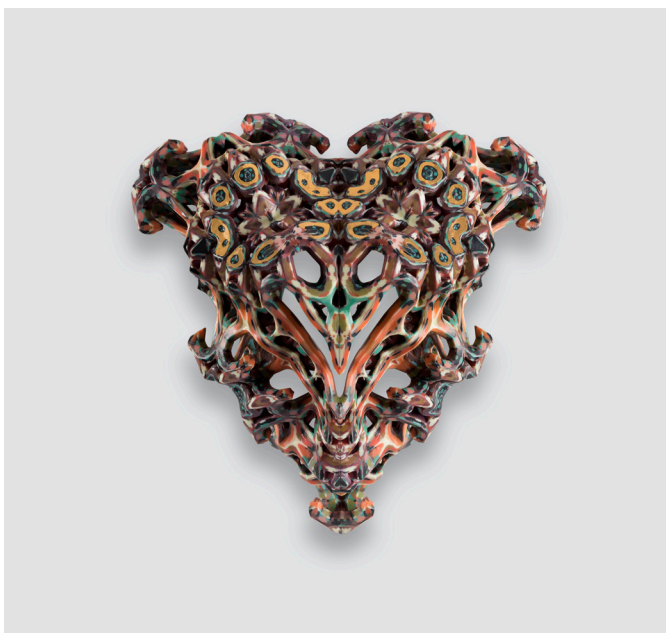
a conversation about past, present and future, delving into a psychological and cultural relationship to death and adornment, while speculating on the capacity of 3D printing to create, at a cellular level, new materials, medicines, and technologies that draw from nature and in-depth design research.

In other terms, VESPERS would lay emphasis on the themes of ancient traditions and future technologies and, bring out the preservation of both cultural and biological life. Furthermore, with what it portrays and the way it has been manufactured, the collection is now part of Stratasys' **The New Ancient**, a 3D printed art and design collection.

Vespers balances the dichotomy between the tribal crafted indigenous qualities with the bio technological advancement.

The manufacturing

One of the primary sub-series of the Vespers collection, entitled 'Past', looks at historic origins, exploring life through the lens of death. Inspired by ancient masks, this sub-series makes use of five material combinations to emulate colors commonly found in cultural artefacts across regions and eras, with impressive accuracy. By using Stratasys' J750 full-color and transparent multi-material 3D printing technology, Oxman's team



created 3D printed objects that, for a premiere, precisely represent the variety and nuance of ancient crafts.

"Vespers' designs are entirely data-driven, digitally-generated, 3D printed, and – at times – biologically augmented," Oxman explains. "By pushing the boundaries of cusp technologies – such as high-resolution material modelling, Stratasys' full color multi-material 3D printing, and synthetic biology – they express the death mask's deeper meanings and possible future use, thus bringing it back to life."

The combination of molecular biology, ecological engineering, design computation and 3D printing makes it difficult to determine or truly evaluate the limits between human and machine or between natural and designed environments. Such combination is so blatant that distinctions can no longer be made. That's why Oxman explains: *"Vespers is the most sophisticated*

expression of our design approach so far, demonstrating that we can seamlessly vary the physical properties of materials in extremely high resolution that matches, and ultimately transcends, the scales of nature."

Naomi Kaempfer, Creative Director of Art, Design and Fashion at Stratasys said it is not often usual to contemplate the topic of life and death from within the discipline and perspective of industrial design. With Vespers, *"a subtle poetic and sustainable hunger has risen to slow us down for just a moment, to gaze deeply into the particles that compose the antique wisdom and emotion of our human heritage, enabling us to cherish and bridge this universal truth."*

To see Vespers, visit the NGV Triennial exhibition in the NGV International building at The National Gallery of Victoria in Melbourne, Australia, running from 15 December 2017 to 15 April 2018.





How 3D technology is used to capture Chinese traditional culture

3D printing technology helps to teach, tell a story or represent a work of art through models, replicas and miniatures. A team of students led by **Professor Nan Yu** at Guangzhou Academy of Fine arts applied 3D scanning and 3D printing technologies to their artwork creation. They reproduced the scene of appointing **Tso Tsung-Tang**, one of the four prominent ministers in the late Qing Dynasty, to be the principal of Lujiang Academy.

