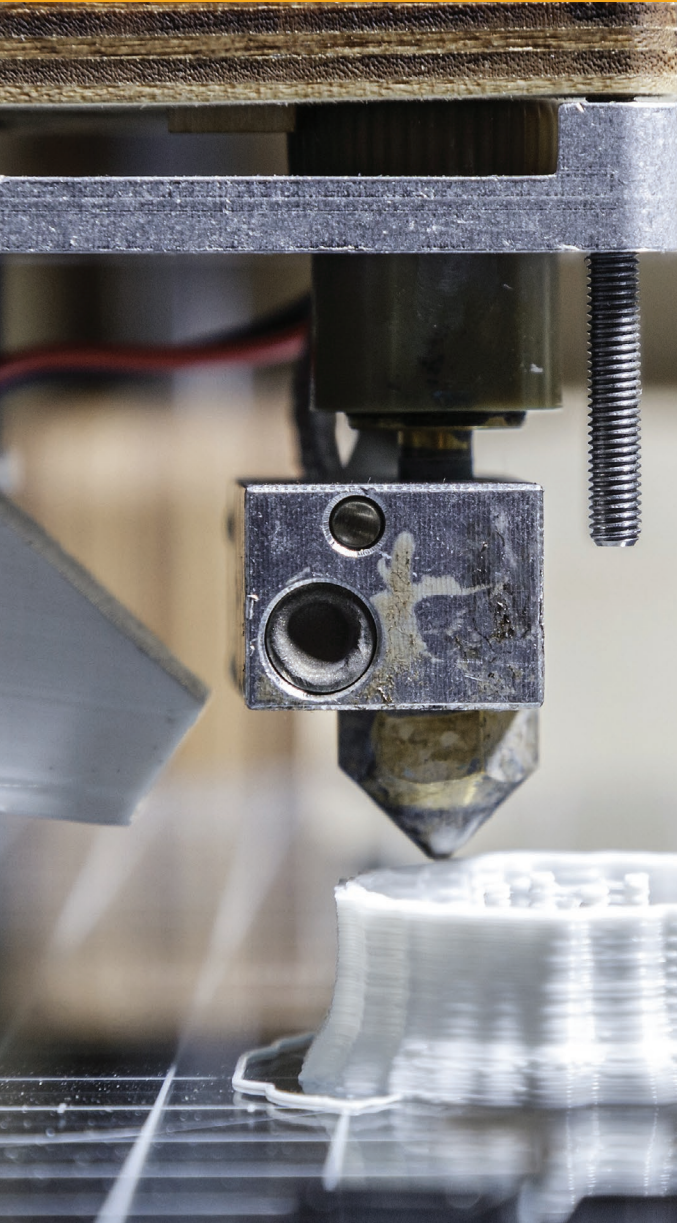


3D PRINTING - A FAST-MOVING MARKET



# Developments in 3D Printing

## A Sector by Sector Overview

This report explores developments in 3D printing across several sectors and categories for the quarterly period of July 15, 2019 to September 15, 2019.



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## General

### **Nefilatek plans to convert Montreal waste into 3D printing filament**

Nefilatek wants to take waste materials and make 3D printing filament out of them. There are other laudable 3D printing initiatives out there already, including turning weed containers into limbs, taking HP MJF powder and turning it into filament, closed-loop systems and recycling PLA. Several firms now take PET or rPET and turn it into filament. Nefilatek's angle is to turn to collected industrial waste materials and to turn those into filaments. The Montreal-based firm is buying recycled HIPS and ABD from Quebec based recycling center Exxel Polymer and is using them to make filaments. Much of the industrial polymer materials worldwide is recycled already. Commercial recycling firms are available that trade in regrind ABS, PC, and many other materials worldwide. These polymers are offered for sale all over the globe.

