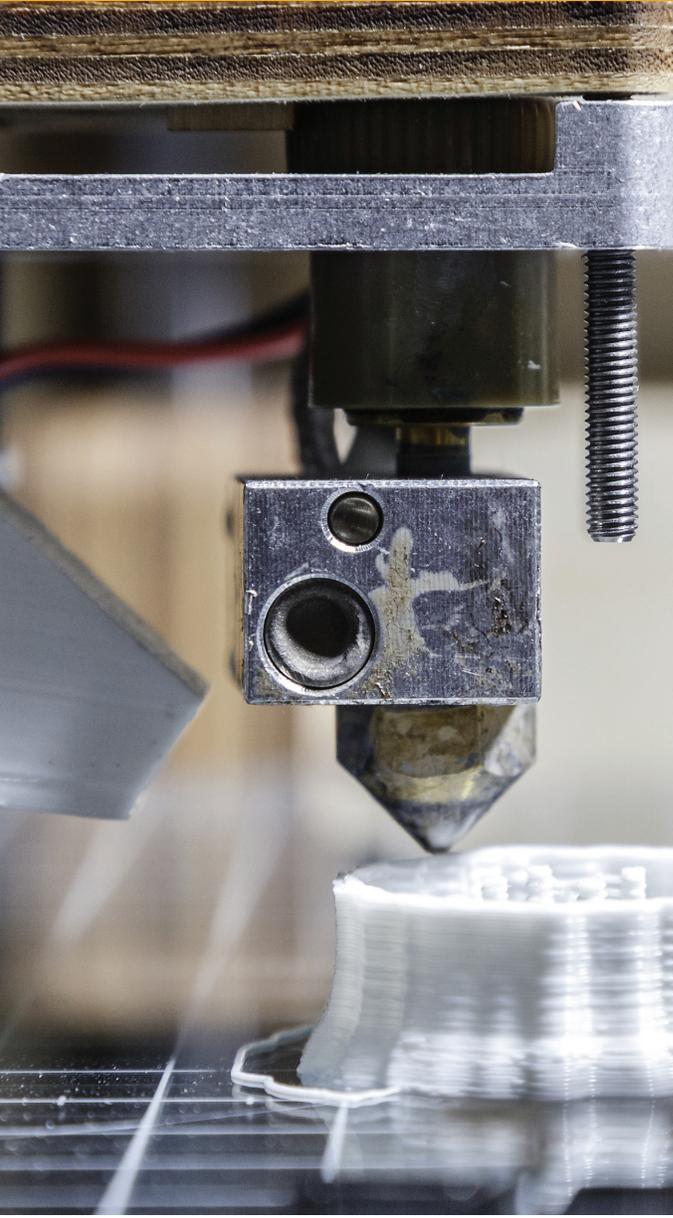


3D PRINTING - A FAST-MOVING MARKET



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 October 1, 2019 to December 15, 2019.



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General

Rösler expands AM Solutions division to offer 3D printing services

AM Solutions, the Italian 3D printing subsidiary of the Rösler Group, a German company specializing in surface finishing solutions, will expand to offer a range of 3D printing services. Originally limited to post processing for Rösler, AM Solutions is now providing a comprehensive service package using a range of 3D printers and software. The services cover engineering, product design optimization, mechanical post processing, surface finishing and quality control.

Northwestern researchers develop large scale SLA HARP 3D printer with record throughput

Researchers at Northwestern University in Illinois developed a new 3D printer that they claim can print half a yard in an hour, a reportedly record-breaking throughput. Called HARP (high-area rapid printing), the speed and size of the system, standing at 13-feet tall, can allow users to 3D print objects “the size of an adult human.” Utilizing stereolithography technology, HARP can be used to produce parts for medical devices, cars, airplanes and construction. It is expected to be commercially available in the next 18 months, as of October 2019.

ACCIONA opens 3D printing center in Dubai with world’s largest powder-bed printer

Spanish contractor ACCIONA opened a 3D-printing center in Dubai to house the world’s largest operational 3D printer, using powder-bed technology and concrete as its base material. The company is hoping to capitalize on the growing interest in Dubai for printed buildings. Mohammed bin Rashid Al Maktoum, the ruler of Dubai, launched the “Dubai 3D Printing Strategy,” an initiative that aims to “promote the status of the UAE and Dubai as a leading hub of 3D printing technology by the year 2030.” The Dubai Municipality passed regulations requiring new buildings in Dubai to be 25% 3D-printed by 2025. The company previously created the first walkway in the world made using 3D printing, in Alcobendas in Spain, and the first architectural heritage item, the Romanesque arch of San Pedro de las Dueñas.

Pittsburgh International Airport to begin construction of additive manufacturing hub in 2020

Pittsburgh International Airport and the University of Pittsburgh will collaborate to focus their locality on additive manufacturing. Neighbourhood 91 is a new concept the parties developed to form part of the Pittsburgh Airport Innovation Campus. Built adjacent to the airport terminal and runway, the facility aims to connect all parts of the additive manufacturing supply chain, with exceptional benefits to lead times and delivery.

HP launches 3D printing as a service model

HP bets that industrial customers will adopt the as-a-service model for additive manufacturing. The company outlined a base subscription service (3DaaS) that features automatic replenishment of supplies, billing and usage tracking and on-site support. The base pay-per-build service is available for HP Jet Fusion 5200, HP Jet Fusion 4200 and HP Jet Fusion 500 series 3D printing equipment. The announcement came as HP outlined expanded partnerships with Siemens and Volkswagen. Volkswagen said it completed a production run with 10,000 parts produced with HP 3D printers.

Modix launches extra-large MAMA 3D printer, capable of making parts up to 5m tall

Modix a global developer of large format 3D printers, will launch its new extra-large 3D printer, with variable print volume between 1 x 1 x 1 meter to 2 x 5 x 1 meter. The printer, Modix MAMA, which stands for “Modular Additive Manufacturing Assembler,” will provide a long desired XXL 3D printing solution for automotive, aviation, boating and other large goods industries.

Dyndrite launches GPU-powered improvements for better 3D printing speed and quality

Seattle-based Dyndrite believes its Additive Manufacturing toolkit and build processor will make 3D printing much easier and faster. Tapping the power of graphics processing units, the company’s Accelerated Computation Engine is a geometry kernel that makes it easier to move a file from design to 3D printing. With GPU processing, a 3D printer can print a model in seconds, rather than hours. The software can take native CAD files and import them for 3D-printed output, and it integrated Python interface for scripting interactive workflows.

Accucode opens first 3D printing electronics service, powered by Nano Dimension

Accucode, a U.S. reseller of Nano Dimension’s electronics 3D printing technology, is opening the world’s first service bureau for 3D printing electronics. To support the new service, the company also purchased a second DragonFly LDM 3D printer from Nano Dimension. Accucode is a technology systems integrator and software developer which will offer electronics 3D printing as a service for end-to-end prototyping and low-volume production of electronics. The company has one DragonFly 3D printer installed at its facility in Denver, Colorado, and the other at its center in Richardson, Texas. Both printers will support its new service offering.

MakerBot establishes METHOD Materials Program to expand 3D printing filament range

MakerBot, the Brooklyn-based manufacturer of the METHOD 3D printer, launched the METHOD Materials Development Program and MakerBot LABS Experimental Extruder to extend the range of filaments used within its systems. As initial partners, Jabil, KIMYA, Polymaker, and Mitsubishi Chemical are working to qualify filaments for use in the METHOD platforms. Moreover, the MakerBot LABS Experimental Extruder aims to advance settings for customization, enabling the printing of high-temperature materials.

