MANUFACTURING
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3D ADEPT MAG

NEWS

INNOVATIONS
CASE STUDY
CREA

DOSSIER & TEST

Interview

Demian Gawianski,
CEO of Smart International (SI)

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Editorial

"Is there anything more valuable to man than Health?" Socrate.

When one is in «good health», it is often difficult to realize how much health is a treasure that we must preserve as long as we are alive. When one is deprived of it, one has the feeling of being completely deprived of freedom.

Writing about 3D printing, we increasingly become aware of the difficulties that men may face when it comes to their physical well-being. However, we are even more delighted to see how the medical profession remedies these difficulties.

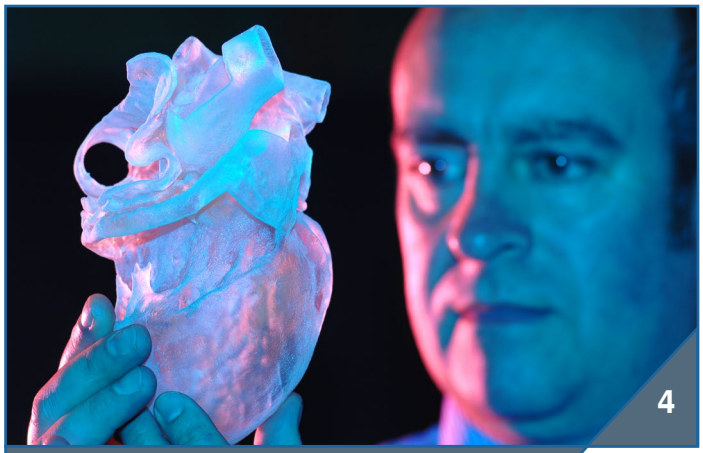
This month, this issue offers an overview of 3D printing in the medical sector, a theme that has been enriched through the experiences of some specialists that we thank: Thank you!

But not only...

The past two months have also been marked by trade fairs, partnerships, launches of new products and services. Some partnerships were unexpected, some launches were quite necessary and it's not over yet ...

We also thought of happier moments, of sunny days. For those who are preparing for the sunny days, who do not always know what to wear during parties or themed evenings, we offer a selection of articles that can inspire your creativity.

So, discover, judge...and use 3D printing!



Aperçu

3D PRINTING IN THE MEDICAL SECTOR

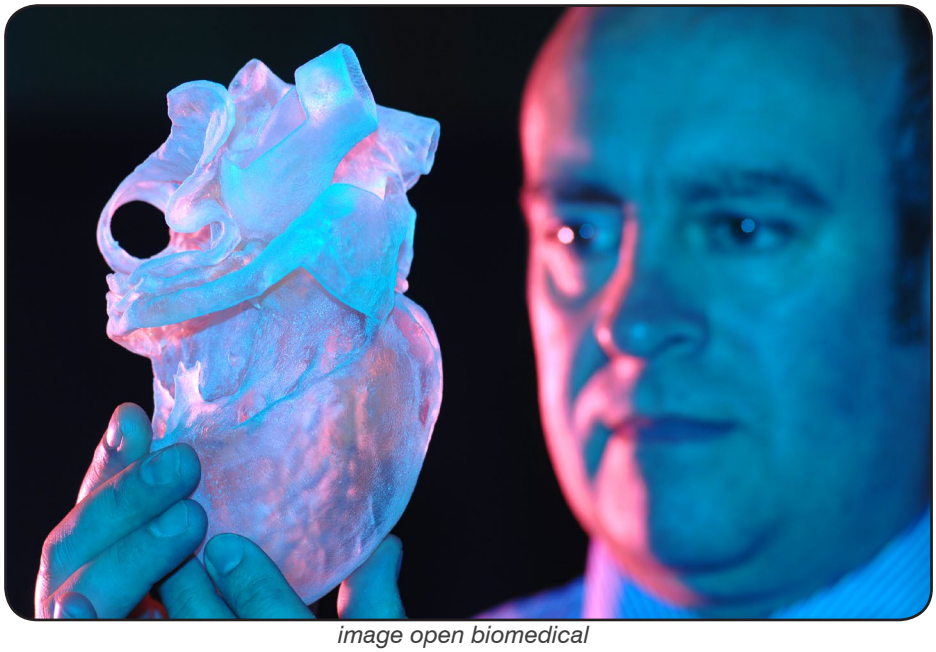


image open biomedical

In a domain where innovation saves lives, additive manufacturing is now positioned as a major asset for healthcare professionals. Although it still has a few years before it is adopted by the majority, the first results allowing to create tissues, bones or custom-made prostheses, are sufficient to consider the enormous potential for the public.

To date, the main areas of application that make the most of this technology are: dentistry, orthopedics, medical training, medical research, preparation of surgical procedures, prototyping of medical tools and equipment intended for surgeons, and the design of customized medical equipment.

This paper aims to analyze the contribution of additive manufacturing technology in the medical sector. It will present the integration of this technology in various fields of application in the medical industry, its advantages, but also its limits or points to be improved.

It should be noted that, as part of this dossier, some industry professionals shared their understandings on the subject, as well as their experience with this technology: Dr. Simon Weidert, specialist in orthopedic traumatology, Daniel Crawford CEO of Axial3D and Alexandre Baelde, head of the 3D Print program at Medicrea.

Personalized care and customized prosthesis

Surgery is currently the main field of application for 3D printing health wise. This manufacturing process makes it possible to create customized prostheses that are perfectly adapted to each patient or even implants in biocompatible but durable materials (titanium, plastic).

Until now, the ***«made-to-measure»*** consisted of modeling a prosthesis by hand, 3D medical imaging combined with a 3D printer makes it possible to create an exact replica of the bone to be replaced. It is mainly the use of a 3D scanner that allows to digitally evaluate the need of the patient, allowing to create a prosthesis perfectly adapted to its morphology.

MEDICREA

Alexandre Baelde's point of view, Head of the 3D Print program at Medicrea

Medicrea is a French company specialized in the design and production of medical devices for spinal cord surgery. At the end of 2014, the company integrated 3D printing technology with the goal of producing customized implants. With additive manufacturing, the company produced custom-made and standard implants.

Alexandre Baelde explains that their "implants allow to quickly create the fusion between the vertebrae. The idea is to have easy surface properties of resistance by bone while properly integrating the mechanical properties". Medicrea manufactures metal powder (titanium) using SLM machines, with the laser deposition technique.

Speaking of the two types of implants made with 3D printing, **Alexandre Baelde** explains: *«For custom-made implants, technology makes it possible to make highly adapted implants. These are the most complex implants, having something modified facilitates the operation. Implants adapt better to structures because they provide a solution that does not exist and produce an ideal post-operative result.*

As for standard implants, it is important to understand that the product offering is based on customization and planning. We have doctors working on algorithms for customization. For planning, however, the surgeon has the

choice to adapt it to his/her needs, to the pathology he/she wants to treat.»

Regarding its range of standard implants, Medicrea offers the possibility to add anchoring options: textures with specific properties

Dr. Simon Weidert's perspective on the cost of prosthesis and production time

Dr. Simon Weidert is a specialist in orthopedic traumatology and works at the University of Munich. He has also founded three companies that have different activities in the medical industry. 3D printing in the medical sector is at the heart of his research.

Dr. Weidert compares the cost and time of conventional orthosis manufacturing with additive manufacturing. Speaking of additive manufacturing, he emphasizes the importance of having good software and knowing how to use it: *"If you have to design an orthosis for 30 hours, nobody will pay for it. But with a 3D printer, the model adapts perfectly to the body, to your pain and its fabrication is fast. As a matter of fact, only the software combined with the 3D printer can give you the freedom to design parts and analysis in the frame structure, perfectly adapted to your needs."*

Dr. Simon Weidert
specialist in orthopedic traumatology

Dr. Weidert mentions his activity at **Mercuris**, a company specializing in personalized prostheses as an example:

"There are kids being born without a foot. They can lose a foot in an accident. They do not know how to run because the 3D printed prosthetic available on the market does not allow that. It is really bad because no company wants to invest in that.

"So, we, at Mercuris, created a 3D printed prosthetic to enable those children to walk and continue their activities. It may change the life of a person and increase the confidence of a person. This is the biggest advantage of 3D printing. A product which is tailor-made to them. It's all about turning a parametric product into a unique one."

Dental Industry

In 2017, 3D printing became widespread in the dental industry. As the additive industry continues to fully transform and delve into manufacturing applications, the growth path of most existing polymer printing technologies has somewhat declined in historical terms. This has allowed well-established, high-value applications in the health care field to shine and attract the attention of industry stakeholders.

Dentists are increasingly taking advantage of digital workflows and manufacturing processes, having recognized long ago that digital dentistry is the future of the industry. Indeed, 3D printing is well positioned to becoming the first digital process in global dental manufacturing with its flexibility in the efficient and accurate production of everything from dental models to orthodontic aligners, dental prostheses and many others.

3D printer manufacturers are developing and bringing to the market more and more innovative machines, enabling better dental treatment by bringing the creation of personalized devices closer to the point of service - in the dentist's office. These include **EnvisionTec, DWS, Formlabs, Shining 3D**, whose machines are the mostly used by dental professionals.

Prototyping of medical tools and equipment

Whether it be for the manufacturing of prototypes of medical equipment, or molds for the production of

mass prostheses, conventional manufacturing methods generally require tools that have an impact on production time and costs. These two factors increase with the complexity of the design (shapes and dimensions).

The efficiency and flexibility of 3D printing technologies complements conventional manufacturing, allowing medical device manufacturers to push the boundaries of innovation, to realize more design and tooling revisions in a short amount of time, while reducing costs, simplifying operations and speeding up delays of commercialization.

For those who do not always have the means to pay for such a service, non-profit organizations such as **Open BioMedical Initiative (OBM)** enable to remedy this situation. Indeed, OBM aims to support the Biomedical field and *"focuses to collaboratively design, develop and distribute open source, low cost and 3D printable Health and Accessibility Supports."* The idea is not to replace the existing structures on the market but to be able to work with them and improve the medical industry.

Dr. Simon Weidert's point of view

Since some professionals do not always have the time or the skills to do this, Dr. Weidert and his team of Medability aim to facilitate the work of doctors. They prepare 3D technologies and equipment needed to help doctors.

At M3I, another company he is involved in, the team notably has the opportunity to customize the doctors' software according to their needs.

Surgical Guides

3D printing combined with medical imaging can be invaluable in that it provides surgeons with the exact copy of the organ to operate on. This gives the medical profession the possibility to visualize the parts of the body in advance to prepare the operations or train teams.

Daniel Crawford's, CEO of **Axial3D**, point of view on surgical guides

Axial3D is a company specialized in medical 3D printing applications. Daniel Crawford explains that Axial3D helps to pre-plan an operation by preparing any equipment that a surgeon will need before going to surgery. This saves time in surgery and therefore improves patient care, i.e., bleeding or risk of infection.

axial3D
Patient data made real

For Daniel Crawford, improving patient care begins with improving the work of a surgeon:

" - First and foremost, improving the pre- planning of the patient's surgery. So, for the orthopedics, if you have a bad trauma injury, the surgeon can actually take existing plates and screws from shelves and pre-band them. Everything that we prepare is 1:1 (1 to 1) scale.

- They are working on the exact anatomy that they are going to be operating on so this in turn reduces the amount of time the patient is under the knife, which then reduces the quantity of the bleeding and chance of infection of the patient.