### **Desktop FDM 3D printed shape memory polymers create QR codes**

In the recently published 'Additive Manufacturing of Information Carriers Based on Shape Memory Polyester Urethane,' a team of researchers explored more in the 4D printing realm. Shape memory polymers are becoming more and more useful today as they can respond to their environment, whether in terms of temperature or moisture and can be 3D printed in complex geometries. For this research, thermoresponsive polyurethane-based SMPs are printed using FDM (also called FFF) 3D printing, which has been relatively rare in research so far. The team created two sample designs for their study: one in the form of a QR code reading Fraunhofer IAP and the other a cylindrical granulate grain.

### **Virginia Tech introduce 3D printing device with crowdsourced data-based creation process**

Researchers and companies are continuing to improve upon the technology's speed and power making the world even closer to the vision of the Star Trek universe. At the recent ACM SIGGRAPH 2019, held in Los Angeles, an interdisciplinary team of Virginia Tech faculty and students displayed Source Form, a standalone 3D printing device that creates objects from crowdsourced data, based on a user's request rather than an existing 3D model. The project's main support came from the university's Institute for Creativity, Arts and Technology (ICAT), the VT School of Visual Arts and two awards from the National Science Foundation (NSF). Source Form works independently of subjective user input, using only crowdsourced data as input. The model is automatically sent to an embedded mask projection vat photopolymerization 3D printer for "immediate fabrication and retrieval." The machine's top screen shows images of the retrieved crowdsourced photos and photogrammetry, while the bottom screen shows the final object's layers during the print job.

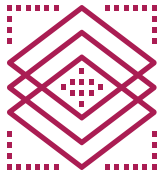


**Dutch design company Freshfiber launches new collection of 3D-printed nylon lamps**

Dutch lifestyle brand and design label Freshfiber, which has developed 3D printing products in the past, launched a new collection of 3D printed lighting. The unique lighting collection consists of three different lamp designs: the Fold, the Flux and the ZooM, all of which are 3D printed and hand-finished. To create the premium collection, Freshfiber married modern 3D printing methods with delicate designs and high-quality materials.

**Students 3D print redesigned heat sinks in GE-sponsored competition**

As the demand for personal devices increases, so too does the need for increasingly sophisticated and effective heat sinks, which help to regulate the temperature of electronic devices. Metal additive manufacturing could offer a viable way forward to improve existing heat sink designs, resulting in more compact and efficient components. Teams from Arizona State University, Purdue University, the University of Maryland, Trinity College Dublin and Pennsylvania State University each submitted their own proposed 3D printed designs at the 18th Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems.



## Materials

**University of Manchester develops 2D material MXene ink to 3D print supercapacitors**

Researchers at the University of Manchester have for the first time demonstrated the possibility of 3D printing freestanding objects with 2D material MXene. As the first study on the 3D printability of MXene, the team has developed an aqueous ink for extrusion of the material. MXene electrodes 3D printed are shown by experiments to have high capacitance and energy density. The electrodes can be used in energy storage devices such as supercapacitors. 2D materials are also known as single-layered materials. When crystals are thinned down to one atom thick, unique physical and chemical properties emerge. The world's first 2D material is graphene, discovered at the University of Manchester. While flexible, transparent and million times thinner than a human hair, graphene is also more conductive than copper and much stronger than steel.

**Researchers 3D print mother-of-pearl-inspired composite material**

Mother of pearl or nacre, the incandescent interior of mollusk shells, is highly prized in jewelry and one of the toughest natural materials on the planet. The material's resilience has made it of particular interest to a research group at the Viterbi School of Engineering at the University of Southern California, which created a 3D printed replica of the natural material. The research breakthrough, conducted through the Daniel J. Epstein Department of Industrial and Systems Engineering and the Center for Advanced Manufacturing, could lead to advancements in the development of new responsive smart materials and safety devices, including helmets and armor for both sporting and military use. Another area of interest for the 3D printed material is in the biomedical field, where it could be used for smart wearable devices.

**Materialise becomes first to offer BASF TPU material for HP Multi Jet Fusion 3D printing**

Belgian software and 3D printing service provider Materialise is expanding its portfolio of 3D printing materials with the inclusion of the Ultrasint thermoplastic polyurethane (TPU) 01 from German chemical company BASF. This new material is designed for HP's new Multi Jet Fusion (MJF) 5200 Series of 3D printers. Materialise is reportedly the first company to make BASF's new TPU powder available through its online platforms Materialise OnSite and i.materialise, as well as its offline prototyping and manufacturing services.