AGC to offer AREVO composite 3D printing on-demand in Japan

AREVO, a Silicon Valley-based company dedicated to the additive manufacturing of composite materials, announced that AGC Inc., a Japanese global glass manufacturing company, installed its Aqua continuous carbon fiber 3D printer. Acting as AREVO's business partner in Japan, AGC will use the system to provide Manufacturing-as-a-service for on-demand 3D printed composite parts for the Japanese market.

HeyGears 3D printing raises \$60 million for global expansion from Group 42

Chinese 3D printer provider and service bureau HeyGears Technology reported the raising of \$60 million in series B1 financing. The money was invested by Abu Dhabi-based AI and cloud computing company Group 42, which is led by CEO Peng Xiao.

3D Hubs enters French on demand manufacturing market with Parisian offices

On demand manufacturing platform 3D Hubs is opening new offices in Paris. Marking its entry into the French market, the move was backed by Future Shape, the investment firm headed by Tony Fadell, inventor of the iPod and founder of smart home product brand Nest, which is now owned by Google. Both 3D Hubs and Future Shape will be co-located in Paris' largest startup incubator Station F, which opened in the 13th arrondissement in 2017.

India's first metal 3D printing machine developed by Wipro, IISc is here

In a partnership with the Indian Institution of Science (IISc), Wipro 3D, the additive manufacturing business of India's tech giant Wipro, developed an industry-grade metal additive 3D printing machine. According to Wipro 3D, the newly developed printing machine works on selective electron beam melting technology. Moreover, the machine offers better thermal management, higher part density as well as superior mechanical properties.

Stratasys expands into the Oceania region, Erpro Group becomes customer of F850 3D printer

Stratasys AP, a subsidiary of OEM Stratasys, expanded its reach in the Oceania region with the appointment of TCL Hofmann and TCL Hunt as authorized channel partners. Furthermore, a Paris-based service bureau, Erpro Group, became France's first company to adopt Stratasys' latest PolyJet additive manufacturing system, the J850.



Materials

EOS launches TPU 1301 material for flexible 3D printed parts

German additive manufacturer EOS, which specializes in both polymer and metal laser-based printing processes, expanded its polymer material portfolio with the launch of a new flexible EOS TPU 1301 powder optimized for industrial 3D printing. The material marks a significant step in the path to 3D printing for mass production due to TPU's current application in industries, such as automotive and the manufacture of consumer-facing products. TPU offers resilience, good hydrolysis resistance, and high UV-stability and is being used in applications that demand elastomeric properties or easy to process capabilities.

Lithoz unlocks Corning glass ceramics for 3D printing

Austrian ceramic 3D printing specialist Lithoz and U.S. multinational specialty materials company Corning was working together to expand the capabilities of their respective technologies. Lithoz's proprietary Lithography-based Ceramic Manufacturing (LCM) technique was used to 3D print Corning glass ceramic materials for the first time. The successful experiment yielded a new potential material for Lithoz's ceramic 3D printing range, in turn creating new applications for a tough, biocompatible superconductor.

Carbon releases new RPU 130 resin for consumer and industrial 3D printing

Carbon, the Silicon Valley-based company behind Digital Light Synthesis, introduced the RPU 130, a new resin to its portfolio of 3D printing materials. It is designed to be a tough, rigid and high-temperature material for the automotive industry, as well as for consumer and industrial applications. Carbon developed the resin with the intention of addressing the demand for an additive material with high impact resistance and dimensional stability at elevated temperatures. 30% of RPU 130 is made of Susterra propanediol, a sustainable plant-based material from DuPont Tate & Lyle, which specializes in bio products.

Mitsubishi Chemical and atum3D develop new Diabeam™ UV resin material for 3D printing

Mitsubishi Chemical and atum3D co-developed a new resin for atum3D digital light processing printers. The material, which can solidify under a 365 nm light source, will be named Diabeam™. Mitsubishi Chemical's expertise in the formulation and production of UV resins and atum3D's competence in combining chemical expertise with their 3D printing hardware and software into customer application solutions proved to be a valid match.

ExOne collaborates with global tungsten and powders to AdvanceTungsten metal 3D printing

The ExOne Company, a global specialist in industrial sand and metal 3D printers using binder jetting technology, and Global Tungsten & Powders Corp., a global manufacturer of metal powders, collaborated to advance tungsten-based metal 3D printing using binder jetting. Binder jetting is a 3D printing process that uses a digital file to inkjet a bonding agent into a bed of powder particles, creating a solid part one layer at a time. Compared to other 3D printing processes, binder jetting delivers precision parts at a high rate of speed, making it an ideal approach for serial production. The new ExOne-GTP collaboration will focus on the development of two metal matrix composites: cemented carbide and copper-tungsten.

DSM releases UL-certified flame retardant PA6/66 extrusion 3D printing material

DSM will release a UL-certified flame retardant PA6/66 material for use on open extrusion-based 3D printing platforms. Novamid AM1030 FR was certified through UL's Blue Card program after testing was carried out with a part produced on an Ultimaker S5. The material was developed from DSM's Novamid technology and is certified as V0 (burning stops within 10 seconds on a vertical specimen) at 1.6 and 3.2 mm and V2 (burning stops within 30 seconds on a vertical specimen) at 0.85mm. DSM believes the material's level of flame retardancy makes the material suitable for application in the automotive and electronics sectors.

EOS and Additive Minds launch 3D printed Digital Foam program

EOS North America and its applied engineering consultancy Additive Minds launched the Digital Foam program, a hub intended to simplify the process of bringing 3D printed foam products to market. The hub is designed to support customers in the manufacturing process, consisting of CAD, materials, part qualification and 3D printing. It is also equipped with engineering software from nTopology to simplify the design, analysis and preparation of the foam material. Using the Digital Foam program, customers can fast-track the production of their foam 3D printed products, which can include protective headgear, individualized orthotics and performance footwear.

Huntsman and Cubicure release new 3D printing materials

Huntsman is introducing two urethane-based 3D printing materials: IROPRINT F 80112 filament and IROPRINT R 1801 resin. The TPU-based materials both offer flexibility, strength and toughness and add to Huntsman's existing family of IROPRINT materials for FFF, SLA, DLP, HSS and SLS 3D printing. Cubicure, an Austrian supplier of industrial polymers for additive manufacturing, unveiled a new SLA 3D printing material: Evolution FR. The material is reportedly the first flame-retardant photopolymer for SLA technologies and has UL94 V0 certification.

Henkel and Origin “set new threshold” in fire-resistant DLP 3D printing

Californian 3D printing startup Origin and leading global chemical company Henkel added a new fire-resistant photopolymer to their respective open material portfolios. Compatible with the Origin One, this resin is the product of a partnership between the two parties signed in February 2019. The news also follows its recent launch of Henkel's Loctite materials, with 3D printing on-demand available as part of the “Loctite powered by Shapeways” program.

3D-printed, layered cubes can withstand bullets travelling at 5.8 km per second

Researchers at Rice University in Houston created near-bulletproof polymer cubes comprised of numerous layered lattices that make them ultra-durable. The plastic material can remain almost intact when shot at by 5.8 kilometer-per-second bullets or subjected to “crushing forces.” The idea was to test a theoretical structure called “tubulanes,” described as microscopic structures comprised of crosslinked carbon nanotubes. Optimizing the lattice design could lead to better materials for civil, aerospace, automotive, sports, packaging and biomedical applications.