- It also improves the way a lot of surgeons can be trained. So, registered surgeons who are typically operating on patients or are developing their skills base only get to do these types of operations in the theatre but if we give them the opportunity to actually dry-run the procedures before they go in and operate, it improves the patients care greatly."

Example of a patient case:

To illustrate this, Daniel Crawford tells the story of an 8-year-old boy patient at the Royal Victoria Hospital in Belfast. He was introduced to a surgeon due to his inability to move his arm and this affected his ability to write, play sports and carry out his daily activities. Traditionally, in order to treat this, it would have been necessary to remove bones (the radius and the ulna) … before undertaking other procedures that would have taken 3 to 4 hours.

However, once the CT scans were taken and the 3D printed models were prepared for the surgeon, the doctors could see that it was not the deformity that was causing the problem, but a soft tissue deformity that was causing the problem. A necessary execution of «keyhole surgery» took place– **a surgery, which would have lasted about 4 hours, took doctors 30 minutes to complete.**

Daniel Crawford, CEO d'axial3D

"There was less bleeding, less chance of infection and I also heard that the patient was able to leave the hospital on the same day which wouldn't have been possible without the use of the 3D printed model," **Daniel Crawford** confirms.

Clinical training

Without clinically relevant models, physicians and students are deprived of the benefits of hands-on experience. The training is longer and requires hours of learning before they can acquire the skills and knowledge needed to perform quality clinical work. 3D multi-material printing allows for the creation of

accurate, versatile models at a reduced cost, thus facilitating the work of the medical profession.

Some medical companies are specialized in these trainings. Dr. Simon Weidert explains that at Medability, 3D printing technologies are used to allow surgeons to better prepare themselves before entering the operating room. «We provide quality training everywhere and provide rapid skills acquisition. (Simulator - training - operation), «says the doctor.

Hybrid trainer : enables to achieve highly realistic imaging simulation – adapted for artificial bone and skin for lifelike haptics

In addition, other 3D printing specialists, such as Stratasys, offer templates that include all the features needed to convey key concepts, including the most subtle visual and tactile details.

Advantages & Limits

Based on our research and the opinions of the professionals who participated in this dossier, we note the advantages and limitations regarding the use of 3D printing in the medical sector:

Advantages
3D printing enables doctors to save time by preparing what will happen in the theatre room
Big asset in fostering medical researches
Training and time saving in the preparation of surgeons
Customization of medical care
At the production level series: the freedom of form, possibility of making small series of parts. – possibility to make prototypes.
Training and time saving in the preparation of surgeons

Areas for improvement
3D technology requires a mastery of the software and its use with the appropriate 3D printer by professionals of the medical sector .
Attention is to be made on regulation
It is still a technology that many health professionals do not know and many people do not have the resources to learn how to produce a 3D model.

Conclusion

3D printing in the health sector illustrates a very positive evolution in the improvement of the patient's care, nonetheless the limits show that the technology is not yet enough present in the hospital environment. It is therefore necessary to make health professionals aware of its potential in the treatment of patients.

Additionally, if the technology is still in its infancy stage in the medical sector, we must not lose sight of the regulations that govern this and the new skills that it implies.

The use of 3D printing in surgical planning and medical training: the case of German University Hospital Mainz

Due to complex vascular surgeries, the surgeons at the University of Mainz Vascular Surgery Department have decided to exploit their in-house Stratasys 3D printer, made available through the interdisciplinary BiomaTiCS research platform.

3D printing at the University Hospital Mainz is integrated into all areas of patient care. The technology is mainly employed during surgical planning in order to better visualize and diagnose complex patient cases faster.

With the help of the Stratasys Eden260VS 3D Printer, specialists 3D print highly-accurate clear transparent models that help in the understanding of staff and patients. Furthermore, they are used as a tool to educate and train future vascular surgeons on how to treat the most complex cases.

Stratasys: 3D printed model of the anatomy

How did they get to the use of the Stratasys Eden260VS 3D Printer?

As far as Cardiothoracic and Vascular Surgery is concerned, it should be noted that the Johannes Gutenberg University Hospital Mainz (University Hospital Mainz) provides research and patient care in areas related to the heart, thorax and blood vessels in the human body.

The reality is that, within the Cardiothoracic and Vascular Surgery Department, a great number of patients suffer from life-threatening symptoms, with aortic illnesses that required complete attention and detailed, patient-specific surgical treatment. In this situation, a possible solution for the surgeons is to offer endovascular treatment. This is a less invasive procedure for the patient compared to open surgery, in which a small hip incision allows medical staff to access the blood vessels and operate remotely 'from within the body'.

In cases of aneurysms, which are a swelling, bulging of the blood vessel that can be extremely life-threatening when ruptured, patients need to be treated quickly and precisely using endovascular or open procedures.

That's why the team around Prof. Dr. Bernhard Dorweiler, Head of the Department of Vascular Surgery, has found in the Stratasys 3D printer the solution to raise the standard of patient care by improving and optimizing surgical planning and treatment of the most complex, life-critical vascular cases.

How did the 3D printer help them to improve patient care?

The 3D printer enabled surgeons:

- To have a better visualization of complex surgeries

- To save time and money

- To train vascular surgeons

"On average, 1000-2000 single images are made per CT scan in vascular-related patient case, which the surgeons use to analyze and diagnose the illness. This can be ambiguous and time-consuming when the issue is complex," says Prof. **Dr. Dorweiler**. *"With 3D printed models, we can quickly understand the cause of the issue and best determine the type of treatment required to successfully treat it."*

Patient Case

A 53-year-old woman who had already been turned down by several other hospitals in Germany and beyond came to Prof. Dr. Dorweiler and his team. Due to an aortic malformation close to the heart, she was suffering from a bulging blood vessel on her neck. Recognizing the need for urgent medical attention, Prof. Dr. Dorweiler and his team undertook CT Scans, however the results did not provide the level of clarity required when it came to the anatomy of the patient.

"Looking through the CT Scans, it was impossible to clearly visualize the anatomy," says Prof. Dr. Dorweiler. "So, we decided to 3D print a model, and it was then for the first time that it became clear what the origin and magnitude of the problem was. Not only did we use the model to explain our findings to the patient in order to increase her understanding and cooperation for the planned 3-step procedure, but we even took it into each of the three surgeries as a point of reference during operation, which was crucial to the successful

outcome."

Therefore, the 3D printer enabled them to get a better visualization of complex surgeries.

Transparent Stratasys 3D printed model of a patient-specific aortic arch

Furthermore, the 3D printing process allows surgeons to save time and money.

In the treatment of complex aortic illnesses, with the endovascular method, the affected blood vessel is replaced and supported by an endovascular stent – a type of implant in the form of a small wire-mesh tube. The stent is inserted through the arteries and placed at the affected area of the aorta. This very precise and difficult procedure means the surgeon is operating using a monitor and has no room for error when finding the appropriate spot to place the stent. As such, the stent itself needs to be perfectly designed to fit the patient's anatomy to mitigate risk, but also save time and money both inside and outside the operating room.

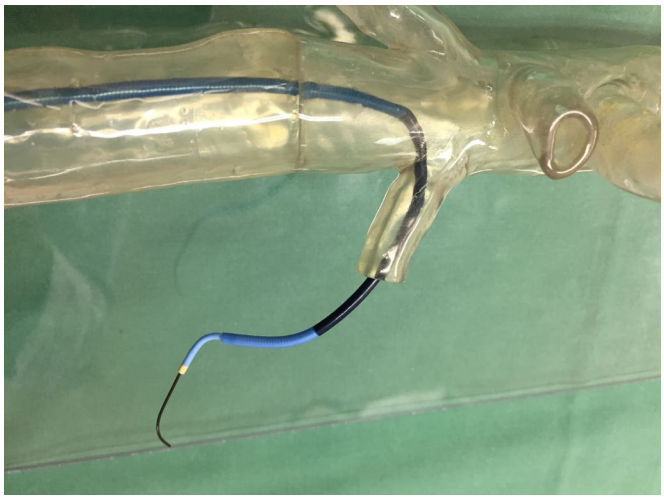
"By 3D printing a model of the patients' blood vessel where the stent needs to be placed, we can save significant time and money as we can practice surgery on the model repeatedly until we are certain everything fits together and that we have perfected the procedure."

Patient Case

Prof. Dr. Dorweiler and his team faced a very complex case of aortic arch aneurysm. Requiring a complex implant, the team decided to undergo a pre-operative simulation of the surgery using a stent prototype and 3D printed aortic arch model of the patient.

According to Prof. Dr. Dorweiler, this ensured the correct design and fit of the stent implant and avoided the need for procedural waste – saving the hospital thousands of euros. Understanding where the stent needed to be placed and having practiced the procedure on the 3D model, the team significantly reduced time in the operating theatre.

"Based on current studies, we are seeing savings in operating time of 5-45 minutes when using 3D printed models prior to surgery," Prof. Dr. Dorweiler says. "Research is still ongoing, but if you take an average surgery time of 2-4 hours, you are looking at time savings of up to 40%. When you are dealing with complex vascular cases every day, these time-savings can be the difference between life and death."

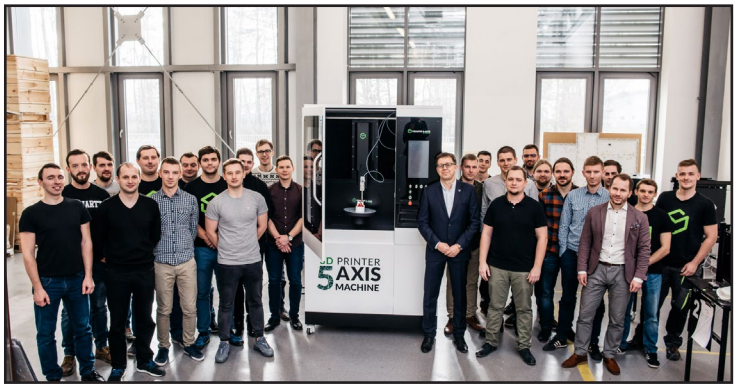


Surgeons use highly-accurate, transparent 3D printed model to practice the complex implant of a stent through the patient's arteries

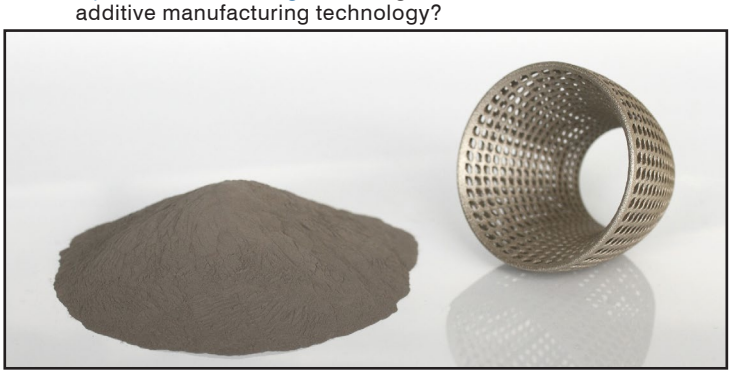
Speaking about the training of vascular surgeons, Prof. Dr. Dorweiler concludes:

"We use the Stratasys Eden260VS 3D Printer in our BiomaTiCS research platform to produce models of aortic anatomies from real-life cases, so that we can use them to teach future vascular surgeons how to successfully perform complex surgeries. With the ability to 3D print ultra-realistic aortic models in clear transparent material, the trainees can practice endovascular procedures and learn difficult Wire-Skills using the accurate replicas of blood vessels. For healthcare, it is crucial that we continue to leverage the capabilities of 3D printing for medical training, education and research for future breakthrough-implementation."