**Printing Techniques & Capabilities****Berkeley Scientists 3D print a liquid magnetic device**

Scientists from the Department of Energy's Lawrence Berkeley National Laboratory used a modified 3D printer to create a magnetic device out of liquids, forming liquid structures from ferrofluids. The team put one-millimeter droplets containing iron-oxide nanoparticles into a magnetic solution to make the device. It's thought this breakthrough could be used in applications such as 3D printing artificial cells to deliver targeted therapies to diseased cells or creating flexible liquid robots that can adapt to their surroundings.

**Engineers succeed at 3D printing sensors embedded inside robots but find materials need improving**

Robotics researchers at the University of California San Diego have for the first time used a commercial 3D printer to embed complex sensors inside robotic limbs and grippers. But they found materials commercially available for 3D printing still need to be improved before the robots can be fully functional. One of the main roadblocks is the development of effective sensors for soft robots, due to the fact that flexible robots often have complex surfaces and movements that are difficult to equip and cover with sensors made with traditional manufacturing techniques. These types of robots are more flexible than their rigid cousins and can safely work side by side with humans.

**Georgia Tech researchers 3D print ant-sized, vibration-powered robots**

Researchers from Georgia Tech developed tiny, 3D printed robots measuring about two millimeters in length that use micro bristle technology and vibrations to move around. The tiny bots, produced using two-photon polymerization lithography, could have diverse applications, including detecting environmental changes and repairing injuries inside the human body. The small robots, referred to as "micro-bristle-bots," are about the size of the world's smallest ant and have been designed to harness vibrations from piezoelectric actuators, ultrasound sources or small speakers to move around. The research team is also developing steering capabilities for the micro-bots by joining two slightly different micro-bristle bots together.

**German scientists explore HelixJet plasma manufacturing process**

Researchers from the U.K. and Germany are exploring a new angle with the HelixJet, a capacitively coupled radio frequency plasma with a double-helix electrode configuration. The researchers compare laser sintering (LS) with their new method of melting powder for digital fabrication via the use of a plasma jet, using filaments that are helically shaped and able to rotate according to angle or ‘helicity’ of materials.

**Bally Ribbon Mills masters 3D weaving to create lightweight, complex structures**

After taking on a research contract from the U.S. Air Force Research Laboratory in 1991, the development team at Pennsylvania’s Bally Ribbon Mills began to explore and master 3D weaving, producing structures helpful in applications such as aerospace, automotive, construction, the military and further applications. The process allows users to create one-piece structures that are strong and complex and can be created with much lighter weight, making such pieces attractive to the aerospace industry as every pound eliminated can save fuel cost up to a staggering \$1 million, including other operating costs too.

**Singapore researchers develop a rapid, low-cost method to 3D print microfluidic devices**

Current 3D printed microfluidics are limited by multiple factors, such as available materials for 3D printing (e.g. optical transparency, flexibility, biocompatibility), achievable dimensions of microchannels by commercial 3D printers, integration of 3D printed microfluidics with functional materials or substrates. Researchers from Singapore University of Technology and Design have circumvented these limitations by developing a novel method that combines direct ink wiring a 3D printer with prefabricated substrates to create microfluidic devices that can be rapidly integrated with functional components

**M&A and Investments****Fortify closes \$10M Series A funding led by Accel**

Fortify, which is known for their next-generation composites and Digital Composite Technology, has just completed a \$10M Series A funding led by Accel. The Boston-headquartered additive manufacturing startup also received funding from Neotribe, Prelude Ventures and Mainspring Capital Partners. Following a previous seed round this year also, yielding \$2.5M, this latest funding will support the Fortify’s Discovery Partner Program and further growth of the Fortify team as they continue to create technology to be used in applications like aerospace, manufacturing, and automotive, with end-use parts in electrical connectors, impellers, mixers and specialty drones. Fortify is known for their use of magnetics (Fluxprint technology) and digital light processing 3D printing, allowing them to fabricate parts made with composites and imbued with high-performance mechanical properties.