EnvisionTEC and Sartomer release water-soluble E-Aquasol resin

3D printing company EnvisionTEC and Sartomer, a business line of Arkema, are introducing a jointly developed water-soluble resin material, E-Aquasol. The material is compatible with EnvisionTEC's proprietary cDLM 3D printing platform. E-Aquasol is based on Sartomer's N3xtDimension UV-curable resin technology and is characterized by its high-water solubility. The material is a safer alternative to other resins which are soluble in more aggressive solvents like caustic. The resin is ideal for 3D printing high-resolution molds for multiple applications.

Optomec updates LENS system to 3D print in copper

New Mexico's Optomec reached a “major milestone” for its Laser Engineered Net Shaping (LENS) direct energy deposition (DED) process. Catering to the popular heat exchanger market and other high-conductivity applications, the company developed process parameters for the production of pure copper parts. Incredibly challenging for laser-based processes due to the inherent reflectivity of copper, this advance is the latest of many initiatives undertaken by metal additive manufacturing stakeholders to introduce the material to the market.

International consortium develops 3D printable alloy for more eco-friendly refrigerators

An international materials research project yielded a 3D printable metal alloy that can make cooling systems, like those used in refrigerators, more eco-friendly and efficient. Made from a combination of nickel and titanium, the material is a type of shape memory alloy that can repeatedly transform to pump heat out of a system. The challenge with such material has historically been that the alloy fails after a small number of cycles.



Printing Techniques & Capabilities

Harvard SEAS researchers 3D/4D print complex shape-shifting structures

Researchers at the Harvard John A. Paulson School of Engineering and Applied Sciences and the Harvard Wyss Institute of Biologically Inspired Engineering created the most complex multi-scale curvature shape-shifting structures to date, lattices composed of multiple materials that grow or shrink according to changes in temperature. The team printed flat lattices that shape morph into a frequency-shifting antenna or the face of pioneering mathematician Carl Friedrich Gauss in response to a change in temperature. The team's inverse design approach and multimaterial 4D printing method could be extended to other stimuli-responsive materials and be used to create scalable, reversible, shape-shifting structures with unprecedented complexity. Application areas include, soft electronics, smart fabrics, tissue engineering and robotics, among others.

Space Foundry develops plasma printing

Startup Space Foundry is approaching a potential major next step in 3D printing: plasma printing. Whereas 3D printing creates plastic objects from filament, a plasma printhead changes the material as it's being fashioned, with "integrated fluid delivery design [enabling] mixing of multiple liquid precursors and gas mixtures," and it's capable of printing with multiple materials. A plasma-based device can produce chips which are printed on a glass surface, which could be potentially revolutionary for the Internet of Things using glass-based circuit boards. A plasma printer can print on any surface and could be a big factor in driving forward with the ability to print in space. Space Foundry plans to offer short-run manufacturing and a contract development service in late 2020. Once over 100 plasma printers were sold, the firm also aims to push for higher publicity with a full marketing team.

Researchers achieve breakthrough for industrial-scale nano-3D printing

Researchers from Lawrence Livermore National Laboratory and the Chinese University of Hong Kong accelerated the rate of nanoscale additive manufacturing. Tackling what has long been a trade-off between resolution and time, the team developed a method that could enable industrial-scale production of minute devices. The technique can create previously impossible 3D structures with 90-degree overhangs. The system "will enable the remarkable performance in materials and structures at this size scale to be realized in usable components."

Oscillation assisted 3D printing renders ultrafast fabrication of microlens array

Researchers from the Singapore University of Technology and Design and Southern University of Science and Technology in Shenzhen, China proposed an approach which integrated oscillation-assisted digital light processing 3D printing with grayscale UV exposure to render an ultrafast and flexible fabrication of microlens arrays with optical surface smoothness. With increasing demand for miniaturization of optoelectronics, microlens array attracted attention and become an important micro-optics device used in compact imaging, sensing, optical communication and others. Oscillation assisted DLP based printing method is energy- and time-efficient without degradation of optical performance, which is convenient for deployment into mass production.

Optomec releases new interchangeable LENS Deposition Head for optimized DED processing

Optomec, the Albuquerque-based company behind Aerosol Jet Printing technology, introduced the Laser Engineered Net Shaping (LENS) Deposition Head (LDH 3.X), which ensures optimized directed energy deposition (DED). The LDH 3.X is a marked advancement for DED processing. Its versatility, robustness and ease-of-use empower the user to control laser power density at the workpiece for optimal results across a wide range of industrial applications.

3D printing used to make glass optical fiber preform

Researchers at the University of Technology of Sydney developed a way to use 3D printing to create a preform that can be drawn into silica glass optical fibers, which are crucial to the global telecommunications network. This fabrication method could simplify production of these fibers as well as enable applications that weren't previously possible. The researchers are interested in working with a mainstream commercial fiber fabrication company to improve and commercialize the technology. They also plan to explore other methods for accelerating 3D printing by refining it for different applications.

New 3D printing technique enables freeform, transparent OLED displays

A materials science and engineering team from Korea's Yonsei University developed a 3D printing technique enabling OLED screens to be printed into transparent structures of any shape. The team aimed to advance the development and manufacturing of complex screen shapes by printing both a 3D support structure and the 3D screen electronics. Current technology often requires 3D structures to be fitted with linked 2D screens, whereas this technique enables designers to create screens of virtually any shape, without requiring any extra thermal annealing steps.

Adiprene prepolymers from LANXESS offer new possibilities in 3D printing

Specialty chemicals company LANXESS is offering the next generation of Low Free isocyanate urethane prepolymers that can be formulated into resins for 3D printing. To create such resins LANXESS works together with 3D printing companies. Based on Adiprene LF pPDI (para-phenylene diisocyanate) prepolymers, these high-performance resins are easy to process and safe for industrial manufacturers as well as for home, office or retail users. The flexibility to formulate LF prepolymers into printable resins enables 3D printers to drive toward mass customization, enabling printing across a wide range of hardness from soft elastomers for cushioning to more structural shoe elements.

ExOne announces exclusive new CleanFuse Binder for 3D printing premium metals

The ExOne Company revealed a clean-burning metal binder, CleanFuse, that enables future binder jet 3D printing of premium metals such as aluminum and titanium, which are sensitive to carbon residue left by other binding agents during sintering. The patent-pending formula will be available in the first quarter of 2020. While ExOne systems binder jet over six qualified metals, including the stainless steels 316L, 304L and 17-4PH, a clean-burning binder is a key step in the development of binder jet 3D printing for some other high-demand metals and some ceramics.

Essentium launches four high-temperature filaments for High Speed Extrusion 3D printing platform

Essentium introduced four high temperature filaments to its High-Speed Extrusion (HSE) additive manufacturing portfolio. PEEK, High-Temperature Nylon (HTN), HTN-CF25 and HTN-Z (ESD safe) materials joined seven other products added to Essentium's material offering in 2019. The company will also integrate the Materialise Magics Essentials to its HSE series of machines. The material developments are designed to facilitate a range of industrial applications requiring high strength and heat, chemical and fatigue resistance, including machine parts, tools, jigs and fixtures in aerospace, semiconductor, and oil and gas markets.