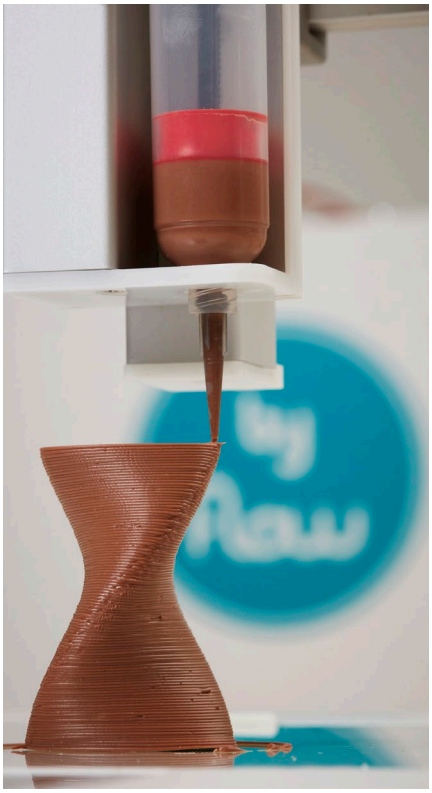
Business 3D Printing



Open Innovation Program: rising trend or real driver of the additive manufacturing technology?



3D printing of titanium parts in the aerospace industry: a booming sector



3D Printers and the Food Industry: Opportunities for Food Professionals?

Open Innovation Program: rising trend or real driver of the additive manufacturing technology?

The Open Innovation Program is a type of collaboration that gathers players within a specific industry. They are called to work together in order to achieve a specific goal or simply to foster the economy within that specific industry. The power of ideas and specialized strengths of every player are the main weapons in such a program. As far as additive manufacturing is concerned, Techniplas is one of the rare companies that succeeds in attracting a wide range of specialized actors in its open innovation program. The aim of Techniplas is then to foster the automotive industry using additive manufacturing. Today, Verashape aims to distinguish itself among companies of the same range. Its open innovation program inspires both change and innovation.

Called **VSHAPER, Verashape's** open innovation program will actually affect the development of production processes. At the heart of this project, industrial companies that will join the company will enable to accelerate the development of a 5-axis 3D printing technology.

With over 20 years of experience in the implementation of advanced CAD, CAM, CAE systems, Verashape is a Poland-based company with a strong presence in the international scene. The open innovation program is not really a première for the company in the development of solutions to foster the 3D printing market.

Through a project called 'Globally innovative additive printer', subsidized by The National Centre for Research and Development, Verashape also exploits the possibility to create 3D printing solutions that will ensure the development of product portfolio of its partners. Its 3D printers are suitable in foundry, education, design, medicine, as well as in industries such as automotive and aerospace.

VSHAPER 5-Axis Machine

The company's R&D team as well as the National Center for Research and Development have developed the VSHAPER 5-Axis Machine. Showcased for a premiere at Formnext 2017, a lot of improvements are still to be made on the conceptual side but potential prospects as well as companies that could be part of the project had the opportunity to discover its potential.

The 5- axis kinematics are equipped with tilting rotary working platform. The machine integrates FDM technology, which will enable 3D printing professionals to go beyond the restrictions of layer-by-layer

printing method.

"Our machine enables indexed 5-axis printing, enhancing the conventional model printing method allowing to transfer the print plane to another surface that was printed earlier. It also allows simultaneous 5-axis printing that moves away from the conventional layer-by-layer printing method and allows creating spatial models on a three-dimensional surface, by using all the machine axes simultaneously," says **Marek Kantowski**, R&D Lead Engineer from VERASHAPE.

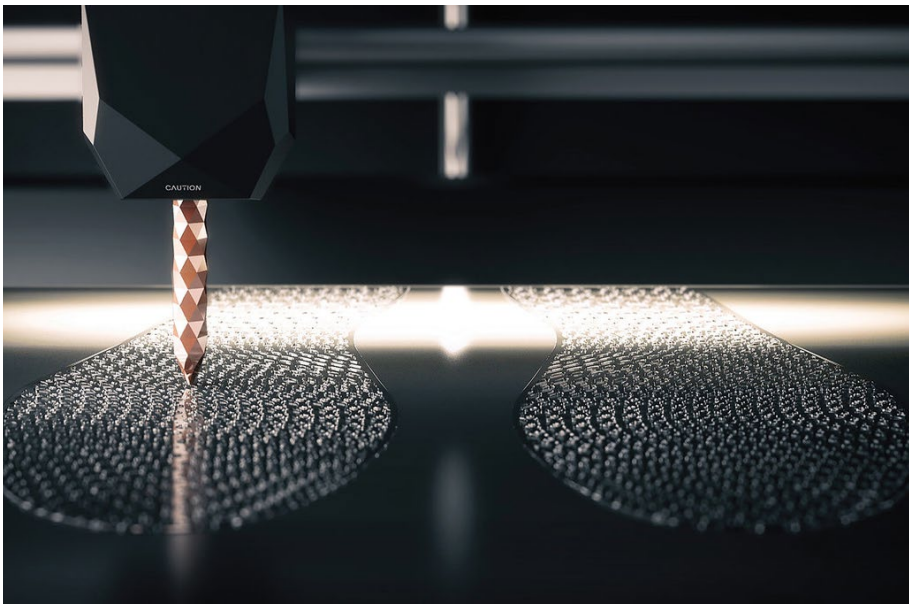
Other technical characteristics of the VSHAPER 5-Axis machine include a cylinder with a 300 mm diameter and a 300 mm height. The tool store integrated in the printer enables the use of few different heads in one printing process. Furthermore, constant temperature inside the working chamber and heated platform enables the printer to process most of thermoplastic materials.

"As part of the VSHAPER Open Innovation program, we will do our absolute best to make sure that the R&D work we conduct on the 5-axis machine supporting additive manufacturing are beneficial to specific recipients of this innovative technology. Companies interested in the implementation of 5D Printing technology, as they are a reality today, have a direct and real impact on the functionality of the machine, which will eventually help their production processes", said **Tomasz Szymański**, founder and CEO of **VERASHAPE**.

The 5-axis machine is expected to be commercially available in 2019. Last, if the Open Innovation Program is increasingly becoming a rising trend among key players of the 3D printing industry, it is definitely a true solution to foster the adoption and the development of the technology.

Industrial 3D Printing: mass production is there ...

We must find a way to combine «customization and mass production» for products intended for the mass public.



If we do not doubt or «almost never doubt» about the potential of 3D printing, one question is still in mind: when will the mass production occur? We've talked about it more than once, to spark interest in the end consumer, companies specializing in additive manufacturing exploit a flattering argument: customization. The only thing is that customization of products may imply impossibility of large scale production and longer time in the delivery. When we know that today's consumers are impatient, we notice that some of them are capable to wait in order to have a custom-made product.

Nevertheless, companies have integrated it well: we must find a way to combine «customization and mass production» for products intended for the mass public.

Fashion is taking a step forward ...

The collaboration between Cambridge Design Partnership (CDP) and the ECCO brand of footwear, opens the door to the possibilities of 3D printed footwear for the mass market.

The two companies are following in the footsteps of Adidas, Under Armor or even Brook Running Company that have collaborated with companies specializing in additive manufacturing including Carbon or HP FitStation.

The QUANT-U («quantified you») project of CDP and ECCO

To quantify the exact measurements of a foot, experts will collect data using gyroscopes, pressure sensors and accelerometers. They will also take into consideration the temperature and humidity inside each shoe to create a unique digital impression.

Furthermore, the data collected will be translated into geometries for 3D printing in the ECCO shoe store based on the biomechanical and orthotic parameters of each individual.

"The biggest challenge was the fact that the sensors are very close to the ground, hidden inside shoes and covered by a human body – yet they need to send data from both shoes simultaneously to a connected device such as a mobile phone," said Roberto Basile, a software engineer at CDP. "We needed to maintain reliable communication – using Bluetooth Low Energy – despite the human body acting as an obstacle to the wireless signals. The mechanical system inside the sensor had to be robust enough for people to walk on it, while the battery had to be small and last at least three days without being recharged."

Both teams made the first prototype of the portable sensor in less than four months. The built-in algorithm filters raw biomechanical data from the sensor into functional information. This data creates the input parameters for a custom 3D printed mid-sole for individual customers in about two hours. For the QUANT-U pilot, the custom mid-sole will be paired with ECCO's iconic Flex Shoe.

The first public release is planned for the month of April at W-21 Amsterdam - the ECCO concept store.

Next, Cars ...

A partnership between XEV, the manufacturer of Italian electric cars, and Polymaker, a manufacturer of materials, gives birth to LSEV, the first 3D printed electric car intended for mass production.

In an interview, Stanley Lu, CEO of XEV says FDM technology will be used in the car's manufacturing. For the CEO, the technique is affordable and less expensive for production.

Polymaker will advise the production team on the appropriate materials for each phase of production.

Both companies believe that achieving this goal would require customized mass production, fast and cost-effective R&D and the ability to produce lighter parts that could lead to greater energy efficiency.

Moreover, following the manufacture of the LSEV prototype, we already know that three objectives were met:

XEV has reduced plastic parts and the number of components in a car from over 2,000 to 57, and the finished LSEV weighs only about 450 kilograms, which is weighed much lower compared to other vehicles of similar size that are typically weighed between 1 and 1, 2 tons.

Aside from the framework, seats and glass, all visible parts of the car are 3D printed. This type of production results in a reduction of more than 70% in the investment cost compared to a traditional production system.

Finally, the R&D process of a car model typically takes about 3-5 years, but it took 3 to 12 months for XEV to complete a new design.

Fashion and automobiles are two examples of sectors that have begun to integrate mass production ... We cannot wait to find out how other sectors will follow.

image: **Tekna**

3D printing of titanium parts in the aerospace industry: a booming sector

Titanium is a material whose properties make it a prime candidate in many sectors: aeronautics, automotive, medicine, chemistry and many others. Far from entering the technical characteristics of this material, we will simply say that it attracts by its mechanical properties, its resistance to corrosion, its lightness, and its biocompatibility. The only thing is that companies that need quality parts made from this material do not always have the means to own it. They therefore develop their own technology that would allow them to 3D print titanium parts to the desired result or form partnerships with specialized companies.

The aerospace sector is perhaps the most profitable sector in the 3D printing market. It is a sector whose manufacturing of parts requires extreme temperature conditions. In fact, the devices used by professionals in this sector must be manufactured by taking into account the environment. Also, one of the advantages of titanium is that it is a material that is suitable for extreme temperatures and environments.

With a very high hardness-ductility ratio, titanium is used for the manufacture of aircraft structures, fasteners, discs, hubs, seals, and many other structural parts or components of turbojets and engines.

The involvement of additive manufacturing

Increasingly, 3D printing is a technology used to facilitate the manufacturing of titanium parts.

Let's try to compare with machining that is traditionally used to make titanium parts. The problem with this method is that professionals face severe constraints at the cutting-edge level; which accelerates tool wear and irregular chips. In addition, it must be taken into account that if there is a lot of material to be removed, the process becomes very expensive and time consuming. The processing time depends on the cutting speed, the amount of cutting oil required, and the tools used.

Furthermore, milling is certainly an expensive method but it makes it possible to generate less waste at the end of the production.

Additive manufacturing provides a solution to the limits of machining. It enables to save time and costs. Here the piece is made layer by layer. These layers are fused together by a laser beam «coupled to a CAD model of the part to be produced».