The miniature scene

The scene represents miniatures of 10 centimeters that are finely sculptured and appeared lively.

Design

Professor Nan Yu divided the miniature scene into five parts. It must be said that, according to the tradition, the appointment of a principal by an academy at that time in China involved five stages. In this particular case: (photo des 5 étapes)

□ The chief of Lujiang Academy asked the magistrate to deliver the letter of appointment, so that the appointment ceremony could be prepared.

□ Tso Tsung-Tang joined the banquet (the next spring at the academy), accompanied by the magistrate, the

two instructors, the disciplinarian and the chief.

□ Students welcomed both Confucius and the new principal.

□ After school had started, the new principal, the magistrate, and both instructors were invited for a drink by the chief of the academy.

□ Tso Tsung-Tang was invited, a few days later, to the Xingxian Hall for a banquet

3D Scanning

Technically speaking, once the team members wore the costumes, they collected 3D data by 3D scanning using the 3D scanner EinScan-Pro from SHINING 3D.

3D Models

Secondly, with the 3D data, they used data modeling to create the background scenes.

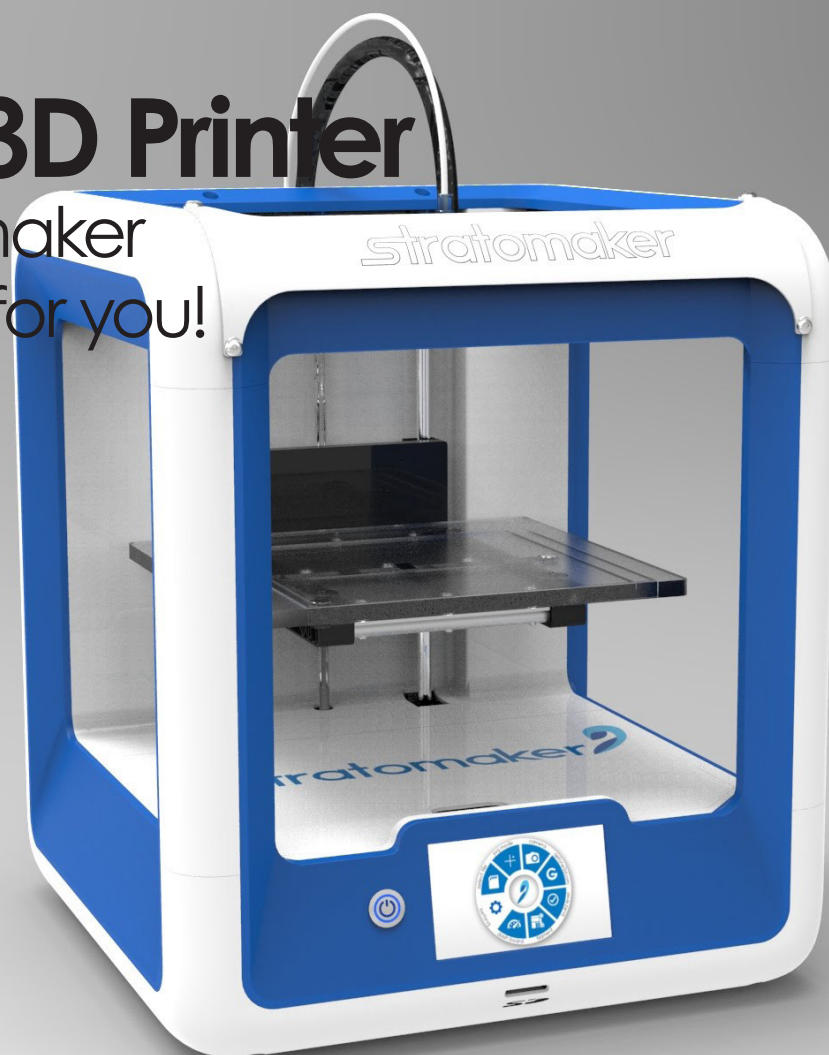
3D printing & coloring

Thereafter, characters were 3D printed out with SLA technology and the art piece was colored.



The 3D Printer

Stratomaker
Tested for you!