Defining a new paradigm: Harvard researchers invent multimaterial multinozzle 3D printing

Researchers at Harvard University developed a method of 3D printing termed multimaterial multinozzle 3D printing (MM3D), the method seeks to help define the emerging paradigm of voxel by voxel fabrication. In this paradigm, 3D printed parts are composed of minute building blocks. Each of these blocks has a different material composition, and are precisely arranged to tune part performance, such as for softer materials for flexibility, harder materials for pressure resistance. A type of "true" 3D printing, the method is being explored to produce functional objects within a single process, rather than relying on an assembly of different parts.



Manufacturing & Construction

HARP 3D printer set to “revolutionize manufacturing”

Researchers at Northwestern University overcame issues around overheating to develop HARP, a 3D printer claimed to produce an object the size of an adult human in two hours. HARP prints vertically and uses projected ultraviolet light to cure the liquid resins into hardened plastic. This process can print pieces that are hard, elastic or ceramic. These printed parts are said to be mechanically robust and can be used in a range of products, including cars and aircraft.

Dubai constructs largest 3D printed two-storey building in the world

The government of Dubai announced the country is now home to the first 3D printed office building and it also hosts the largest 3D printed two-storey structure in the world. The building, which spans 640 square meters and is 9.5 meters in height, was recognized by the Guinness Book of World Records.

3D printed houses from locally sourced clay

WASP and MC A - Mario Cucinella Architects embarked on the construction of a model for a 3D printed habitat and will launch the first prototype near Bologna, Italy. Born from a vision to provide a home for everyone at a time of exponential population increase and an associated lack of affordable housing, TECLA is a circular housing model, created using entirely recyclable materials taken from the local terrain. Built using Crane WASP, TECLA represents a change in the move to eco-housing.

Winsun completes world’s first, 500 meters long, 3D printed river revetment wall

Located in the Jiangsu region, Suzhou is a former mining town that was completely rebuilt, attracting investments from some of the largest global construction companies. Old mines were rapidly transformed into beautiful parks bringing the city to its former prestige from the days of several Chinese emperors. As the city moves into the future, one particularly innovative project stands out, conducted by construction 3D printing company Winsun: the first 3D printed river revetment wall, over 500 meters long, is the largest 3D printed structure ever built.

Middle East Architecture Network creates 3D printed pavilion made from 30,000 water bottles

The Middle East Architecture Network (MEAN) installed a 3D printed pavilion made from 30,000 recycled water bottles at the Dubai International Financial Center (DIFC). This structure is known as Deciduous and aims to provide a form of public interaction that revisits human relationships with nature.



M&A and Investments

Relativity, a company 3D printing entire rockets, raises \$140M from venture firms Bond, Tribe

Los Angeles-based space start-up Relativity Space raised the money needed to transform the rocket supply chain in the U.S. with 3D printing. Relativity closed \$140 million in new fundraising, led by Bond Capital, a fund whose partners include Mary Meeker, and recently-formed Tribe Capital. Meeker helped spin Bond out of Kleiner Perkins in 2018 and the \$1.3 billion fund's investment in Relativity is its first in the space industry.

Northrop Grumman grants \$150K support to additive manufacturing programs at the U.S. Naval Academy

Northrop Grumman, a U.S. global defense company, awarded \$150,000 to the U.S. Naval Academy Foundation in support of additive manufacturing programs in the Academy's Division of Engineering & Weapons. The grant will support the development of the USNA MakerSpace, a student-faculty 3D printing laboratory. The funding will be utilized in assisting USNA student capstone projects aligned with Northrop Grumman's own additive manufacturing programs.

Singapore's 3D printing startup Structo raises funding; to develop digital additive manufacturing solutions for dental industry

Structo, a Singapore-headquartered dental 3D printing solutions startup, closed a round of funding from EDBI, GGV Capital, Wavemaker Partners and Pavilion Capital. Structo will use the money to develop digital additive manufacturing solutions for the dental industry. It will also launch products focusing on leveraging automation to enable mass production of custom patient-specific products. Its proprietary mask stereolithography (MSLA) technology enables 3D printers to achieve speeds higher than conventional SLA printers.

GKN Powder Metallurgy acquires FORECAST 3D, enters polymer additive manufacturing

Metal powder and parts manufacturer GKN Powder Metallurgy acquired specialist polymer 3D printing service provider FORECAST 3D. Combining both companies' expertise in HP 3D printing technologies, the acquisition presents a significant expansion of GKN Powder Metallurgy's additive capabilities. Financial terms of the deal have not been disclosed.

AMT raises \$5.2M in funding round led by DSM Venturing and Foresight

Additive Manufacturing Technologies, a specialist in post-processing technologies for 3D printed parts, completed a \$5.2 million Series A funding round that will enable it to accelerate its goal of creating a fully integrated, end-to-end digital manufacturing system. The investment round was led by DSM Venturing, which recently invested in Voxel8, and Foresight Williams Technology EIS Fund. DSM Venturing, the investment arm of materials firm DSM, made a strategic move with its investment in AMT, as the latter can benefit from its knowledge of 3D printing materials. Foresight Williams Technology EIS Fund, a collaboration between Foresight Group LLP and the venture arm of Williams Advanced Engineering, will also offer AMT knowledge in engineering applications and Formula One.

Materials giant Evonik invests in 3D printing software startup Castor

Evonik Venture Capital, the investment arm of German chemical company Evonik, invested in Castor Technologies, a startup whose software is helping AM adopters to identify how and where to use additive manufacturing for production. The investment in the Israel-based startup will allow it to expand its business beyond selling materials for the 3D printing market into services, enabling customers to test the printability of parts.

PostProcess Technologies raises \$20M in Series B funding, plans European expansion

New York-based automated post-printing developer PostProcess Technologies completed a \$20 million Series B funding round. The company also plans to expand its European presence, comprising a benchmarking facility in France, and E.U. Channel Partner Network appointments. PostProcess' Series B funding round was led by Grand Oaks Capital. The company plans to use the funding to accelerate the development of its proprietary software, hardware and chemistry post-processing solutions, focusing on data analytics and machine learning. PostProcess also aims to significantly increase its global go-to-market activity.

BASF expands 3D printing industry hold with acquisition of Sculpteo

BASF, the largest chemical producer in the world, acquired Paris-headquartered 3D printing service bureau Sculpteo. A formal agreement regarding the acquisition was signed between BASF New Business GmbH (BNB), a division of the German chemical company focused on innovative technologies, and Sculpteo. The agreement is expected to become effective following regulatory approval by the relevant authorities. Terms of the transaction, including the value of the deal, have yet to be disclosed. Sculpteo's management team will remain in place as the acquisition is carried out.

Siemens acquires Atlas 3D, optimizes metal additive manufacturing processes

Siemens, Europe's largest industrial manufacturing company, signed an agreement to acquire Atlas 3D, the cloud-based developer of Sunata, a print preparation software for Direct Metal Laser Sintering 3D printers. The acquisition is to be made by Siemens Digital Industries Software, formerly Siemens PLM, which specializes in automation and digitalization, and seeks to decrease 3D printing errors caused by thermal distortion. The acquisition was due to close at the end of Nov. 2019. The terms of the transaction have not been disclosed.

University of Waterloo receives \$2.1 million from TMMC to advance additive manufacturing research

Toyota Motor Manufacturing Canada granted CAD \$2.1 million to the University of Waterloo in Ontario, to advance engineering education and additive manufacturing research. Reported as the largest single donation by TMMC to any Canadian university, this investment will introduce an undergraduate engineering innovation challenge as well as dedicate a wing to faculty and student research in 3D printing renamed the Toyota Additive Manufacturing Wing.



