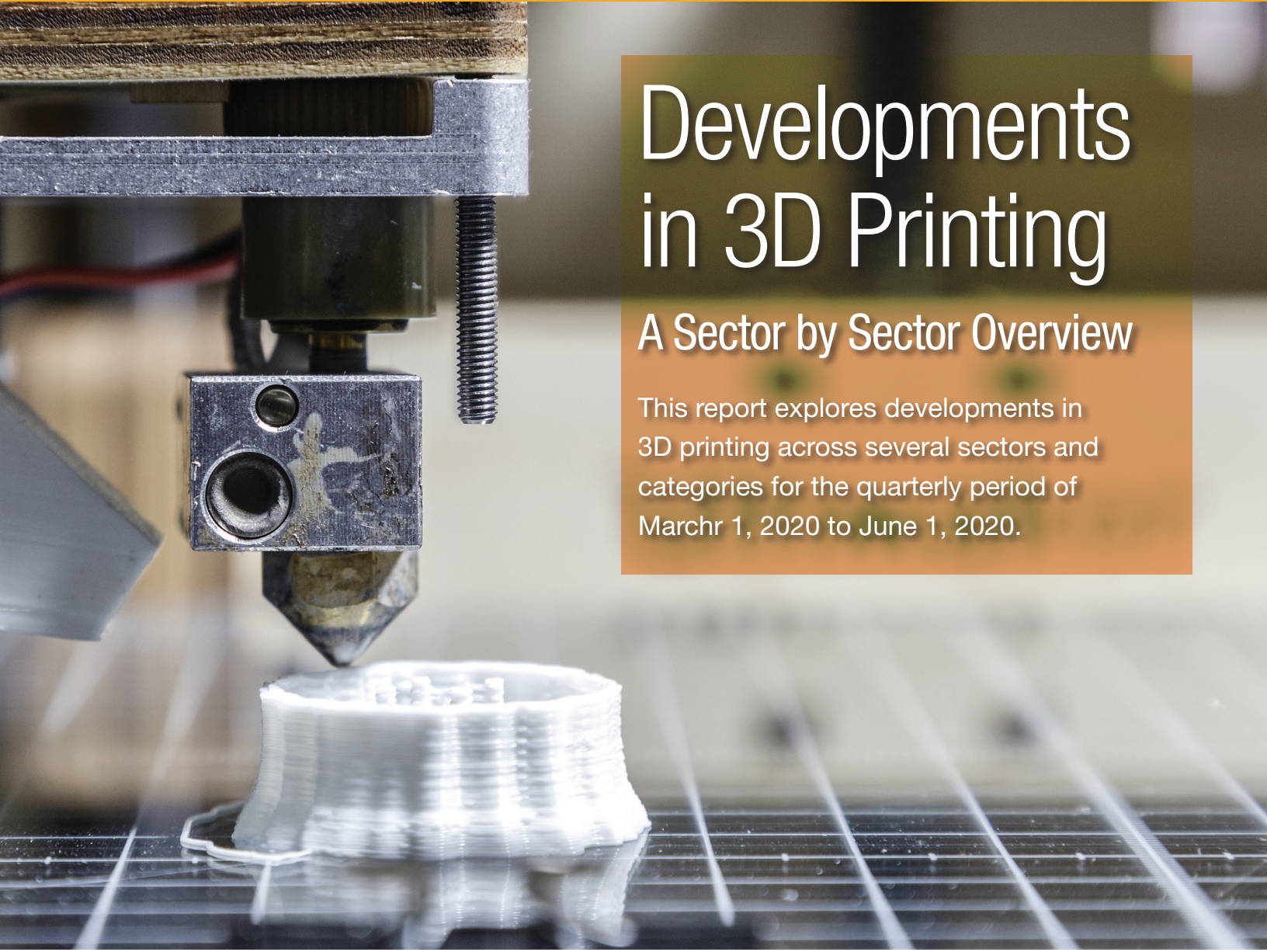


3D PRINTING—A FAST-MOVING MARKET



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 March 1, 2020 to June 1, 2020.



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Table of Contents

Overview	1	Miscellaneous Partnerships	21	Wearables	55
General	2	Auto & Transportation	27	Food	55
Materials	4	Navy, Military, Aviation & Aerospace	27	Education	56
Printing Techniques & Capabilities	9	General Life Sciences	31	Environmental Efforts & Energy	57
Manufacturing & Construction... ..	16	COVID-19 Support and Medical Personal Protection Equipment	38	History, Arts & Entertainment	59
M&A and Investments	18			Home Decoration	59



General

Thermwood introduces LSAM 1010 3D printer with enclosed configuration

Indiana-based manufacturing company Thermwood released a version of its Large-Scale Additive Manufacturing system: the LSAM 1010, a low-cost enclosed AM machine that was built to meet the needs of Thermwood's clients. In November 2019, Thermwood introduced the LSAM MT, a lower-cost, moving-table version of its industrial LSAM system. Though the LSAM MT is suitable for many applications, Thermwood reported that many of its large customers asked the company for a similar system, in terms of size and cost, but with an enclosed machine configuration. This resulted in the development of the LSAM 1010, a system that combines the gantry, control and sub-systems of the cost-friendly LSAM MT and the enclosed walls of the industrial-scale LSAM system.