However, for the additive manufacturing of large metal parts, Prodways and Nexteam tell us that Rapid Additive Forging (RAF) can be used. The technology was discovered by Prodways in collaboration with Commercy Robotique, a subsidiary of Groupe Gorgé, and was recently revealed to the general public.

« The technology implements a head depositing molten

metal in an atmosphere of inert gas. Metal is thus deposited layer by layer and a large part is completed within the space of just a few hours. Metallurgic analyses conducted over the past 12 months have demonstrated complete mastery of the process with an absence of porosity, homogeneity of the part in all directions, and productivity that is significantly higher than usual 3D metal printing techniques using powder sintering with a laser or electron beams. «

The technology will be used on an industrial machine built for this purpose. Nexteam will be the first company to have the honor of using it.

The industrial machine dedicated to the manufacture of large titanium parts

Industrial machine based on the RAF technology **(Prodways Group)**

The big printer can manufacture parts in a production envelope of 1200x800x500mm. According to experts, it has been specially adapted to the realization of titanium parts. This was made possible by the mastery of inserting waste in a glass compartment to avoid components to be spread in the environment and the use of a patented printing system.

In terms of its advantages, there is a reduction of more than 80% in material loss compared to other machining techniques. In addition, there is the absence of tools and their associated non-recurring costs (shapes, molds, etc..) compared to forging techniques and finally a reduction in manufacturing lead times.

Other partnerships for the production of titanium parts

Other companies have preceded Nexteam and Prodways, mentioned above, in the additive manufacturing of titanium parts in the aerospace industry.

In the case of the Arconic-Airbus partnership, it is the installation of a 3D printed titanium part on a commercial mass production aircraft by Airbus, as opposed to a test airplane. This partnership is an important step in the manufacturing of complex parts for aircraft production.

A 3D printed titanium part installed on a commercial airplane Airbus (A350 XWB)

To improve the manufacturing of commercial aircraft, Boeing and Norsk Titanium have collaborated to produce 3D printed titanium parts. The two companies were also awarded in Washington on March 1st for this production by the «Aviation Week Network» in the category «Commercial Supplier Innovation».

Finally, Boeing has signed a partnership with Oerlikon to develop standard materials and processes for metal-based additive manufacturing. The two companies will first work on ways to industrialize the manufacturing of titanium powder bed additives. They must ensure that parts made with this technique meet the requirements of the Federal Aviation Administration and the Department of Defense.

These partnerships are just a few examples of how the 3D printing market can move forward with the production of titanium parts. The same material used in the medical sector, will certainly have a different impact ... but it still has to be checked...

3D Printers and the Food Industry: Opportunities for Food Professionals?

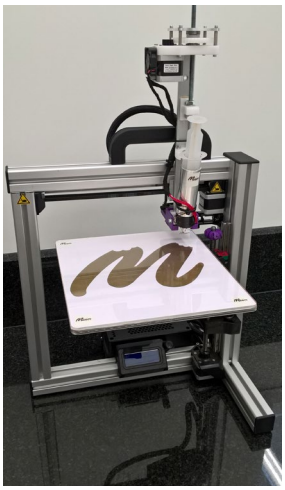
If 3D printing is currently creating a lot of media hype, it should be noted that the popularity of this technology is due to the endless uses of a 3D printer. 3D printers have managed to penetrate sectors such as health, automotive, aerospace and the fashion industry. In these areas, the key word that comes to mind is customization. Today, 3D printers have managed to fit into the food industry, and we wonder if we can also speak of "specialtized or customized food".

In the eyes of many people, food is an art. When combined with 3D printing, it can look like a sci-fi movie. On the market, there are not yet many players who are specialized in this sector. And yet, companies already present, still young, manage to stand out both by their specialty with their 3D printing technology.

For your pleasure and to "make your mouth water", two of these actors specializing in 3D food printing have particularly caught our attention this month: **Miam Factory and byFlow.**

Miam Factory

Miam Factory is a start-up of the Smart Gastronomy Lab, which is integrated in the Faculty of Gembloux Agro-Bio Tech in Belgium. Its story begins with research on 3D food printing in the faculty's research laboratory. Very quickly, after a few appearances during events, the start-up developed a passion for 3D printed chocolate because naturally the demand is present.



Given the lack of satisfaction from the chocolate 3D printers on the market, the team of Miam decides to create its own. Certified, according to FASFC standards, this 3D printer produces different forms based on food matrices. Through an exchange, **Gaëtan Richard** explains, *"We were not convinced by the result of the chocolate 3D printers available on the market, and [today], with our printer, the final quality is much better."*

With the conventional method, the molding technique is used to work the chocolate. Regardless of its nature (white, blond, milk, black), chocolate can be worked to obtain 2D and 3D printed forms.

Once the liquid chocolate is obtained, the fusion deposition technique (FDM) is then used to print it. If it is important that the chocolate is liquefied before it is deposited. It must also be kept at a specific temperature in the container for as long as necessary.

The challenge of this process is adapting the printing parameters to give enough time for the chocolate to solidify while avoiding the collapse of the shape.

Finally, it is important to note that their 3D printer allows them to make complex shapes or even small productions.

byFlow

byFlow is a 3D food printing company based in The Netherlands. The company's activities rely on Focus, their 3D food printing technology. Through the arrival of this technology on the market, **Nina Hoff**, CEO & Co-Founder of the company, aims to change the way people experience food.

The Focus printer has the ability to print more than 50 different ingredients. To name a few: chocolate, sugar, butter, meat… Easy to use, it integrates a simple control interface and portable. It is future proof which means it is upgradeable to keep up with the latest technology and reusable cartridges allow for multiple ingredients to be filled and changed. byFlow brings food to life by printing complex and beautiful

designs.

When it comes to printing food, the company reflects on those with swallowing problems, especially seniors. Eating should be an enjoyable experience but is not always the case for this latter group. To support byFlow in this vision, Verstegen, a food company, has developed the first edible filling for a 3D printer.

This development in terms of "materials" that can be used with the 3D printer makes it possible for the HORECA to use the Focus.

Nina Hoff is goal oriented: she is involved in a market that is continuously evolving over time. Speaking about her vision of the company in this growing industry, the CEO believes: *"We are able to build this future. We know that we have to live here for another 50-60 years so we better be a part of it right now instead of waiting for something great to happen. I think that's also why working at byFlow is fun."*

The promise of 3D printing for the food industry

In general, as in all sectors of activity where 3D printing lays emphasis on personalization, we can deduce that the first idea would be to have personalized food.

According to experts, the advantage of 3D printing would be the ability to quantify the physical form of products as well as caloric requirements, which is achievable with the precision of 3D printers.

Furthermore, once meals are well balanced, professionals in this industry also want to target people subjected to strict diets including high-level **athletes** and/or **babies**.

Health wise, as explained above, the elderly can find their account to the extent that their meals can be made more «enjoyable» if they are 3D printed. In fact, more and more retirement homes are using this technology to make life easier for seniors.

In addition to the complex 3D printed forms, it is possible to transform other protein inputs such as algae and insects into 3D printable foods that have beautiful texture.

In this case, the real question is whether we can talk about a food that respects the environment ...

TCT ASIA: an overview of a promising market for 3D printing vs interest of Asian companies in the European market

Speaking of the evolution of 3D Printing, the Asian continent is not to be neglected. According to a market analysis conducted by INKWOOD Research, the predictions of this market between the years 2017 and 2025 show that Asia would be one of the fastest growing regions in the 3D printing global market. The market is expected to grow at the highest CAGR of 26.83% during this period, generating an estimated $16.377 million by the end of 2025. Key players in this evolution are India, Japan and China. The latter country hosted the fourth edition of TCT Asia.

The fourth edition of TCT Asia, dedicated to additive manufacturing innovations, was held for the first time in **Shanghai (China)** from **February 28th to March 3rd**, 2018. Once again, many companies have marked their presence at the event by the launch of new products and signatures of new partnerships. Moreover, this event was also a first entry for many companies in the 3D printing market and the opportunity for others to announce their arrival in Europe.

Amongst the usual participants such as **Stratasys, 3D Systems**, or even **TRUMPF**, Clariant, a global Swiss chemical company, made its debut in the 3D printing market by making its entrance in China.

As far as partnerships are concerned, **Oerlikon** and **Farsoon Technologies** have partnered to develop additive manufacturing (AM) in China. This long-term agreement consists in providing Oerlikon's metal powders to Farsoon's additive manufacturing systems. Both companies aim to increase the adoption of 3D printing in China by combining 3D printing equipment and certified metal powders.

Meanwhile, **Optomec** announced that it will distribute its metal additive solutions via HUSUN, a China-based industrial 3D printing provider

According to the **Ministry of Industry and Information Technology (MIIT)**, the country still lacks skills in key technologies and innovation capacity. In addition, the scope and depth of the 3D printing applications is another area that requires special attention. For this reason, international 3D printing companies are strongly encouraged to establish themselves in the country.

China's Interest in Europe

This event did not only show the interests of the Americans and Europeans for China, but the opposite has also been proven.

Take for instance, **Farsoon Techonologies**, a provider of industrial plastic laser sintering and laser melting systems, the company took the opportunity to announce its next expansion on German soil. For the founder of this company, **Dr. Xu Xiaoshu**, president of Farsoon Technologies: *q*

3D Metal Printing highlighted during the event…

38 is the number of metallic systems that were showcased at the event in all shapes and sizes. An important thing to notice is that there is a remarkable price difference between the systems of the Western and Chinese enterprises. Indeed, Western systems are often more expensive than those of the Chinese systems.

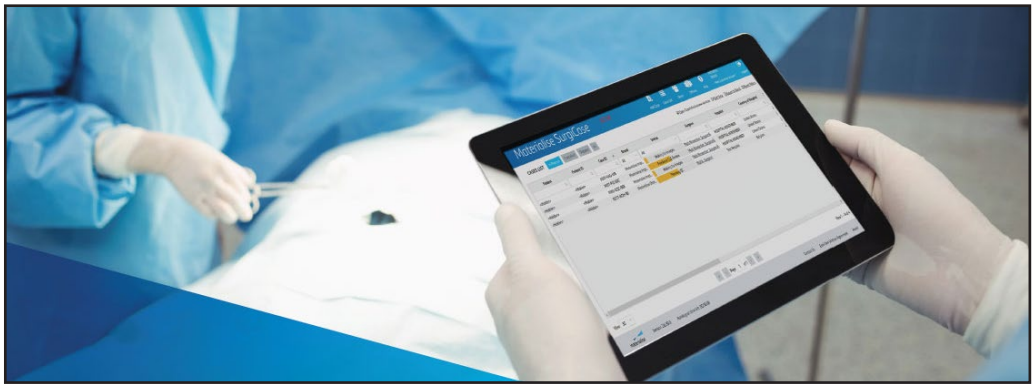
This significant number of 3D metal systems is explained by the fact that the automotive and aerospace sectors are of paramount importance for the manufacturing economy of China. They are therefore considered as sectors that could enable an exponential growth.

Finally, it should be noted that when it announced its new action plan for 3D printing, the Republic of China hoped to achieve an annual turnover of more than 20 billion yuan (3 billion USD) on this market with an average annual growth rate of at least 30%.

The innovations presented during the TCT Asia event show that actions are being implemented to achieve this goal.

Medicine

3D Printing



The digital dentistry: a sector very much coveted by additive manufacturing companies

Materialise and DePuy Synthes provide surgeons with a 3D printing guide for shoulder surgery

THE DIGITAL DENTISTRY: A SECTOR VERY MUCH COVETED BY ADDITIVE MANUFACTURING COMPANIES

It's no longer a secret, the digital revolution concerns all sectors of activity. In the medical sector, particularly digital dentistry, 3D printing has made it a reality. Additive manufacturing companies are gaining ground in this sector and specialists of the medical industry are forced to adapt their working methods considering the technological evolution. An evolution that involves new partnerships, laboratories dedicated to digital dentistry, new product launches, all compliant with regulations.