Miscellaneous Partnerships

Polymaker and Covestro launch three polycarbonate-based filaments for 3D printing

Chinese 3D printing materials company Polymaker will launch three polycarbonate-based materials for 3D printing. Each of the materials were developed in collaboration with Covestro, a German manufacturer of high-performance polymers, and are designed to contain specific properties for use in a variety of industries, like automotive, aerospace and electronics. Using formulations well known to industry professionals, PC-ABS, PC-FR and PC-PBT, the companies plan to optimize the recipes for 3D printing and bring them to market.

BCN3D enlists Global 3D as Polish 3D printer reseller

Barcelona-based 3D printing company BCN3D Technologies signed a distribution partnership with Global 3D, a Polish reseller of 3D printing filaments and printers. The partnership establishes Global 3D as a distributor of BCN3D's Sigma and Sigmax 3D printers as well as filaments and accessories across the Polish market. The distribution agreement is part of BCN3D's strategy to expand its global reach. Global 3D was chosen because of its own rise within the Polish 3D printing market. The company is positioned to supply BCN3D 3D printers and materials to Polish companies, universities and professionals.

Airbus and LM Industries form 3D printing digital mobility startup Neorizon

Aerospace company Airbus and San Francisco-based digital OEM LM Industries (LMI), the parent company of Local Motors and Launch Forth, partnered to form Neorizon, a digital mobility startup. The collaborative venture between the two firms aims to provide innovative products with a focus on autonomous mobility. Both firms will bring their respective expertise in digital manufacturing, 3D printing and co-creation to create mobility solutions for changing urban environments. Neorizon will be headquartered at Airbus' Ludwig-Bölkow-Campus near Munich, Germany, where a micro-factory will be built for the company's manufacturing operations.

Remet and 3D Lab open \$3.1M 3D printing laboratory equipped with ATO Lab atomizer

Remet, a Polish steel structure manufacturer, opened a €2.8 million (\$3.1 million) metal 3D printing laboratory in Stalowa Wola with 3D Lab, a Warsaw-based 3D printing service bureau. 3D Lab helped to equip the facility with 3D printers from leading OEM 3D Systems, as well its ATO Lab metal powder atomizer. Remet opened the laboratory as it sought to implement additive manufacturing into its production. The facility will therefore house a range of devices and machines supporting both research and production for additive manufacturing. Remet's 3D printing laboratory also represents the first installation of 3D Lab's ATO Lab machine.

Hans Weber Maschinenfabrik to launch large scale 3D printer supported by Ai Build

Large-scale additive manufacturing developer Ai Build entered into a partnership with German industrial equipment supplier Hans Weber Maschinenfabrik. Hans Weber, which has long-standing extrusion and grinding expertise, is entering the 3D printing market through new business unit WEBER Additive. Ai Build's cloud-based 3D printing software will be used by the company for operation of its large-scale extrusion systems. The partnership's initial product is yet to be unveiled.

3DGence, Arkema and Armor partner to expand PAEK 3D printing applications

Polish 3D printer manufacturer 3DGence partnered with advanced material companies Arkema and Armor Group to make its ESM-10 (Engineering Soluble Material) compatible with the Kimya PEKK-A high performance material. The partnership between the companies aims to expand the use of open-market applications for PAEK based materials in 3D printing. PEKK-A, developed by Armor Group's filament brand Kimya, and based on the Kepstan PEKK Resin from French advanced materials company Arkema, is available on 3DGence's Certified Material Base. Users can 3D print Kimya PEKK-A material with the ESM-10 soluble support on 3DGence's INDUSTRY F340 FFF/FDM 3D printer.

XG Sciences and Terrafilum enter joint development agreement to produce graphene enhanced 3D printing filament

XG Sciences, designer and manufacturer of graphene nanoplatelets and advanced materials containing graphene nanoplatelets, and Terrafilum, a filament producer for the 3D printing industry, agreed to develop, produce and market 3D printing filaments and coatings using graphene-based materials. Graphene-enhanced filaments help solve product related problems, historically associated with Fused Deposition Modeling (FDM) printing, by enhancing z-direction strength, providing more ESD robust parts and creating overall lighter parts in less time.

DSM and Twikit partner to develop new 3D printing applications in automotive, medical and apparel markets

Royal DSM and Twikit partnered to leverage 3D printing to co-develop solutions in the medical, automotive and apparel industries. The companies will identify new ways of utilizing additive technology. They expect to develop made-to-measure turnkey solutions across several vertical markets. Every 3D printed product developed through this collaboration will be a result of an initial 3D scanning process before product design, material optimization, testing and modelling takes place.

Evonik and Voxeljet to co-develop material systems for binder jet 3D printing

Evonik's strategic innovation unit Creavis will collaborate with Voxeljet AG to develop material systems for the next generation of the binder-jet 3D printing. The focus on binder jetting, which involves layering powder bonded by a binding agent and is most used in mold-making and sand core manufacture, aims to open up material opportunities for producing industrial final parts with greater mechanical properties.

Aleph Objects acquired by Fargo Additive Manufacturing Equipment 3D

Aleph Objects, the manufacturer of LulzBot open-source 3D printers, announced that its assets were acquired by Fargo Additive Manufacturing Equipment 3D (FAME 3D). Based in North Dakota, FAME 3D is a limited-liability corporation set up by a venture capitalist to buy the assets of Aleph Objects.

Shapeways and Henkel enter exclusive 3D materials partnership

New York-headquartered 3D printing marketplace and service bureau Shapeways entered into an agreement with material provider Henkel. Working with the Loctite materials brand, the partners aim to expand Henkel's material provisions for large-scale additive manufacturing. Under the "Loctite powered by Shapeways" program, the partners are also offering customers on demand 3D printing services with Loctite materials. One of the areas identified for focus by Loosen is "the large-scale 3D printing of customized Loctite parts."

AGC becomes AREVO's first MaaS partner in Japan

AREVO, a Silicon Valley company specializing in composite 3D printing, enlisted AGC as a strategic business partner in Japan. Through the collaboration, AGC will provide manufacturing-as-a-service (MaaS) to Japanese customers for the on-demand production of lightweight, 3D printed composite parts. The new service will leverage AREVO's Aqua platform, an industrial continuous fiber 3D printing system with a build volume of up to one cubic meter.

Etihad opens Abu Dhabi MRO 3D printing facility with EOS and BigRep

Etihad Engineering, a division of the Etihad Aviation Group dedicated to Maintenance, Repair and Overhaul (MRO) services, opened an additive manufacturing facility in Abu Dhabi, in collaboration with German 3D printer manufacturers EOS and BigRep. It is the region's first 3D printing lab with Design and Production Approval from the European Aviation Safety Agency (EASA) to produce aircraft parts using powder-bed fusion technology. The facility features two approved 3D printers in total from EOS and BigRep. Its systems include the EOS P 396 SLS 3D printer, which received Airline MRO approval from EASA, and BigRep ONE, a large-scale FFF 3D printer. Using the 3D printers, Etihad Engineering expects to make quicker repairs, more lightweight designs and customized parts tackling key challenges in aerial vehicle downtime.

DSM, Chromatic and German RepRap partner in adoption of FlexTune 3D printing materials

Royal DSM, Chromatic 3D Materials and German RepRap (GRR) formed a partnership to develop solutions for 3D printing using Chromatic's line of FlexTune polyurethane (PU) materials. The companies will create PU-based 3D printed parts for the automotive, rail and footwear sectors, among others. The partners want to support the broad industrial adoption of flexible PU-based materials in the additive manufacturing industry. By working together and leveraging their respective areas of expertise, Royal DSM, Chromatic and GRR will aim to overcome challenges in 3D printing with such materials that inhibit adoption.