**Axial3D raises \$3M to expand 3D printing in U.S. healthcare**

U.K.-based medical technology firm Axial3D closed a \$3 million funding round to extend its 3D printing software and services in healthcare across the U.S. The company will focus on expanding its machine learning team to develop automated algorithms that make access to medical 3D printing easier for hospitals. The round was led by London-based Imprimatur Capital Fund Management, including a U.S. investment consortium of surgical angel investors, Tallahassee Memorial Healthcare and previous investors Techstart Ventures, Clarendon Fund Managers and Innovation Ulster Ltd.

**CELLINK to acquire German startup cytena for €30M**

Bioprinting company CELLINK entered into an agreement with the owners of life science company cytena, of Germany, to acquire all of the company shares for a purchase price of \$33.8 million in cash and stock. With the acquisition of cytena, CELLINK could extend its growth phase and, although it is already a leading player in the bioprinting business, there's a wide variety of other smaller companies that could be acquired attractively and add to its growth. Through cytena's complimentary technology offering, CELLINK sees great synergies that will support and accelerate their future growth. cytena customers and partners will obtain benefits in the extended product offering and a stronger global presence.

**Redefine meat raises \$6M for 3D printed meat alternatives**

Redefine Meat, the Israeli company developing technology to 3D print plant-based meat, has raised a \$6 million seed round led by CPT Capital with participation by Hanaco Ventures, angel investors and German poultry company The PHW Group. The startup will use its new capital to finalize its alternative meat 3D printer and ensure it hits its timeline release goal of 2020, when it plans to begin selling its 3D printer and corresponding ingredient packs to a handful of meat processing partners and restaurants.

**Novameat raises funds to 3D-print meat replacements**

Novameat, a Spanish food startup wanting to bring plant-based meat alternatives to the public, has gotten an investment from New Crop Capital to bring its 3D printed plant-based steaks to market. In 2018, the startup made the first 3D printed plant-based "beefsteak" in the world. Now, it's going to use the funding to help with the development of other plant-based proteins. The company said it has a new technology that can replicate the texture and appearance of fibrous meats like fish and chicken. Novameat is trying to move the market forward because, while plant-based ground meat is the norm, the fibrous nature of meat cuts hasn't been as easy to replicate.



## Miscellaneous Partnerships

### **Betatype and nTopology use metal 3D printing and intelligent design to increase productivity**

3D printing consultancy company Betatype specializes in optimizing metal AM production applications to deliver functional components for customers in multiple industries, including consumer goods, automotive and medical. The London-based company published a new case study explaining how it teamed up with software company nTopology to create and manufacture a functionally optimized, 3D printed part for a rocket nozzle. Betatype recognizes collaborating with companies in industrial sectors, as well as the AM industry, can help produce better project results, with higher standards, than companies working alone can sometimes manage. Its recent partnership with nTopology is a perfect example of how collaboration was able to increase productivity in metal 3D printing.

### **axial3D to launch in-house 3D print lab at Newcastle Hospitals**

U.K.-based company axial3D, which aims to assist the healthcare sector to adopt 3D printing technologies, will work with the Orthopaedic and Spinal Surgeons at Newcastle Hospitals NHS Foundation Trust. axial3D will provide a point-of-care 3D print lab to serve Newcastle Hospitals and produce patient-specific 3D printed models to improve patient care and surgical planning.

### **Aidro Hydraulics and EOS highlighting AM processes for the oil and gas industry**

In a recent collaboration involving the realm of oil and gas, Italy's Aidro Hydraulics and 3D Printing and EOS are working to raise awareness regarding the benefits of additive manufacturing. Aidro recently expanded their services to oil and gas due to the need for production of valves, heat exchangers and spare parts. Currently, their goal is to create guidelines and standards for qualifying AM metallic parts to use in petroleum and natural gas. The two companies have signed a letter of intent regarding their "common approach to the oil and gas industry in Italy and on a global scale."