At the heart of such a coveted business sector, what better way to position itself on the market than to affirm its presence in an event dedicated to it? LMT Lab Day is a social and informative center dedicated to dental laboratories. This centre organizes several events dedicated to the growing industry of 3D Printing. During the LMT Lab Day Chicago, held on February 23rd and 24th, additive manufacturing companies took the opportunity to showcase their 3D printing solutions for digital dentistry.

Partnerships: ultimate weapon of "advancement"

3D Printing companies have understood the saying: ***"United, we stand"***. For this very reason, they sign partnership contracts with businesses in the digital dentistry sector to better conquer the market.

This was the case of EnvisionTEC and AvaDent Digital Dental Solutions that have decided to facilitate the adoption of digital prosthesis together. They can now offer a complete digital workflow solution for digital dentures, from print and digital design to its experimentation and final restoration.

Speaking of the strengths of each party, it is worth noting that the Food and Drug Administration (which controls the commercialization of drugs) has approved EnvisionTEC's pink E-Denture base material. The materials E-Dent 100 and 400 stimulate teeth in every shade. This means that labs and dentists can now 3D print realistic prosthetics directly in their office if they possess a 3D printer.

In the case of this partnership, **EnvisionTEC** brings forward its new high-speed 3D printer, **Vida cDLM**, which would also be suitable for digital dentistry. In addition to orthodontic models printable in less than 30 minutes, dentists can accurately print 3D crowns, bridges, bite splints, gingival masks and concretes.

With regards to **AvaDent** the company already directly offers a range of digital dental prosthesis services including base plates, linked dentures, monolithic, dental prosthesis, hybrid prosthesis, washers and printing files. Therefore, customers will be able to entrust their print files to AvaDent, which will take care of its fabrication.

Still within the context of partnerships, Carbon, a digital manufacturing company, is contributing to the dental world with the introduction of a new 3D printed prosthesis with **DENTCA**; as well as gingival masks and trays with **DREVE**.

DENTCA and **DREVE** are respectively specialized in CAD/CAM dental prosthesis and dental materials.

Its should be noted that with Carbon's 3D printing solutions, everything is digitally traceable. A unique identifier can be automatically engraved on any piece. This unique identifier can be used to identify the digital history of that part, including identification of the printer, resin, and even post-processing protocols involved in making that part – this is extremely valuable for FDA-highly regulated industries that will increasingly require piece-specific data to ensure product performance and patient safety.

Therefore, just as with EnvisionTEC, there is also a need for FDA approval here.

The dedicated laboratories

Failure to enter this sector through partnerships results

in some companies having to pay the luxury of directly creating their laboratories dedicated to digital dentistry.

This is what **DWS Systems** is doing: creating its own dental unit. In this laboratory, the manufacturer will supply the world with dental models, restorations and prosthesis. The **LFAB** and **DFAB** 3D printers, as well as the **XCELL 600PD**, an automated 3D dental printer, are some of the machines that will be used to provide these services.

On the capabilities of the aforementioned printers, the company explains that in order to allow patients to have dentures that resemble real teeth, the LFAB and DFAB 3D printers offer customizable colored restorations using light curable composites. Furthermore, the new DFAB can effectively replicate patient-specific gradients using DWS Photoshade technology to improve the overall appearance of prosthesis. For instance, dentists can match colors and 3D print patient-specific functional restorations in their office during a single visit.

The launching of new products

Finally, new products are simply made accessible to laboratories dedicated to digital dentistry.

This is the case of **E-OrthoShape** and **E-Ortholign**; two new orthodontic materials launched on the market by **EnvisionTEC**.

E-OrthoShape is used to produce models on which thermoformed transparent aligners can be created. It is an ABS gray material that prints in 100 micron layers and can be used with all EnvisionTEC DLP machines.

As for the **E-Ortholign**, it is used for 3D printing directly from a retaining aligner. This material meets the requirements of biocompatibility, stability, flexion and strength for a first aligner. It evolves through a regulatory approval process.

Moreover, it should be noted that seven of EnvisionTEC's 12 dental materials are also approved by the FDA.

Finally, **Stratasys** also brings forth its touch to the market through its **Object260** dental 3D printer.

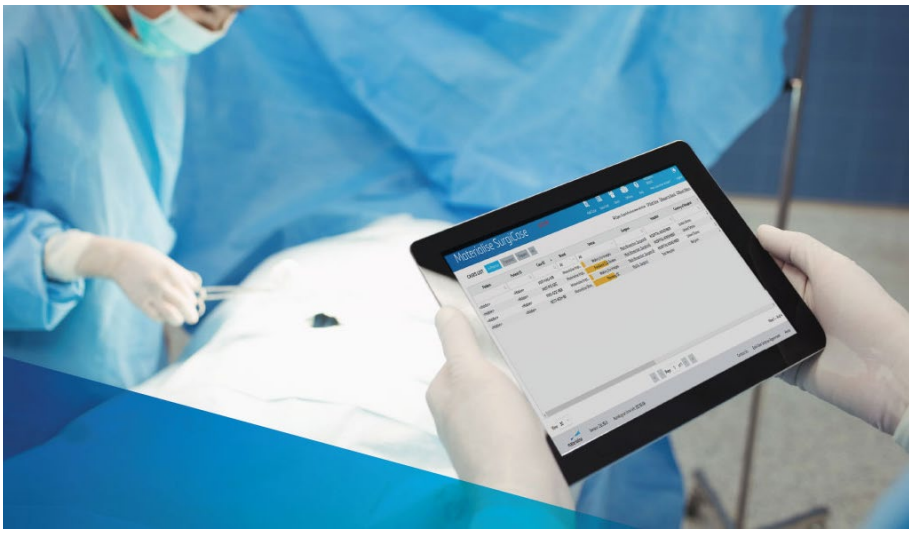
Based on **PolyJet triple-jetting technology**, it has the capability of 3D printing 2 different materials on a single tray, make surgical guides, models and devices to a variety of requirements.

In terms of materials, the flexible biocompatible material, **MEDFLX625**, helps labs prints 3D soft tissue implant designs on a single print.

"There's no denying the power of 3D printing for digital dentistry to significantly decrease turnaround time, reduce labor costs, and provide new streams of revenue. Multi-material 3D printing pushes the boundaries of what's possible in dentistry today, while unlocking the next-generation of applications for tomorrow" said **Mike Gaisford**, Director of Healthcare Solutions at Stratsys.

Materialise and DePuy Synthes provide surgeons with a 3D printing guide for shoulder surgery

The TRUMATCH® Personalized Solutions Shoulder System, revealed at the AAOS Annual Meeting in New Orleans, marks a further extension of Materialise's longstanding collaboration with DePuy Synthes, that will distribute the guide in the United States, Canada, Australia, New Zealand and Europe.



There are a thousand of ways 3D printing companies can make their contribution to the medical industry. To mention a few of its actions, **Materialise** is already bringing 3D printing via its software **Mimics inPrint** to worldwide hospitals. The Belgian company also partnered with Tailored Fits to improve feet welfare and today, it offers surgeons the possibility to plan shoulder arthroplasty cases and order patient-specific shoulder guides.

Made in collaboration with **DePuy Synthes**, the 3D printed guide for shoulder surgery is called the **TRUMATCH® Personalized Solutions Shoulder System.**

TRUMATCH® Personalized Solutions Shoulder System

The system consists in an all-in-one, web-based platform that enables doctors (surgeons precisely in this case) to better plan and prepare for operations as well as order patient specific surgical guides. It especially concerns **Reverse Shoulder Arthroplasty** (RSA) and **Anatomic Total Shoulder Arthroplasty** (TSA) operations.

The truth is RSA and TSA operations include challenges such as **limited visibility** due to the small incision; the **Glenoid cavity** being deep in the surgical window and the **lack of reliable landmarks**. Therefore, precise alignment is more than necessary because of both limited bone stock and its impact on overall screw length and fixation on the one hand, on the other hand, the occurrence of peg perforation.

What surgeons can expect...

With 3D virtual pre-surgical planning, implant positioning is carried out "within a stable reference frame, linked to the entire scapula, using reliable landmarks that are not subject to case specific wear patterns. This allows the surgeon to be more precise in the alignment of the implant and screw positioning, improving overall fixation."

Thanks to the system, preparation prior to the theatre room is increased as well as confidence and control during surgery on the side of the team.

Thanks to the preparation prior to the theatre room, surgeons may choose to carry out the surgery with personalized guides if traditional instruments or guides are less appropriate because of glenoid deformities.

Furthermore, the **TRUMATCH®** Personalized Solutions Shoulder System also allows surgeons to order patient specific 3D printed shoulder models within the same platform.

Speaking about this collaboration, **Wilfried Vancraen**, Founder and CEO of Materialise said: *"3D planning is gaining popularity with orthopaedic surgeons performing shoulder operations. Together with our strategic partners like DePuy Synthes, we are continually working to improve surgical planning processes for a range of operations. We are proud that this expanded collaboration will empower even more orthopaedic surgeons to discover the benefits of online planning and 3D-printed, patient-specific surgical guides."*

Last, the solution will be available in the United States, Canada, Australia, New Zealand and Europe.

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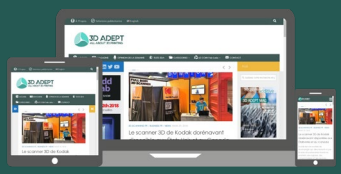

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INTERVIEW

Demian Gawianski, CEO of Smart International (SI) : Kodak's first steps in the 3D printing market and change for SI

Smart International *is a company that has been developing and manufacturing printers for about 6 years. Located in the United States, the company has made its first steps in Argentina where it has developed its commercial and technical expertise in 3D printing. It will almost be two years since the company has been developing 3D printing solutions for a more professional market.*

In December 2017, when Kodak announced its arrival on the 3D printing market, the photography specialist gave Smart International its license to use its brand, thus, making the company the global representative of Kodak in the market of 3D printing. This is a win-win partnership for both parties. Smart International (SI) benefits from Kodak's image on the market, the latter finds in SI, the technical and commercial expertise desired to penetrate the additive manufacturing market.

Demian Gawianski*, CEO of Smart International tells us today about this change for SI as well as Kodak's first steps in this growing market.*

What drove Kodak's decision to enter the additive manufacturing market?

About three or four years ago, Kodak hired Steven Overman as CMO. He was in charge of Kodak's rebranding and research about the best positioning of the company. He defined Kodak as a brand for creative professionals, for photographers, of course, designers, engineers, architects, entrepreneurs, etc....

Kodak has traditionally been a brand in which, we all have our Kodak memories for our moments in the past where we took some pictures and they last all the way to the present so we have something printed that is out there and reminds us of some family moments or artistic creations. That's the way Steven Overman saw an excellent fit between the brand and the 3D Printing market.

With that being said, Kodak and Smart International working together in this market is something that I still enjoy today.

Kodak's first 3D printer is named "The portrait", is it a way to recall its core business?

Yes. This was the name that we picked and suggested to Kodak. We wanted to bring some of the history of Kodak without making it old. So, taking something that people can relate affectionately to the brand and where they can still perceive innovations.

What are the main advantages of this 3D printer as well as of its filaments compared to other products of the same range?