Siemens launches Additive Manufacturing Network, partners with ASME

Siemens launched its Additive Manufacturing Network, a cloud-based solution fostering collaboration between engineers and suppliers for the creation of 3D printed parts. Furthermore, the company's oil and gas division, Siemens Gas and Power and the American Society of Mechanical Engineers partnered to develop additive manufacturing training services that will be offered through Materials Solutions.

EOS and AMFG tackle machine connectivity in new partnership

Through a new partnership, industrial 3D printing company EOS and AM software developer AMFG aim to improve connectivity across the additive manufacturing workflow. AMFG's MES software for 3D printing will be integrated with EOS machines to enable direct streaming and improved machine control. EOS clients will be able to leverage AMFG's Manufacturing Execution System to further automate their workflow as well as to connect with their EOS 3D printers. Ultimately, the partners aim to facilitate AM workflows to push adoption and industrialization ahead.

Hamilton Labs, ACG Construction and Saint-Gobain to establish Additive Manufacturing & Robotics Hub

Hamilton Labs, a Singapore-based 3D printing company active in the construction sector, partnered with Ang Cheng Guan Construction and French materials manufacturer Saint-Gobain to establish an Additive Manufacturing and Robotics Hub. The Hub aims to give building and construction SMEs a starting point for adopting 3D printing and sustainability in the sector.

Velo3D expands into Japan as 3D printing distribution alliance is struck with TNSC

Velo3D will expand into the Japanese market through welding equipment supplier Taiyo Nippon Sanso Corporation (TNSC). TNSC will distribute Velo3D's metal 3D printing equipment throughout the country and provide service to support users.

M. Holland signs distribution agreement with Henkel to further expand 3D printing portfolio

M. Holland Company, a distributor of thermoplastic resins, onboarded as an authorized distributor of LOCTITE 3D branded 3D printing products from Henkel, a leader in adhesives, sealants and functional coatings. The agreement will provide M. Holland's industrial manufacturing clients access to a wider range of 3D printing materials, including UV-curable silicone elastomeric, ultra-clear, durable, high impact, high temperature and general-purpose resins.

EOS partners with Wibu-Systems to secure 3D printed part production

Leading 3D printer OEM EOS entered into a Digital Rights Management (DRM) agreement with security technology specialist Wibu-Systems. Together, the companies developed an API enabling Wibu-Systems and other DRM vendors to securely connect with EOS machines. Wibu-Systems ensures the protection of files from the design stage through to the finished parts. It also offers part manufacturers with the option to monetize designs with pay-per-print licenses.



Patents & Copyright

iRobot, SharkNinja sue each other over robot vacuum patent dispute

SharkNinja Operating, creator of the Shark IQ Robot vacuum cleaner, filed a complaint against iRobot in the U.S. District Court for the District of Delaware seeking a ruling from the court that the Shark IQ Robot does not infringe certain iRobot patents directed to robot vacuum cleaners. The company filed the lawsuit in response to a threatening letter from iRobot “wrongly accusing SharkNinja of infringing these patents.”

Grons and Dartmouth researchers to develop 3D printable implants for Traumatic Brain Injuries

Grons, a New York-based biotechnology start-up, announced an Intellectual Property License Agreement with Dartmouth College, New Hampshire, to develop 3D printable implants to treat penetrating or traumatic brain injuries. TBI is caused by sudden damage to the brain from an external force. As stated by the World Health Organization, TBI resulted in deaths and impairments leading to permanent disabilities. Such injuries require long-term care and incur approximately \$76 billion in medical costs annually.

Tethon 3D granted patent for binder jet additive manufacturing method

Tethon 3D was granted a patent for a binder jet additive manufacturing method and is stepping up its pursuit of a partner to commercialize the technology. The company filed the patent in December 2015 before focusing on developing ceramic resins and the Bison 1000, a desktop digital light processing platform tailored to process them. However, previously it planned to delve back into binder jet technology and with this latest development looks set to reignite its endeavors of four years prior. Tethon’s binder jetting technology uses compression plates to increase the isotropic density of parts made from a granular material.

ETH researchers develop and patent glass photopolymerization process

ETH researchers produced complex and highly porous glass objects using a special resin that can be cured with UV light in a novel glass photopolymerization process. Researchers from ETH Zurich used a new technique to produce complex glass objects using photopolymerization and specifically DLP photopolymerization. A Complex Materials group developed a special resin that contains both plastic and organic molecules to which glass precursors are bonded.



Transportation

Emission-free BICAR driven forward by German RepRap 3D printing

Share your BICAR AG, a Swiss company specializing in sustainable vehicles, used FFF technology from 3D printer manufacturer German RepRap to support the development of its electric, emission-free single-seater automobile. Using a German RepRap x1000 system located at the Zurich University of Applied Sciences' School of Engineering, Share your BICAR AG clarified the technical and economic feasibility of its BICAR. The company was also given larger design freedom thanks to the advantages enabled by additive manufacturing.

Amey assesses robot 3D printers for in-situ repair of U.K. rail network

Amey, a U.K.-based infrastructural support service provider, plans to apply 3D printing to train-track renewal. With concept drawings provided by Swiss robotic arm manufacturer ABB, the company demonstrates the construction of an independent repair carriage, capable of moving along railway lines and removing and replacing faults. Though still in its early stages, the company estimates that over 60% of U.K. railway lines could be refurbished using such a system, returning material economy and efficiency savings equating to over £40 million a year.

Big Dog, Jay Leno & Stratasys collaborate in 3D printing parts for hundreds of classic autos

Jay Leno, who was connected to 3D printing in the past, is beginning a major partnership with his Big Dog Productions and Stratasys Direct Manufacturing. Stratasys will be offering access to FDM 3D printers as an extension of the Stratasys' Performance Partner Program launched in October 2019. The goal is to use additive manufacturing processes to further empower competitive auto racing, classic vehicles and next-generation aviation.

Stratasys announces Rail Industry Solution for 3D printing spare train parts

OEM Stratasys made two major announcements regarding its continued endeavor to integrate 3D printing within the railway industry. The company created a "Rail Industry Solution" package designed to help the maintenance of passenger trains using 3D printing. Included in the solution are materials that passed the E.U.'s Rail Standard, EN 45545-2, alongside a Stratasys Fortus 3D printer. This will help railway firms to 3D print spare parts on-demand that meet certification requirements for smoke, fire and toxicity.

Daimler to 3D print spare bus parts using Sintratec S2

Swiss SLS 3D printer manufacturer Sintratec will partner with German multinational automotive corporation Daimler AG. Sintratec's S2 3D printer was installed at the production site of EvoBus GmbH in Neu-Ulm, a subsidiary of the Daimler Trucks & Buses branch. It will be used to further the company's spare part supply efforts.



Navy, Military, Aviation & Aerospace

Army announces new push to get 3D printing, advanced manufacturing to troops in the field

The secretary of the U.S. Army announced an advanced manufacturing policy that looks to use technologies like 3D-printing, robotics, artificial intelligence and composite materials to change everything from how soldiers fix equipment in the field, to how much their weapon systems weigh. As opposed to an armor brigade combat team requesting replacement parts from a warehouse 1,000 miles away, troops could have a 3D-printer create them inside the Conex box of a sustainment brigade, putting an Abrams tank back into the fight faster and cheaper.