As part of its series of tests, the engineering department of 3D Adept carried out the test of the Stratomaker 3D printer of the French manufacturer Obro.

It is a 3D printer that integrates the Fused Deposition Modeling (FDM) additive manufacturing technology and offers advanced features for both professionals and 3D printing amateurs. Its printing dimensions are 225x205x220 mm.

Without further ado, 3D Adept's opinion ...

Unpacking

It must be said that this 3D printer associated with its packaging and its accessories has a total weight of 18 Kg. Furthermore, the layout of the different components in the box enables the user to bring out the machine without the need for assistance.

Content of the packaging

The packaging included a range of tools required for operations before and after printing: a cleaning brush, two PLA bobbins, a power cable, adjusting wrenches and a user guide.

The 3D printer itself consists of a removable tray, an intuitive touch screen of 5 inches with color display that enables to easily manage the settings and the printing on the one hand; on the other hand, a Wi-fi connection and an SD card reader for file transfer as well as an Ethernet port for a possible networking. The 3D printer also integrates a camera for real-time monitoring of the printing process from an Android or iOS computer or smartphone and an extruder with a 0.4mm nozzle.



Installation

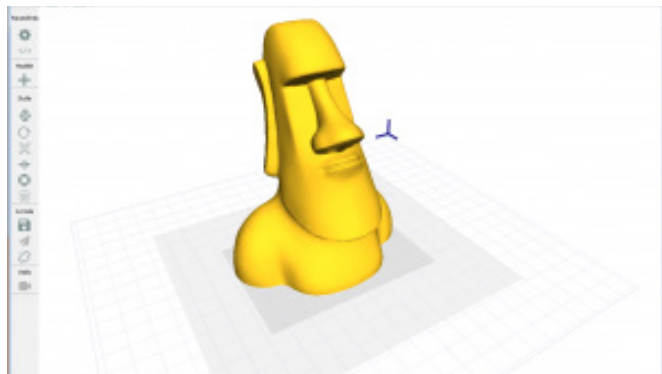
Fifteen minutes after unpacking, we started the first 3D printing. It should be noted that the printer was completely assembled when we received it. In addition, the user guide provides further details about the settings and images describing the functioning of the machine. Furthermore, features such as automatic calibration enable the user to save time and to have a rapid control of the machine.



Software

The Stratomaker printer works with StratoSoftware, an easy-to-use and intuitive software. It can be downloaded for free from the manufacturer's website. The software allows the user to edit the 3D models and transfer the print file from the computer to the 3D printer using a Wi-Fi connection. The file transfer can be also done using the SD card provided with the accessories. However, once the 3D model is edited, it is converted to the "g.code" file format (it is the file format recognized by this printer).

Apart from the StratoSoftware, the user can use the mobile application Stratomobile (Android or iOS). Just as software, it enables the user to remotely control the printing.



Printing

The touch screen of 5 inches facilitates navigation through the menus of the interface. It is therefore possible to adjust settings and presets before printing (preheating, calibration, verification, etc.).

Once the machine was ready and calibrated, we

introduced our 3D model in the software in order to edit it and convert it to the print format compatible with the printer.

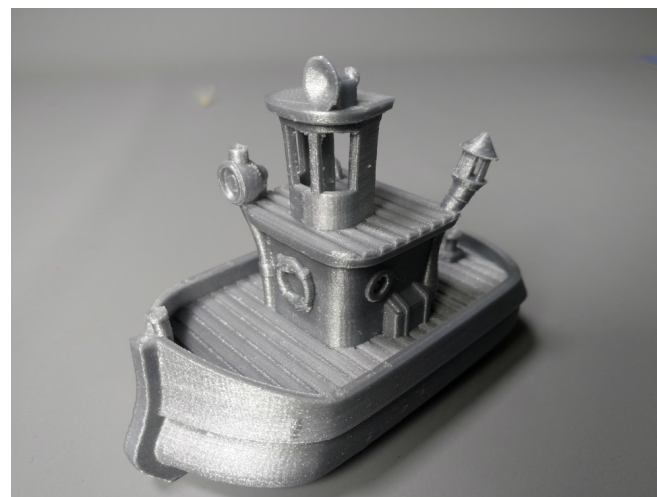


In order to facilitate the removal of objects after printing, the manufacturer recommends the use of a glue on the tray.