## Auto & Transportation

### **Specialized and Carbon use 3D-printing and liquid polymer to make a more comfortable bike saddle**

Specialized unveiled a new technique for designing and building bike seats it claims will change the bicycle seat manufacturing industry. Using a process called Digital Light Synthesis, Specialized has developed Mirror Technology, a material that is far more tunable and versatile than traditional foam padding. The DLS process, which was created by Carbon, allows designers to use liquid polymers to 3D print the complex lattice structure that makes Mirror Technology unique. This has the added benefit of greatly speeding up the development time for Specialized designers, allowing them to produce 70 different saddle designs in a single year.

### **Signal failure? AECOM's 3D printed graphene could fix that**

American multinational engineering firm AECOM is applying 3D printing to the modernization of transport networks. Currently testing at Bristol Parkway signalling training school in southwest England, CNCTArch is a thin, lightweight bridge proposed by the company as an alternative means of installing new, digital signalling equipment. With this 3D printed structure, the company can potentially cut time required to conduct railway upgrades, reducing downtime and, importantly, the resulting delays and disruptions to journeys on public transport.

### **VSHAPER 3D printer used in fabrication of underwater scooter prototype**

Polish 3D printer manufacturer Verashape is using its VSHAPER 3D printing technology to help create an underwater scooter that can float. Rzeszów-based company B-4 Association is working with Verashape to manufacture a scooter prototype of the underwater device. The use of 3D printing in the design process allowed creation of a solution that would have been much more difficult to fabricate with traditional forms of manufacturing. The scooter has a patented immersed motor and is both comfortable and safe for even the most demanding of dives. Plenty of famous divers have helped test the underwater scooters by exploring shipwrecks and caves in both fresh and salt water.



## Aviation & Aerospace

### **NASA funds demonstration to 3D print spacecraft parts in space**

After 3D printing over 200 astronaut tools and devices from a manufacturing unit aboard the ISS, Made In Space received a \$73.7 million contract to explore 3D printing a small spacecraft in orbit. NASA is currently betting on 3D-printing and self-assembly technology being ready for as early as 2022. The contract will fund a test of a small spacecraft, called Archinaut One, in low-Earth orbit. If successful, the technology will be a game-changer for space exploration, allowing companies and governments to construct complex structures in orbit and reduce the need for astronauts to do spacewalks for repairs.



**Tyvak, SWISSto12 to 3D-Print mini-GEO satellites**

Terran Orbital subsidiary Tyvak Nano-Satellite Systems partnered with 3D-printed telecommunications equipment provider SWISSto12 to manufacture mini-GEO satellites. Tyvak will provide mission operations, platform and payload expertise. SWISSto12 will contribute end-to-end telecom payload and 3-D printed RF products. With both companies' engineering teams from Europe and the U.S. working together, the partners will aim to deliver low-cost, customized mini-GEO satellites covering frequency bands from X-band to Ka-band and Q/V bands.

**Roscosmos confirms plans to 3D print lunar shelters from moon dust**

Russian space corporation Roscosmos confirmed plans to support long-term lunar missions by 3D printing a structure made from on-site material. Seemingly the best option for such directives, the declaration adds to plans made by NASA and the European Space Agency that also intend to use Lunar Martian regolith as source material for 3D printers on the Moon and Mars. According to Roscosmos Chief Dmitry Rogozin, Russian cosmonauts will land on the Moon for the first time in 2030.

**Health & Life Sciences****ETH researchers 3D print silicone heart valves**

Scientists at ETH Zurich and the South African company Strait Access Technologies are using 3D printing to produce custom-made artificial silicone heart valves. This could help meet an aging population's growing demand for replacement heart valves. Initial tests have produced promising results for the new valve's function. The material scientists' goal is to extend the life of these replacement valves to 10 to 15 years. It only takes about an hour and a half for researchers to produce a valve with a 3D printer.