Plastic recycler will turn space station trash into 3D printing stock

Made In Space is set to launch its Plastic Recycler toward the orbiting lab aboard Northrop Grumman's robotic Cygnus cargo spacecraft. The recycler will process waste plastic into feedstock for Made In Space's Additive Manufacturing Facility, a 3D printer that's available for commercial use. The Recycler will complete the plastic sustainability life cycle on orbit by providing astronauts the ability to convert plastic packaging and trash as well as objects previously fabricated by the 3D printer into feedstock to be reused by the printer. The invention will improve the autonomy and sustainability of long-duration space missions, while also reducing the cost and weight of payloads carried from Earth.

New Air Force-developed steel with 3D printing capability cuts costs while retaining strength

A U.S. Air Force scientist developed a low alloy, high-performance steel that can be powdered and 3D printed into components, and other replacements parts for military and commercial applications. The USAF-96 steel, originally designed for bunker-buster bombs, is reportedly an ideal material for military and commercial use. Compared to existing standard material and manufacturing standards, USAF-96 steel contains no tungsten or cobalt and is a low carbon, low nickel-alloy composition. In addition to its material cost advantage, USAF-96 Steel can be produced using standard air-melt production processes, at a substantially lower cost than prior methods. With the new alloy, producers could cut costs by half, according to the U.S. Air Force Research Laboratory's Munitions Directorate. Until now, new ways of manufacturing steel failed to retain strength while cutting costs.

Etihad Engineering receives approval to 3D print aircraft parts at new lab

The Engineering, Maintenance, Repair and Overhaul division of Etihad Aviation Group, collaborated with EOS and BigRep to open Abu Dhabi's first additive manufacturing facility with Design and Production Approval from the European Aviation Safety Agency. The laboratory, located at the Etihad Engineering facility adjacent to Abu Dhabi International Airport, features two approved industrial 3D printers. The laboratory utilizes the EOS P 396, a powder-bed fusion technology system, for high performance and quality aircraft applications, therefore enabling faster production and reduced weight of cabin parts.

America Makes inks seven-year \$322M agreement with U.S. Air Force to advance additive manufacturing

America Makes, the Ohio-based national accelerator for additive manufacturing, entered a seven year Cooperative Agreement (CA) with the U.S. Department of Air Force's Air Force Research Laboratory (AFRL). Comprising a Cost-Reimbursement/Cost Share agreement, the \$322 million funding value is made up from a combination of government cost and America Makes cost share. The funding will support America Makes in expanding its mission to advance the adoption of additive manufacturing, specifically focusing on the areas of materials, design, education and community in additive manufacturing.

FIT Additive Manufacturing Group develops novel 3D printed aerospace components

IT Additive Manufacturing Group, a German 3D printing service provider, developed novel aerospace components in collaboration with Turkish Aerospace Industries (TAI), ArianeGroup and HAUNI Group. The company also will commit to accelerating additive manufacturing through a recent, partially undisclosed multi-million investment.

NTU selects Optomec LENS 3D printing for bi-metallic NASA project

Optomec, the New Mexico-based developers of Directed Energy Deposition (DED) and Aerosol Jet Printing metal 3D printers, revealed that its Laser Engineered Net Shaping (LENS) 3D printing technology will help NASA reach the moon in 2024. As part of a project led by the Navajo Technical University (NTU), Optomec's LENS 3D printer will be used to produce bi-metallic rocket engine parts that will support NASA's mission to send astronauts back to the moon. Also working on the project are the Marshall Space Flight Center Advanced Manufacturing Center (MSFC), University of Alabama Huntsville (UAH) and V&M Global Solutions, a scientific and engineering consulting firm.

Fabrisonic embeds sensors in NASA's rocket fuel piping using 3D printing

Ohio-based solid-state metal 3D printing specialist Fabrisonic, and optical sensor specialist Luna Innovations, collaborated a 3D printed sensor project for NASA. The team was contracted to help gather data in cryogenic fuel pipes for rocket test stands at NASA Stennis Space Center. Leveraging the capabilities of its patented Ultrasonic Additive Manufacturing technology, Fabrisonic was able to 3D print sensors directly into the wall of an existing NASA pipe. This helped to increase the fidelity of the data gathered from within the fuel piping.



Life Sciences

University of Birmingham develops soft materials technique for artificial biomaterials

A new way of 3D printing soft materials such as gels and collagens offers a major step forward in the manufacture of artificial medical implants. Developed by researchers at the University of Birmingham, the technique could be used to print soft biomaterials that could be used to repair defects in the body. The new technique, called Suspended Layer Additive Manufacturing (SLAM), uses a polymer-based hydrogel in which the particles are manipulated to create a self-healing gel. Liquids or gels can be injected directly into this medium and built up in layers to create a 3D shape. The method offers an alternative to existing techniques which use gels that are minced to form a slurry bath into which the printed material is injected. Called Freeform Reversible Embedding of Suspended Hydrogels (FRESH), these offer many advantages, but frictions within the gel medium can distort the printing.

myReflection uses 3D printing to create personalized prosthetic breasts for cancer survivors

myReflection, a New Zealand-based medical start-up, is developing personalized breast prostheses for post-mastectomy cancer treatments using 3D scanning and 3D printed molds. The prostheses are made from a 3D torso scan and are designed with an inner core and an ISO-certified outer silicone.

Stratasys launches 3D printer, materials aimed at printing human anatomy models

Stratasys launched a new 3D printer devoted to printing human anatomy and medical models as well as materials designed to replicate cardiac and vascular systems and bones. The J750 Digital Anatomy 3D Printer is designed to produce models that replicate the feel, responsiveness and biomechanics of human anatomy to allow surgeons to prepare and train for procedures and advance the development of medical devices.

nScript releases nRugged 3D printer/bioprinter built for harsh environments

Following the early successes of two initiatives, nScript introduced the nRugged system, the first 3Dprinting/bioprinting platform built for harsh environments. nScript entered a partnership with the U.S. Military to deploy a ruggedized version of its BioAssembly Tool bioprinter to print samples in a forward-deployed desert environment. In July, the company also sent its bioprinter into space to be used aboard the International Space Station.

Thinking Robot Studios to develop \$84M 3D printed implant manufacturing plant

Thinking Robot Studios, a privately held medtech company based in New York, was granted permission to build an implant 3D printing facility, focusing on printing anatomical accurate knee, hips and spinal implants. The company will acquire 22 acres of land located at Buffalo Lakeside Commerce Park. The intention is to build office and manufacturing space on the lot worth an estimated \$84 million. Construction is scheduled to begin in early 2020. With it, the company expects to create around 270 high-end and entry level jobs over the next five years.

3D Systems and Antleron enter 3D bioprinting partnership

Leading 3D printer OEM 3D Systems will partner with Antleron, a Belgium-based biotechnology company, to develop regenerative products for personalized patient care. 3D Systems and Antleron will address solutions for medical device and advanced therapy medicinal product applications. In particular, the advancement of growing cells and tissues will be a focus to enable the transition from a static 2D to a bioreactor-based 3D cell culture. This will lead to new ways of producing medical implants, vaccines, cell therapies and living tissues.

New method promises advances in 3D printing, manufacturing and biomedical applications

In a development offering promise for additive manufacturing, Princeton University researchers created a method to precisely create droplets using a jet of liquid. The technique allows manufacturers to quickly generate drops of material, finely control their size and locate them within a 3D space. Although both 3D printers and traditional manufacturers already use droplets to carefully add material to their products, the new jet method offers greater flexibility and precision than standard techniques.