The printer is a two-device system with a lift nozzle, so that when one nozzle is printing, the other is out of the way. This allows the printer to print complex geometries. It is a fully enclosed chamber, totally transparent with an efficient air filtration system (filter and activated carbon included).

The printer comes also with a 5-inch full colored touch screen that is connected via Wi-Fi to the cloud and we will offer lots of cloud capabilities on a partnership that we will be announcing in the next few weeks.

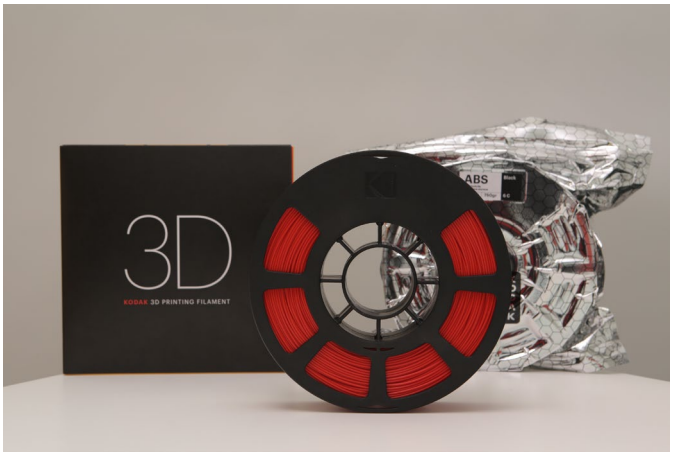
As part of our researches with Kodak's advanced materials and 3D printing team in Rochester, New York, we had to find answers to one important question: what are the standards to guarantee the top-quality filaments in the market? Then, an important issue that came up was the relevance of controlling moisture. If the filament has a moisture rate of over the recommended tolerance, the polymer will deteriorate at a molecular level that will break when you will be melting the plastics.

So, let's say you have a filament that is in a solid state, you melt it and if it has humidity it's going to deteriorate resulting in poor print or the print will be successful but eventually it will lose its main properties. If it needs to be rigid it's going to be less rigid.

So, with all this research, we were able to guarantee the lowest moisture rate in the market for filaments. Our moisture rate for PLA is under 0.025%, which is four times lower than the second lowest filament moisture in the market.

We can also guarantee precision at the highest level because we buy pallets adapted to each of the applications for which they are used.

Thus, we can offer superior quality filaments on the market.



The 3D printer "The Portrait" can be used with other filaments. Is that correct?

That's correct. Since I told you that we found moisture to be such a big issue for filaments, we developed air tight cases to protect the filaments. Not only is it manufactured with the lowest moisture but it's also packed in a vacuum sealed aluminum bag.

When users open these bags, they place the spool inside an air tight plastic case with a gel that continues to protect the filaments from absorbing moisture and dust.

So, there is a dual device that comes with the machine that allows you to use it properly according to your needs. Our aim, let's remind it, being to provide the best experience to customers.

These filaments can also be used with other types of 3D printers?

Yes, and we provide the filament cases as well so the air tight cases can be used as a stand-alone device next to another printer. That is why our 3D printer works with 175mm filaments but we manufacture also 285mm.

What is the value proposition you made to Kodak regarding the 3D printer?

We told Kodak that we wanted to develop a product for a market that is not high industrial. Kodak therefore focused on creative professionals. We wanted to provide reliable solutions for a professional who does not want to make a big investment on machinery. This is the segment that we are focused on. So, reliable solutions for a reasonable price. That is what we have done with The Portrait.

What is the targeted market?

This use is mostly recommended for professionals and schools. Currently, most of the devices that are being sold to the educational market are open devices and they have no air filtrations so we believe that this is something that the educational market needs.

Are the company's 3D printing solutions already available in Europe?

Not yet. A local inventory will be made available to the public by the end of April - no specific date for now.

If you had to talk about the 3D printer of Kodak, "The Portrait" in one sentence to convince the public, what would you say?

"Reliable solutions for a timeless product"

Do you have any last words?

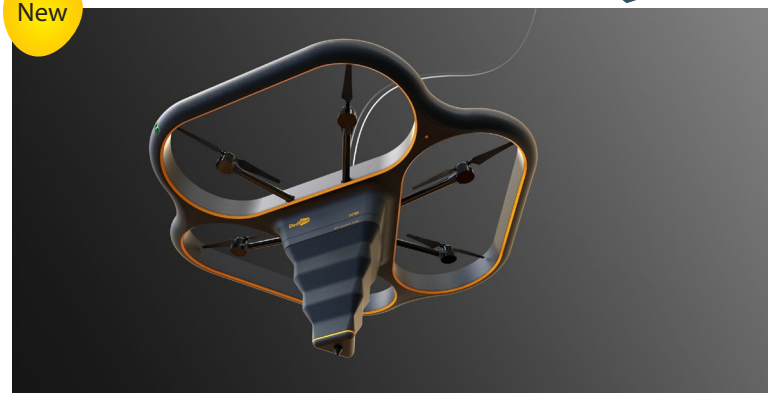
We are very happy to enter this market where we believe there is a great opportunity here and a big need for solutions being developed by a player who has 130 years' experience in customer satisfaction.

News

3D printers & materials

3D Printing

New



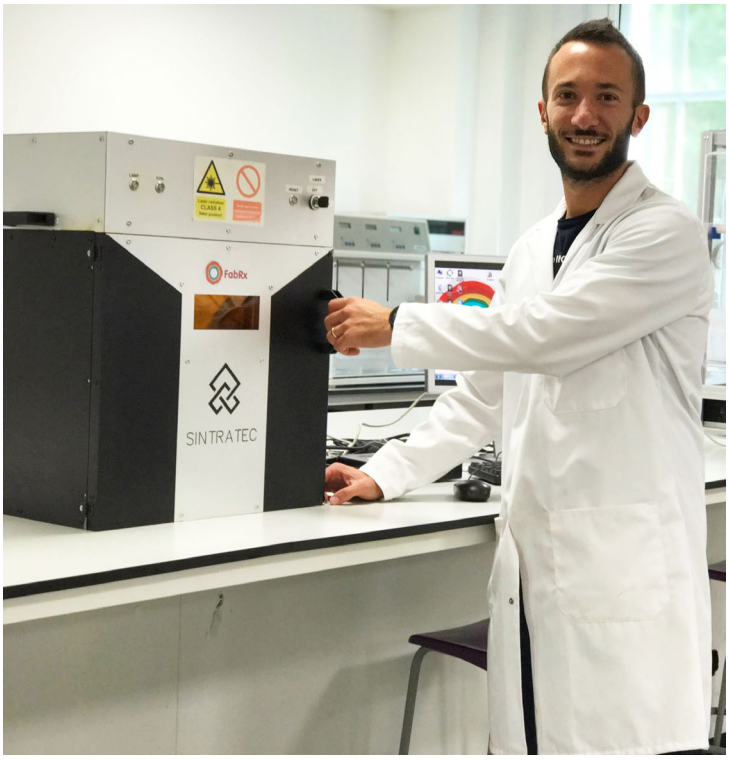
Fly Elephant, the first flying 3D printer or the drone that prints in 3D

New

Why is carbon a coveted material in 3D printing?

Special 3D printers for hearing aids?

SLS technology for 3D printed drugs



In the interview of the February issue, in regards to Aprecia's 3D printing technology, Cycle Pharmaceuticals CEO, **Antonio Benedetti**, explained that to 3D print drugs, the 3D Printing technology has the ability to include high doses of drugs in a single tablet. The idea of **Leroy Cronin**, researcher in the field, goes beyond this one. According to the scientist, it would soon be made possible to 3D print drugs at home.

It has already been proven that it is possible to 3D print drugs. However, the question is **which 3D printing technology is capable of such innovation?** Very few technologies specialized in this activity are available on the market, probably because it also requires a commercial authorization. However, we have recently discovered that some **SLS 3D printers** may be suitable for this exercise. It is the case of the Sintratec's 3D printer.

How does FabRx use SLS technology to print drugs?

First and foremost, for those who do not know the company: FabRx is a research group at the **University College of London** (UCL) that uses 3D printing technology to make 3D printed tablets called Printlets TM.

The company aims to make **medicines more attractive to young people and older people to facilitate compliance of treatments.**

Our researchers used the SLS 3D printer from Sintratec (Swiss manufacturer of 3D printers) to 3D print drugs.

It is a printer that has a maximum print volume of **110 x 110 x 110 mm**. However, the recommended print volume is **90 x 90 x 90 mm**.

Laser sintering makes it possible for the drugs to be printed in many shapes. It's a technology that lets you print mobile assemblies and multiple nested objects in a single print.

Using the Sintratec kits, researchers were able to better treat temperature-sensitive materials. In other words, the 3D printer adjusts settings such as **laser speed and the temperature of the material.**

In addition, the technology requires the use of powder materials to form complex 3D objects. As a matter of fact, drugs can be successfully 3D printed in a variety of shapes, sizes, colors and textures.

As a reminder, the technology can also be used in other sectors of activity.

Special 3D printers for hearing aids?

It's still hard to imagine everything you can do with a 3D printer. It has probably already been said, what makes this sector of activity so original is the variety of uses of a 3D printer. We've discovered 3D printers for construction, 3D printers for the food industry, 3D printers for digital dentistry ... and today 3D printers for hearing aids?

The healthcare industry needs such precision and certainty, that discovering the possibilities in terms of using 3D technologies is just fascinating. Last November, we discovered through a report how Sonova, specialized in the production of hearing aids, appropriates 3D printing to make hearing aids. The company collaborates with EnvisionTEC, a 3D printer manufacturer that has supplied 20 3D printers including the **P4 LED XXL**. Until now, we do not know if we can't talk 3D printers specifically intended for hearing aids because they might be also used in other industries.

However, this month, Rapid Shape, a German manufacturer recently unveiled a range of 3D printers dedicated to the manufacture of hearing aids. This range includes three 3D printers: the Studio-Line 3D Printer, **HA20 II, HA30 II** and the **HA40 II** 3D Printer.

A patented technology

According to the company, the open system normally allows all printers a good use of materials. However, the Studio Line would be much more interesting for beginners and stores in this type of manufacturing. Indeed, they will not want to invest a lot but first discover the technology and turnaround time.

For these printers, the company offers an optional remote maintenance option that ensures an annual renewal of the biocompatibility certificate according to the standards of the devices. The advantage here is that since maintenance can be done remotely, maintenance costs are reduced.

The **HA20 II** printer allows you to create several hearing aids in about 30 minutes. It can also be used in stores.

The last two 3D printers, **HA30 II and HA40 II**, are very useful when considering a slightly larger production. Laboratories and producers are then the targeted consumers who would be most likely interested. One of the striking differences between the two is that the main feature of the HA30 II, is the size of the compact camera which is different from the **HA40 II**. The latter incorporates a slightly larger construction platform (150 x 85 mm), making it a technical addition.

Additional information was not given on the type of materials.

"The new Hearing printers make it quicker and easier than ever to produce professional and biocompatible hearing aid parts. Rapid Shape has worked closely with our customers and material partners to develop the new generation of 3D printers that meet and exceed current needs,» says **Andreas Schultheiss**, Managing Director. *«Our optional remote maintenance is a win-win for customer, material partner and system manufacturer. The total costs could be reduced by up to 50% while preserving medical device directive compliant processes.»*

Fly Elephant, the first flying 3D printer or the drone that prints in 3D

The use of drones has rapidly evolved over time. Apart from the generally known civilian or military use, the Chinese company DediBot, unveils a new use: the possibility of using a “3D printer – drone” in construction, the first time in history.