The automated 3D printer manages the upgrade of the removable tray at each launch, ensuring accurate and consistent work. The print file being selected, the expected printing time is displayed on the touch screen of the machine.

Once the printing process has started, an LED light whose color changes according to the steps of the printing is activated, thereby making the printing process more lively to the printing process.

As far as the sound is concerned, the Stratomaker 3D printer is less noisy than other printers of the same category and fits well in a workspace. As for the vast majority of printers using this manufacturing system, we recommend its use in a space dedicated to manufacturing, in order to keep people away from odours resulting from filament fusion.



Printed objects

A review of the first printed objects gives an overview of the print quality of this machine. The following images illustrate the print quality of the printer:



Using the kit supplied in the accessories, we cleaned both the external and internal parts of the nozzle after printing. As far as compatibility is concerned, this printer is compatible with PLA filaments (1.75 mm of diameter). An automatic charging and discharging device is integrated in the printer. The use of filaments from third-party companies also offers a range of possibilities for the printing.

The last word

In the end, we believe that the Stratomaker machine is a quality 3D printer, based on a simple, automated and intuitive use. Its design, its robust and rigid construction are its first main highlights.

We highly appreciated the ease of use of the machine due to the automation of certain operations. Thanks to the touch screen of the machine, it is possible to easily manage settings and presets.

However, some points still need to be improved. Despite the automatic charging and discharging device, it is not very easy to insert the filament in its tube. Since we encountered some difficulties regarding these operations, we believe some improvements still need to be made in this regard.

Despite these difficulties, the test of this printer remains positive. The quality of the printed objects speaks for itself. In our opinion, the beginner who is looking for a 3D printer to begin his 3D printing journey or the expert who is looking for a machine to quickly prototype his technical parts (PLA) will not be disappointed. Thanks to its large print volume, this 3D printer distinguishes itself from other machines in the same range.

Summary

Strengths

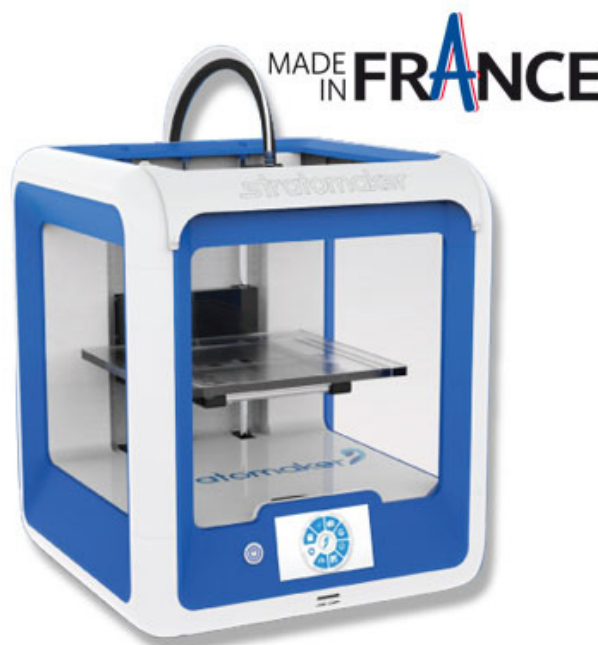
- Ease of use
- Print quality
- Compatibility with third-party companies' Filaments
- Automatic Calibration
- Printing supports : Stratomobile (mobile) et StratoSoftware (PC)
- Control camera
- Automatic charging and discharging device

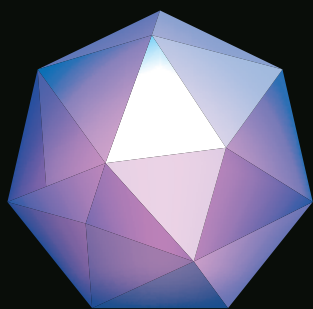
Areas for Improvement

- Filament difficult to introduce in its tube

Last, all things considered (ease of use, accessories, print quality, speed, software and applications), if we should give an overall grade for this printer, it would be **8/10**.

Makers or professionals who are looking for performance could definitely be interested.





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