Guysen International introduces Power Flush system for 3D printed medical implants

Guysen International, a U.K.-based industrial finishing equipment manufacturer, launched its Powder Flush system to clean 3D printed medical implant trabecular structures. Trabecular structures aid in the interlocking of human bone growth at the end of long bones or in the spinal column. Metal additive manufacturing processes such as selective laser melting (SLM) and electron beam melting (EBM) enabled the customization of these implants. Due to its porous nature, particle residue is often present in the 3D printed implants.

SCC receives grant from NSF to develop mobile additive manufacturing platform

Somerset Community College's Additive Manufacturing Center of Excellence in Kentucky received a second National Science Foundation Advanced Technological Education grant award for its Mobile Additive Manufacturing Platform. The NSF ATE focuses on the education of technicians in high-technology fields. Its grant will be used to help the Mobile AMP project provide in-depth training for teachers in advanced design for 3D printing, in partnership with the Tennessee Technological University.

BellaSeno 3D printed breast implants to commence clinical trials with Evonik materials

German specialty chemicals business Evonik signed a long-term agreement with 3D printed scaffold developer BellaSeno GmbH. The agreement guarantees BellaSeno's use of Evonik's bioresorbable polymer RESOMER in the production of its proprietary 3D printed Senella product. BellaSeno achieved ISO 13485 certification for its Senella breast scaffolds in July 2019 and raised a further €1 million (\$1.12 million) to continue development of the product. With Senella, the company aims to improve procedures for breast reconstruction, augmentation and revision surgery, creating implants that can safely be absorbed by the body.

Formlabs launches Form 3B 3D printer and Formlabs Dental business unit

Formlabs devoted a new business unit and 3D printer and materials for dental 3D printing. Its Form 3B 3D printer is a resin-based system marketed to dental labs and supported by an expanded range of materials. Applications for the Formlabs 3B include crown and bridge models, clear aligner and retainer models, diagnostic models, surgical guides, occlusal splints, patterns for casting and pressing, and dentures with four base and six tooth shades. The new business unit will be called Formlabs Dental. The unit will offer a Dental Service Plan run by a team of certified dental specialists. A mixture of guiding training courses and remote learning will be offered to both experienced and new users of 3D printing in dentistry.

3D printed biomimicry of bone yields important discovery for lightweight and durable engineering

A collaborative team from Cornell University, Purdue University and Case Western Reserve University studied the spongy, trabeculae structure of vertical and horizontal struts forming the center of human bones. Challenging a long-held belief, the team found that the seemingly insignificant horizontal rods of the bone are crucial to their ability to last a lifetime. To better understand how bone structure responds to cyclic loads, the team ran a microstructural simulation. After digitally testing the load-bearing capabilities of the structures, the team then 3D printed structures based on the designs and performed further investigative compression tests, finding that increasing the size of horizontal struts by 30% allowed materials to last 100 times longer than thinner structures. The study creates the potential for the treatment of osteoporosis as well as industrial engineering applications, including automotive and aerospace sectors.

DNA of Things: Researchers embed DNA into 3D printed objects

A research team based out of ETH Zurich developed a way to store DNA-like information inside 3D printed objects. The novel approach could allow people to reproduce 3D printed objects without any external digital information, such as original CAD files. The innovative technology, dubbed the DNA of Things, was pioneered by a professor in ETH Zurich's Department of Chemistry and Applied Biosciences and an Israeli computer scientist.



Wearables

Covestro developing 3D printed orthopedic insoles made from TPU

German chemical company Covestro revealed a new application for its TPU material for additive manufacturing: 3D printed orthopedic insoles for shoes. Traditionally, the custom products were made by hand and required extensive time and resources to produce. They could cost several hundreds of dollars. With its mass customization potential, 3D printing has proven to be a viable solution for manufacturing custom insoles at faster and cheaper rates.

Casca aims to revamp shoe retail by manufacturing with 3D printers

Casca, a startup out of Vancouver, seeks to use 3D printing to enhance mass personalization in the insole and footwear market. The company, which recently raised \$3.5 million from Khosla Ventures, launched its first store in Vancouver. Casca's system uses custom 3D printed insoles made from 100% recyclable materials, a digital app that scans a foot with a smartphone and shoes that are designed for better support. The company aims to fully scale its retail outlets by 2029 with 3D printers to create insoles and shoes on demand. If successful, Casca will decentralize its supply chain.



Food

Israeli company developing 3D printing of clean meat

Ophectra Real Estate and Investments signed a memorandum of understanding to merge with MeaTech, which is developing technology for the 3D printing of lab-grown Clean Meat produced from stem cells. The company is developing an advanced and unique technological process for the industrial production of clean meat without slaughtering animals, by using 3D stem cell printing technology.

Singapore scientists develop 3D printed chocolate with cold extrusion method

Researchers from the Singapore University of Technology and Design developed a new approach to 3D print chocolate-based products at room temperature by cold extrusion. The hot-melt extrusion method is used in 3D printed chocolates where the chocolate is required to be between the temperatures of 31°C to 36°C. The narrow range of operating temperature can be restrictive, while cold extrusion does not require the manipulation of temperature as it depends on the rheology of printing ink that is added to chocolate at the operating temperature. Using the chocolate-based ink 3D printing (Ci3DP) approach, available chocolate products such as syrups and pastes were mixed with cocoa powder to alter the rheology of the ink.



Education

CREATE Education launches U.K.'s first Primary Education 3D Printing Hub with Rolls-Royce

The CREATE Education Project, the U.K. organization championing 3D printing in the classroom, launched its first Primary Education 3D Printing Hub in partnership with Rolls-Royce. Wyndham Primary Academy in Derby was selected as the chosen hub after a call went out to schools in the area to pitch how the technology would be embraced within the school and the wider community in a bid to become a center of excellence for 3D printing in education.



Environmental Efforts & Energy

Argonne National Laboratory: Recycling nuclear material through 3D printing

Nuclear materials scientists at the U.S. Department of Energy's Argonne National Laboratory were able to recycle up to 95% of used fuel from a nuclear reactor; however, the 5% of fuel that is left still amounts to a lot of material to be stored. The scientists explain how "expanded low-carbon baseload power production through the use of nuclear fission can be enabled by recycling long-lived actinide isotopes within the nuclear fuel cycle." Further, they can recycle an additional 2% of the nuclear material.



History, Arts & Entertainment

MIT students recreate bridge concept by Leonardo da Vinci using 3D printing

An MIT team 3D printed a 1:500 scale model of a proposed 16th century bridge design by Leonardo da Vinci and tested it to see how it could support weight and withstand settlement of its foundations. Once the blocks were 3D printed, the team assembled them using scaffolding inspired by 16th century construction. The resulting structure was a 32-inch-long bridge that matched da Vinci's design. To test the scale model of the bridge, it was built on two platforms, which could be moved to simulate the movement of foundations caused by weak soil or even an earthquake. The bridge showed resilience to the horizontal movement and deformed only slightly until it was stretched to the point of collapse.

3D printed saddles keep Canadian military tradition alive

The Lord Strathcona Horse Regiment is utilizing 3D printing to help keep a military tradition alive. By creating replicas of century-old horse saddles they've found a way to preserve the originals. The designers have a tough task on their hands as they have to scan and model parts that will fit onto the original designs dating back to the 1800s. However, this also means certain parts can be improved upon from a design perspective.