Unveiled for the first time at **TCT Asia 2018**, the device named **Fly Elephant** is a 3D printer capable of flying. Also described as a drone capable of printing, the innovation of the Chinese company has aroused both the interest of the visitors of the TCT and the web.

We were also curious to find out the features of this printer and the company behind this innovation.

Hangzhou DediBot Intelligent Technology Co.

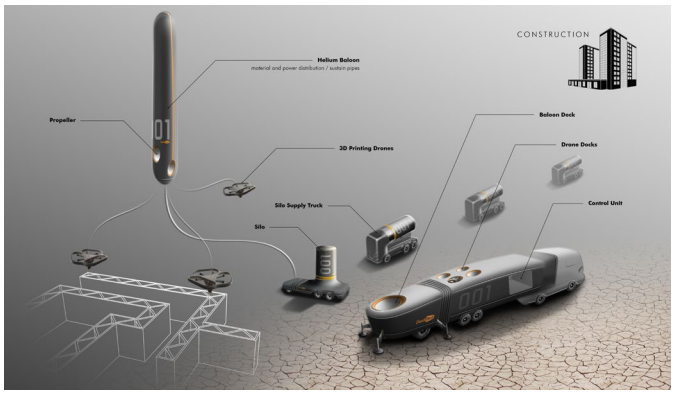
Hangzhou DediBot Intelligent Technology Co., Ltd., is an enterprise that develops 3D printing, consumable materials and platforms of 3D model construction. Such product developments are applied in the medical, architecture and many other industries needing professional equipment and solutions.

The company also integrates a R & D unit constituted of specialists in scientific research and additive manufacturing experts that were able to design its 3D printing technology.

Fly Elephant: the main features

While many other devices are devised in the typical rectangular form, this machine is set apart from the rest because of its unique design. It would be difficult to describe all the features of the printer because we are still in the prototype phase.

However, what marks us first is that DediBot has developed its own technology: **Open-ended Additive Manufacturing**. It consists of the use of *"UAVs as print execution units, while still maintaining a very high print accuracy, to achieve rapid prototyping of large-size 3D printing structures."*

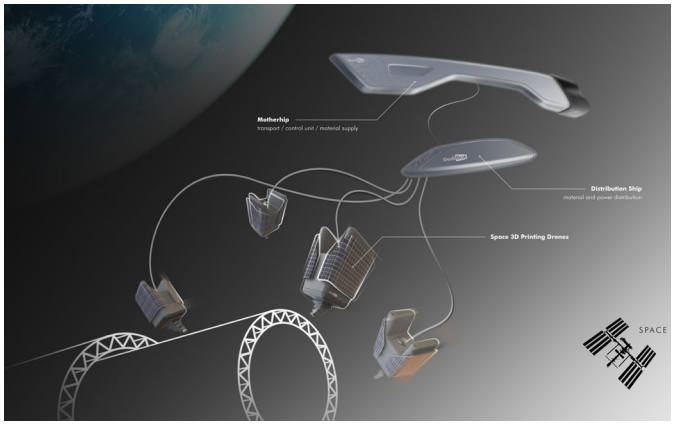


Technically speaking, the 3D printer can be used for material handling, accurate positioning or the selection of materials.

In regards to material handling, the manufacturer wanted to make sure the device can move freely in the air while delivering the material to any location in a specific area.

As for the positioning system, the device can accurately transfer materials to specific positions. The use of different materials allows for quick solidification methods like **layer-by-layer piling, wiredrawing or painting in the air.**

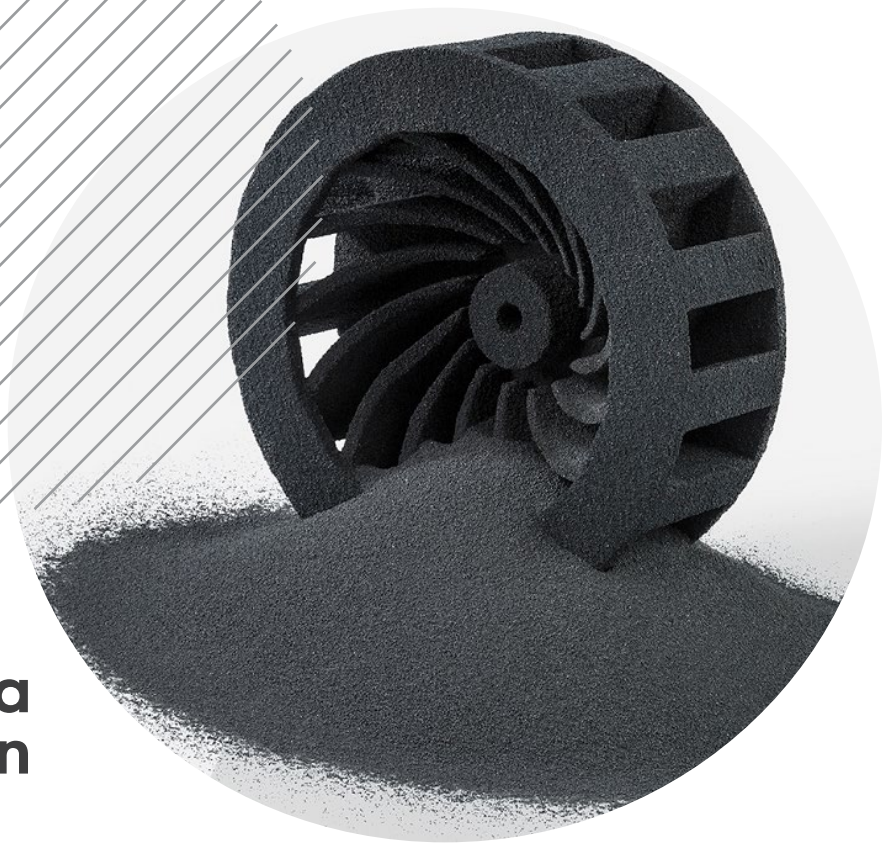
In addition, it is possible to use the printer simultaneously with "other drone printers". In other terms, the 3D printer facilitates the simulation and the control of several drones that share one or more tasks.



Construction: the primary objective

Different scenarios are plausible according to the company. The 3D printer can be used for **geological exploration, architectural planning and design, structural design and print construction that is not affected by climate.**

Fly Elephant can also be used for space purposes and can enable to directly print large equipment in the open and zero-gravity fields. The printer does not limit itself to work on land; it would also have undersea applications.



Why is carbon a coveted material in 3D printing?

Carbon is a particularly popular material in the 3D printing industry. Some manufacturers have even made 3D printers that uniquely print carbon. It must be said that it is a material that is useful to the automotive, fashion or aeronautics sectors. But why?

First, in terms of properties, carbon fiber is much lighter and stronger than steel. In addition to its flexibility, the fiber can be easily woven and is less likely to deteriorate.

Printing in 3D with carbon

Generally used via the FDM technique, carbon is printed at a temperature between **240 ° C** and **260 °** C. Used for the manufacture of mechanical components that can regularly suffer shocks and rapid wear, when 3D printed, this material presents points that we should pay attention to:

Freedom of design: According to SGL Group, 3D printing with carbon allows for free-form surfaces. Parts designed this way are used with optimal function without compromising manufacturing constraints.

Cost: When the materials are made of carbon fiber and binder, there is a material built into the carbon fiber that makes it a composite material. Moreover, the more carbon fiber in the reel, the more the final piece will have the properties of the material and the higher the cost will be.

Association with other materials: carbon is also easy to print when combined with PLA.

Finally, it can be used **to print more complex pieces**. Indeed, by printing it, it is possible to control the alignment of the fibers, which makes the final part more solid.

Carbon used for more complex parts

Researchers at the **Lawrence Livermore National Laboratory** (LLNL) have been able to produce more complex pieces using the **Direct Ink Writing** (DIW) technique. This process solely requires a liquid substance of carbon fibers.

The **LLNL** has come up with a chemical formula that can harden the material in seconds instead of hours. With the help of computer scientists in the laboratory, they were able to analyze the flow of carbon filaments.

Analyst Yuliya Kanarska explains that they developed a numerical code that allowed them to model 3D fibers under different printing conditions. They were able to find the optimum length of the fiber and its performance. However, further research is needed to find the best possible alignment of the fibers by applying magnetic forces.

For **Jim Lewicki**, the researcher in charge of the project, this material is probably the best among those available on the market.

Crea 3D Printing

New

Behind the scenes of Black Panther: 3D printed clothing

New

4000 $ 3D printed homes: a project that comes to life

You will not look like a “dork” with Loop’s 3D printed earplugs

4000 $ 3D printed homes: a project that comes to life

Building a house does not only require a very important financial investment, but also time and a skilled labour force. Everyone cannot afford such an investment. Even with the advancement of technological innovations including 3D printing, only a certain social class can afford it. ICON, an Austin-based start-up (USA) specializing in construction, wants to change the game. The company joins New Story project, an NGO that aims to help communities in need.

$ 4000 is the estimated price of a 3D printed house. However, it should be noted that New Story and ICON aim to 3D print a house for underserved families.

In order to undertake this project under transparent conditions, New Story explains in 3 steps the process: once a donation is made, the donor first meets the family to which he/she allows to have a home. Partnerships are thereafter carried out with local partners to take decisions about the construction and lastly a video of the built house is sent as proof to the donor.

How ICON 3D prints a house

ICON's idea is to build a house that will serve as a representation of sustainability, affordability, and customizability. The construction company achieves its goal by using a 3D printer called the **Vulcan**.

The device can work under difficult conditions such as the ones in **Haiti** and rural **El Salvador** where power can be unpredictable, potable water is not a guarantee and technical assistance is sparse. Indeed, the portable printer can work with almost zero waste and does not require a big workforce.

Human resources however involve the presence of a specialized workforce in new technologies: engineering, materials science, robotics or software development.

For **Jason Ballard,** co-founder of ICON, *"Conventional construction methods have many baked-in drawbacks and problems that we've taken for granted for so long that we forgot how to imagine any alternative. With 3D printing, you do not only have a continuous thermal envelope, high thermal mass, and near zero-waste, but you also have speed, a much broader design palette [and] next-level resiliency."*

Companies that helped in the development of the Vulcan 3D printer are **Pump Studios, Yaskawa Electric, Alchemy Builders, TreeHouse, Andrew Logan Architecture, Linestar Automation and the University of Texas.**

The long-term goal

The goal of New Story is to print a series of homes in the next 18 months for underserved families. Housing will include cutting-edge materials tested to the most recognized standards of safety, comfort and resiliency.

The more partnerships will increase, the more other communities may be helped.

You will not look like a "dork" with Loop's 3D printed earplugs

According to the World Health Organization, one out of three young adults risk hearing damage due to loud music at concerts, events and clubs. Despite frequent awareness campaigns, only 15% wear earplugs. Loop takes on tinnitus by making earplugs amazing.

Maarten Bodewes and Dimitri O both suffered in the past from hearing damage after a night of clubbing. Their wish to prevent hearing loss gives life to Loop. The company based in Antwerp (Belgium), has recently launched a new earplug for music. The device has been developed in collaboration with Dynamic Ear Company, specialist in hearing protection and 3D Systems for the manufacturing process. They used Comply's services for comfort and fit.

In addition to be stylish, the earplug enables to reduce decibels by combining an acoustic channel and filter for natural sound in eight hot colors. Loop's co-founders do not want wearers look like "dorks".