**Chinese researchers 3D print peripheral nerves for complex study using enhanced staining**

Researchers are using 3D printing for nerve reconstruction, learning more about how nerves work both functionally and internally in a peripheral capacity. They outlined their methods and results in the recently published "An enhanced staining method K-B-2R staining for three-dimensional nerve reconstruction." The researchers found with this method, it took much less time for processing and adjustment and partition results were almost just like true nerve fascicles, making the technique better over alternative approaches.

**FluidForm & Carnegie Mellon: closer than ever to bioprinting a human heart**

With a collaboration between startup FluidForm and Carnegie Mellon University, scientists may be getting closer to bioprinting a human heart. Findings on the subject were published recently in the Aug. 2nd edition of Science regarding work by the Carnegie Mellon University research team and the nine members of the Carnegie Mellon team. They have just developed an advanced version of Freeform Reversible Embedding of Suspended Hydrogels (FRESH) technology, which allows them to 3D print collagen. With these new advancements, scientists can fabricate cardiac components, including tiny blood vessels, valves and beating ventricles.

**The International Space Station has a new partner in regenerative medicine**

A research alliance between the ISS and the University of Pittsburgh's McGowan Institute for Regenerative Medicine aims to potentially advance biomedical products in space in order to benefit human health on Earth and discoveries in space-based science. The new partnership will evoke the principles of microgravity and its effect on regenerative medicine-based therapies as research moves to the orbiting laboratory and scientists continue to experiment with 3D printing in space.

**3D Printing therapeutic proteins with a new bioink by Texas A&M engineering team**

A Texas A&M University team of researchers developed a 3D printable hydrogel bioink containing mineral nanoparticles that can deliver protein therapeutics to control cell behavior. TAMU researchers led by Akhilesh Gaharwar, an assistant professor in the Department of Biomedical Engineering, came up with an innovative way to design biologically active inks that control and direct cell behavior and can be used to engineer 3D vascularized tissue structure for regenerative medicine. The team has designed a new class of hydrogel bioinks (3D structures that can absorb and retain considerable amounts of water) loaded with therapeutic proteins made from an inert polymer: polyethylene glycol (PEG).

**Harvard researchers develop SWIFT method to 3D print organ building blocks**

Researchers from Harvard University's Wyss Institute developed a novel sacrificial ink-writing technique called SWIFT (sacrificial writing into functional tissue) to 3D print large, vascularized human organ building blocks. Demonstrating its method, the team created cardiac tissue that fuses and beats synchronously over a seven-day period. This enables the rapid assembly of perfusable patient and organ-specific tissues at therapeutic scales.

**UW Medicine, VA partner on 3D-print models for heart care**

The University of Washington School of Medicine and VA Puget Sound Health Care System today announced a two-year partnership to develop new uses of 3D printing to aid in the diagnosis and treatment of complex heart conditions. The collaboration is expected to help cardiologists better visualize the complex anatomy unique to each patient and improve access to, and outcomes for, new minimally invasive treatments.



## Manufacturing & Construction

### **Austin groups 3D-print tiny homes to help end homelessness**

Community First Village, run by Mobile Loaves and Fishes to provide permanent, personal housing and services for homeless people in Austin, has partnered with Austin-based Icon and Cielo property group to open the second phase of its development with a 3D-printed prototype house that will serve as a welcome center for the community. The 500-square-foot building took a total of 27 hours to print. Phase II adds 24 acres to the northeast Austin development, bringing the entire property to 51 total acres. When completed and at full capacity, Community First will have space for around 480 formerly homeless people.

### **GrapheneCA MoU sets sights on disrupting construction industry with 3D Printer**

GrapheneCA, a commercial scale graphene producer and developer of graphene-based technology for industries and consumers, announced it has signed a memorandum of understanding with Apis Cor to develop a 3D printing system capable of printing graphene materials. GrapheneCA and its partner Apis Cor, a developer of specialized concrete 3D printing equipment, are discussing a future co-operation in which GrapheneCA will design an extruder and mixing system that can be embedded into Apis Cor's 3D printer. Together, the two companies are expecting to develop a 3D printing system capable of printing graphene material.

### **3D printing in construction: French startup XtreeE will have new facility in Dubai**

French startup XtreeE continues to be a presence in the construction industry with the introduction of 3D printing on the large scale and now a new production unit in Dubai, United Arab Emirates. The opening of this second site comes on the heels of the XtreeE plant in Paris, as the dynamic company forges ahead in their mission to create a worldwide network of over 50 connected 3D printing units by 2025. Local partner Concreative will be in charge of operations at the Dubai facility while using XtreeE technology. XtreeE caters to clients in architectural elements, infrastructure and interior and exterior furniture.

### **Makerbot launches Method X, brings real ABS 3D printing to manufacturing**

MakerBot, a global leader in 3D printing, has launched METHOD X, a manufacturing workstation engineered to challenge traditional manufacturing with real ABS (acrylonitrile butadiene styrene) material, a 100°C chamber and Stratasys SR-30 soluble supports to deliver exceptional dimensional accuracy and precision for complex, durable parts. METHOD X is capable of printing real ABS that can withstand up to 15°C higher temperatures, is up to 26% more rigid and up to 12% stronger than modified ABS formulations used on desktop 3D printer competitors. Real ABS parts printed on METHOD X have no warping or cracking that typically occurs when printing modified ABS on desktop platforms without heated chambers.





## Clothing & Wearables

### **LIMB-Art teams up with Design Reality to 3D print prosthetic leg covers**

Prosthetic leg cover design firm LIMB-Art is harnessing 3D printing to produce its products through service provider Design Reality. LIMB-Art and Design Reality are both based in North Wales and, working together, are leveraging the capabilities of HP's Multi Jet Fusion 4200 platform to create custom prostheses covers quickly and cost-effectively. Using a robust and durable thermoplastic material on the HP 3D printing platform is said to enhance the quality of LIMB-Art's products and, by recycling the unused powder, the company is also able to do its bit for the environment.

### **Annie Foo shoe design relies on 3D printing for Bespoke styles**

The Annie Foo Design company is embracing 3D printing through HP Multi Jet Fusion 4200, seeing the use of 3D printing in design as "just getting started." Employing the benefits of 3D printing allows for faster turnaround in the product, greater affordability and better customization, Annie Foo also believes in fighting waste overall.

### **Stratasys and threeASFOUR Debut NYFW Collection, featuring a dress with elements 3D printed directly on the fabric**

As is the case with many other industries, from aerospace and medical to automotive and military, 3D printing has been infiltrating the world of fashion. New York design firm threeASFOUR, previously founded an avant garde fashion label often using 3D printing, has teamed up again with its collaborator Stratasys to develop the first high fashion garment with elements directly printed onto the fabric itself. The Chro-Morpho collection, introduced at the firm's fall/winter runway show, shows that 3D printing on clothing has commercial potential. For example, its Greta-Oto dress from the collection uses a lenticular effect, engineered by Stratasys, to play with both color and light, spherical cells made of photopolymers the size of fish scales were 3D printed directly onto polyester, which causes the piece's color to shift each time it moves.



## Food

### **Oceanz working with Dutch association to explore food 3D printing**

Food 3D printing is not only limited to specialized startups and crowdfunding campaigns. A number of established companies in the 3D printing sector have also invested in the niche AM segment, including 3D Systems, Netherlands-based Oceanz, a professional 3D printing service, also stepped its toe into the emerging food 3D printing area, through a collaboration with Cooperative DOOR, an independent growers association for fruit and vegetables in Holland. The collaboration, first announced last year, aims to investigate the potential of 3D printing vegetables with the broader goal of reducing food waste. Around the globe, an estimated one-third of all food produced is wasted, a shocking statistic that has inspired members of the food industry and consumers to seek out innovative solutions. 3D printing has presented a possible avenue for curbing food waste.