After testing 25 earplugs…

After testing over 25 earplugs, both friends did not find the one that would meet the best their criteria. *«When going out, I want to enjoy the atmosphere,»* says **Maarten**. *«Most earplugs distort the music, are uncomfortable—not to mention downright ugly.»* The only solution remained to create theirs.

The importance of the shape

A good earplug must be comfortable, hence the importance of the design. It goes without saying that it must fit the shape of the interior of the ear which is round. Loop's efforts resulted in a high-fidelity earplug for music that is discreet, *"yet nothing like what is available in grandma's drugstore"*.

Acoustic

The earplug integrates an acoustic filter that reduces the volume by 20 decibels. *«It's the perfect balance between protection and experience,»* says **Dimitri**. Acoustic experts that worked on the project took into consideration that each ear is unique. Therefore, the product also integrates in its package memory foam that adjusts to the user's ear as well as soft silicone ear tips in two sizes.

According to the co-founders, who have certainly already tested their product, *"the earplugs stay put while dancing at your favorite club or concert and are easy to insert and remove."*

3D Printing

Even though we know the earplug has been 3D printed using 3D Systems' services, no information has been released yet regarding the technique used.

BEHIND THE SCENES OF BLACK PANTHER: 3D PRINTED CLOTHING

You have probably come across the excitement about Marvel's latest superhero movie, Black Panter.

The movie tells the story of **Wakanda**, an African country which is incredibly technologically advanced, but due to its isolation from the rest of the world, it has kept deep roots with its African culture. To portray a community that is both technologically advanced and attached to its African culture, every detail needed to be considered: the environment, the languages, clothing, etc. everything.

As far as clothing is concerned, it seems that only 3D printing could enable to achieve this mix between tradition and modernity.

Between tradition and hypermodernity

The aim of Head Costume Designer **Ruth E. Carter** was to bring **the perfect mix between traditional African designs and the futuristic elements of the developed Wakanda community**. She therefore approached Julia Koerner, a designer specialized in 3D-printed wearables.

"In the case of T'Challa's mother, Queen Ramonda, the answer to the puzzle lay in 3D Printing." For **Carter**, Ramonda's crown should look like the traditional crowns worn by married Zulu women and 3D printing enables to bring the futuristic touch that made it look **"Wakanda"**.

So, our designer firstly digitally created a design which blends these two ideas, thereafter took advantage of **Materialise**' service for the manufacturing part.

As far as the manufacturing is concerned, 3D printing expert chose Laser Sintering technology and the Polyamide 12 powder. As a reminder, laser Sintering is a 3D printing technology where a part is produced by melting together a layer of powder particles with a laser.

Images - ©Marvel Studios 2018

"Once the first layer is done, a second layer is added and so on, until the part has been completely built up. When using Polyamide 12, the resulting parts tend to be sturdy and stiff, making it (at first glance) an unusual choice of material for a design which required a degree of flexibility."

However, the company explained that the end results

of a 3D-printed part are just as dependent on the design as on the material and technology. Julia then came up with a structure that was designed in the extent that it enables the flexibility of the laser-sintered polyamide.

The resulting pieces were supple enough to be worn comfortably by **Angela Bassett**, the actress playing Queen Ramonda, and stiff enough to retain their shape and maintain that imposing royal bearing.

Images - ©Marvel Studios 2018

OCTOBER 71: 3D PRINTED GLASSES "MADE IN FRANCE"

In an era where the consumer becomes more and more demanding, where he/she wonders about the quality and origin of the products consumed, brands increasingly prefer the "home-made". This was the goal for French start-up, October 71, when it unveiled its brand of 3D printed glasses.

Damien Fourgeaud, **Noel Reynard** and **Christophe Mouty** promote products "Made in France". Respectively designer, 3D graphic designer and engineer in the optical sector, the three partners present the spring-summer collection of their ultralight glasses. Solid and comfortable, they choose to manufacture them using 3D printing.

The "home-made"

"Today, the majority of glasses sold in France are made in low-cost Asian countries. It was while trying to reverse this trend that I turned to the new possibilities offered by 3D printing," explains **Christophe Moutv**, founder of October 71.

After two years of testing, the glasses of October 71 come to life with the help of well-known partner, **Sculpteo**, a provider of 3D printing services. Manufactured in the Parisian factory of the specialist of 3D printing, these glasses with a nice design are manufactured with the technique of **powder sintering (SLS) and polyamide**. They are almost 30% lighter than glasses made of plastic or acetate.

With regards to timing, this process allows the manufacturing of quality products in a short amount of time. For October 71, 3D printing is not only fast but also qualitative.

For a price between **89 and 129 euros**, the glasses of October 71 are for the moment available via the website of the company or the marketplace of ELLE magazine. We are already preparing for spring!

re:3D Inc: A dream come true?

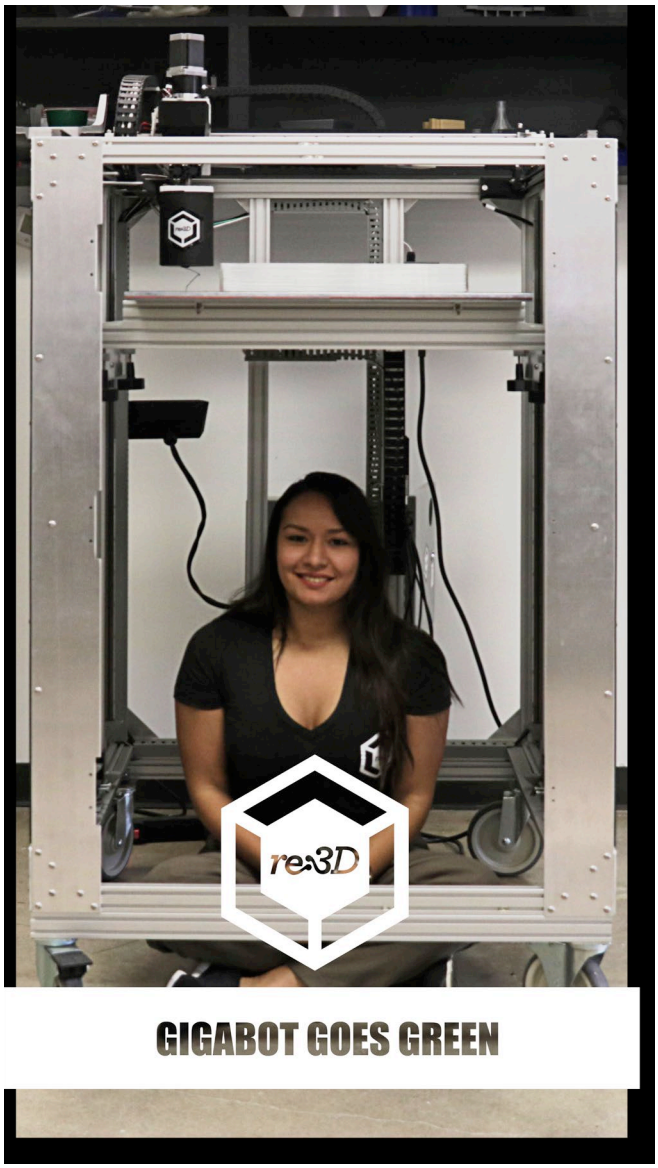
Innovation is essential to any business. Especially in a market where opportunities are constantly being explored. For a company to grow, creativity must be encouraged throughout the company. Innovation is how businesses and markets start. Without innovation, how else would the end consumer wear 3D printed clothing? Drive a 3D printed car? ...All of this requires the need of specific 3D printers. That's why re:3D offers the market Gigabot X, a large-scale 3D printer ...

re:3D is a start-up with the full intentions of "encouraging the spread of 3D printing and supporting the diverse ideas for 3D printing applications." re:3D's audience is composed of speciality manufacturers, engineers, designers, universities and amateurs of this growing industry.

What is particularly unique about this product is that it is a human-scale printer that can be used with reclaimed plastic.

Gigabot: Breaking expected limitations

The Gigabot is the foundation for the other products to be released. The company released the first Gigabot in 2013 and has participated in several accelerators.



This year, it renews the experience by launching a Kickstarter campaign to develop its product.

Gigabot X is currently breaking the limitations of 3D printing. The flagship's key strength is its large format at an affordable price. The 3D printer has the ability to print objects up to 30x larger than the desktop models currently competing in the market, 17 times faster and costs about 10 times less than the printers' alternatives. The printer works by first "accepting the pelletized plastic which is pulled own from a hopper, pushed through the heated barrel and is then extruded through a very small nozzle."

Many steps and precautions have been taken into account to achieve the 3D printer. The first step was the focus on direct pellet extrusion. This focus was very important as it yields many benefits, such as direct pellet extrusion allowing faster printing. Such a technique is usually used in larger manufacturing systems and is quite costly. With this in mind, re:3D bridges the gap between the cost of the procedure and the size of the printer. The mindset of re:3D is to enable the Gigabot's users to purchase "this printer knowing that in the future this is still going to be the necessary printing tool," says Co-Founder and Head

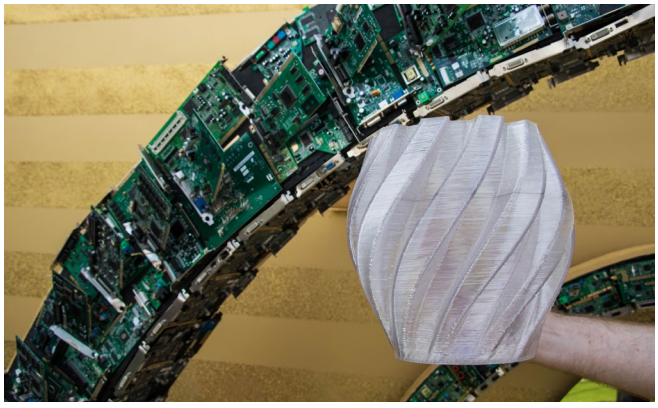
of Technology, Matthew Fiedler.

Furthermore, the creation of this product stems from the limitations within the 3D printing industry: cost, printer size, its speed and access to input material. re:3D addresses these issues by creating the technology that is on the larger scale and affordable for profesisonals.

Going green

The revolutionised printer can be modified to fit your needs and can be quickly cleaned. Furthermore, it is easy to change the filaments.

Sustainability is quite complex. Organisations struggle to find the balance between satisfying the needs and wants of customers while performing societal duties. Others struggle to understand the importance of a sustainable business practice. re:3D invites us to a sustainable & locally driven manufacturing. The young company makes it a point to have minimal negative impact on the environment – whether it be on a local or global scale. This point should be noted as it can be potentially greener than the traditional competition within the market. Such an added value can be beneficial for partners, customers and the environment.



re:3D Inc relies on reducing costs and how to break the expected limitations within the 3D printing industry. The company is currently in the testing phase and is continuously engaging and collaborating with the open-source community.

Contributions for the Kickstarter campaign close in April but the team will be continuously busy with other phases of the Gigabot X in the upcoming months. Designs are to be finalised in May-June as well as packaging and shipping protocol developments. Gigabot X will be assembled in July-August and finally built in September. Extensive testing will be carried out in October and finally the Gigabot X shipment will be scheduled in November 2018 for the world's first users.

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BY 3D ADEPT MEDIA

THROUGH THIS SPECIALIZED MAGAZINE FOLLOW THE EVER-GROWING EVOLUTION OF 3D PRINTING TECHNOLOGY IN VARIOUS SECTORS.

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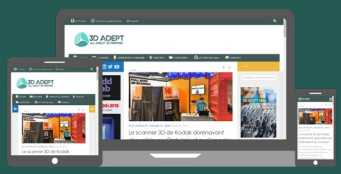

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