### **‘Sushi Singularity’ restaurant 3D prints sushi based on dietary needs derived from customer bodily fluid sample analysis**

Sushi Singularity, a Tokyo restaurant slated to open in 2020, want its customers to send in samples of their bodily fluids two weeks prior to their actual reservation date so their meal can be tailored to their dietary needs. The restaurant is developed by Open Meals, a Japanese food tech company that’s looking to revolutionize the culinary world with the “digitization of food.” According to the company’s site, digitization of food is the natural next step in food production’s evolution, which started with fire, shifted to agriculture and then moved to preserved foods that were ultimately mass produced.

### **Juice bar uses 3D printed cup made from orange peels**

Circular juice bar developed by Italian design studio Carlo Ratti Associati is providing ecofriendly cups for its products. The system, which was created for Italy-based global energy company Eni, juices oranges and then turns the unused orange rind into 3D printed bioplastic cups. The machine, called Feel the Peel, is a prototype system that hopes to make one small part of our daily life more circular. Standing at 3.1 meters in height, Feel the Peel is a marvel in terms of design. Circular in its economy and in its structure, the juice bar’s domed roof is made up of 1,500 oranges, which automatically slide down into the squeezer when someone orders a cup of juice. Once the orange has been halved and juiced, the remaining orange peel is dumped into a transparent bin at the base of the machine. When the compartment is full, the rinds are dried and milled to create an orange powder which is then mixed with PLA to form a printable, bioplastic material.



## Education

### **PrintLab launches 3D printing learning platform for the Netherlands**

In early 2018, British 3D printing curriculum provider PrintLab set up its online PrintLab Classroom portal to give teachers a little help in coming up with creative lesson plans that integrate 3D printing into core classroom topics, like arts, computing, engineering, geography, languages, and science. The program is available in Polish and Greek, and accessible in Spanish in 2020.



## Environmental Efforts

### **Project PLA makes recycling and composting a reality in the U.S. for 3D printing users**

As the ongoing need for and conversation about recycling and saving the environment from plastic trash continues, the concern has expanded to the 3D printing industry, especially since polymers are so often used. While polylactic acid (made from corn starch), and commonly known as PLA, is often touted as a better choice due to its biodegradability, researchers are investigating its viability. Project PLA acts as a ‘middleman’ for collecting plastic from makers in the US, breaking it down, and then composting it at industrial sites. Project PLA also takes empty spools for recycling. They can be ‘tossed in with the PLA’ to be shipped, and then sorted and shipped for recycling. They also hope to be recycling ABS and PETG soon.

### **Singapore researchers 3D print beak for Great Hornbill at Jurong Bird Park**

While the medical field serves humans with a wide variety of new technologies and techniques, animals also need to be nursed back to good health for many reasons. A Great Hornbill at Jurong Bird Park was diagnosed with squamous cell carcinoma of the casque (or the bill). Researchers and veterinarians in Singapore began working together to create an artificial replacement.





## Arts & Entertainment

### **Ogle Models uses SLS 3D Printing to make a better tennis racket handle**

U.K. prototyping company Ogle Models has been in the business of making models and prototypes for over 65 years now, offering its manufacturing and 3D printing services to companies all around the world in a variety of industries. Its many 3D printing projects include making automotive parts for Formula Student racing and the Mars Rover prototype, creating business class airplane seats and telephone models and even 3D printing some elements for a sea drone that collects weather data. Racket painting, stringing and customizing specialist Unstrung Customs, which is based in London and Spain, was looking for a different way than traditional molding to adapt the grip size of their rackets. Their goals were to offer users a precision grip and a faster supply process. Ogle worked with Andrew Kelly of Skywide Design to create a weight-balanced, fully customizable tennis racket handle for Unstrung. They focused on accuracy and durability during the handle development process and used selective laser sintering (SLS) technology to help reach targets in weight and robustness.

### **Students' 3D-printed Concrete Choreography pillars provide a stage for dancers**

Dancers at the Origen Festival in the Swiss Alps will perform around nine unique, concrete columns 3D-printed by students from ETH Zurich. The masters students produced the columns using a new process, developed at the technology school, that allows for the fast 3D-printing of concrete structures completely without formwork or any other kind of mould. The Concrete Choreography structure series took less than two-and-a-half hours to print in the lab using an industrial robot arm that extrudes concrete in precise layers.