3DPRINTUK moves to 10K square-foot facility in North London

3D printing service bureau 3DPRINTUK, which specializes in selective laser sintering 3D printing services, completed its transition to a space inside the Leyton Industrial Village in North London. The site will allow 3DPRINTUK to meet its customer demand and future growth plans. The site in North London spans nearly 10,000 square feet, making it about 8,000 square feet larger than 3DPRINTUK's previous facility. The building was designed for 3DPRINTUK's production, including its expanding fleet of EOS polymer SLS systems, as well as all other ancillary and post-processing equipment. The location has two rooms dedicated to post-processing parts, cleaning and dyeing, as well as a sealed break down room to avoid risks of powder contamination.

Peopoly launches Phenom L and Noir MSLA 3D printers

Peopoly, a Hong Kong-based 3D printer manufacturer, launched two 3D printers in its Phenom series of SLA systems. Named the Phenom L and the Phenom Noir, each of the systems presents an upgrade in size and speed over the previous Phenom, launched in October 2019. The Phenom L is positioned as a larger alternative to the original Phenom, equipped with a 50% larger build volume. The Phenom Noir, on the other hand, was built as a faster system, potentially capable of printing 80% to 100% faster.

Argonne scientists scale up medical isotope recycling using 3D printing

A U.S. Department of Energy's Argonne National Laboratory research team scaled up the recycling of Molybdenum-99 (Mo-99), a medical isotope, using 3D printed parts. The additively manufactured parts make the laboratory's original recycling process faster, more reliable and less costly, enabling the method to be used on an industrial scale. Radiologists use Mo-99 to detect and diagnose heart disease, bone decay and various rare cancers. Enriched molybdenum, which is crucial for the production of Mo-99, typically costs about \$1,000 per gram to procure. Mo-99 manufacturers were previously unable to cost-effectively recycle enriched molybdenum on a large scale.

Koala 3D: Chilean researchers investigate climbing 3D printer

Researchers at the University of Chile [explored](#) a mobile form of 3D printing that allows a machine to produce objects bigger than itself. Named 'Koala 3D', the system is a combination of a climbing robot and 3D printer, capable of scaling along the object that it is printing to create an infinite fabrication loop. The researchers present the design, construction and characterization of the Koala 3D system alongside experiments and tests on vertically fabricated columns and statues. The Koala 3D has a range of applications in construction and product fabrication.

MakerBot launches LABS extruder for METHOD to enable engineering material extrusion

Desktop FFF system manufacturer, MakerBot, launched its experimental LABS extruder for use with its METHOD 3D printer. The LABS extruder converts METHOD into an open materials platform, enabling the 3D printing of a range of third-party engineering materials. MakerBot's LABS extruder is designed to encourage engineers to experiment with 3D printing filaments on METHOD. With a heated chamber reaching 100°C, METHOD can produce strong and accurate parts, making it a complementary system for experimentation. SR-30 supports provided by Stratasys and PVA supports, known for their water solubility, can be used to fabricate complex geometries with minimal post processing.

VELO3D launches larger format metal 3D printing system

VELO3D launched its next-generation Sapphire metal 3D printing system which can produce parts up to one meter tall. The machine will begin shipping in late 2020 with Knust-Godwin set to become the first adopter of the platform. Knust-Godwin is a user of VELO3D's original Sapphire system and will continue to leverage the company's metal 3D printing technology to manufacture end-use parts for the oil and gas industry. VELO3D's product was developed to enable applications in the oil services and aerospace fields. It will encompass many of the same technical features as the original Sapphire system, including its SupportFree technology and compatibility with VELO's Flow and Assure software tools, while also featuring a 315 mm-diameter build plate, dual 1KW lasers and in-situ optical calibration.

Haute Fabrication launches self-learning metal 3D printing service

Texas-based Haute Fabrication is launching an automated contract additive manufacturing service powered by self-learning metal laser sintering technology. The company's Hybrid Direct Laser Sintering (HDLS) process has been in development for more than seven years and is set to become operational for the first time in summer 2020. Seeking investment via the StartEngine platform, the company is working to develop and deploy four variations of its HDLS system, with build volumes varying from 0.6 meters cubed to 5.2 meters cubed, which will be operated by a suite of virtual reality-trained robotic systems and a built-in adaptive artificial intelligence cloud-based control system. The finishing touches are reaching completion on an initial 30,000-square-foot facility in Austin.

DyeMansion launches 17 colors for post-processing 3D printed HP MJF parts

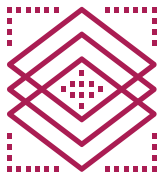
AM finishing system manufacturer DyeMansion released 17 colors specifically for post-processing 3D printed grey HP MJF parts made of Polyamide 12. The color range is expected to enable a set of applications for grey 3D printed parts after being made commercially available in July 2020. Before the release, customers who own an HP Jet Fusion 4200 or 5200 system will have the option to participate in a beta program to test the color range.

Creality announces its first crowdfunded 3D printer

Creality's CR-6 SE 3D printer will be the Chinese manufacturer's first crowdfunded 3D printer, receiving Kickstarter backing from May 6th to June 6th prior to its launch. With an expected price tag of around \$300 to \$400, the user-friendly focused FDM system is aimed at hobbyists and newcomers to the world of 3D printing.

CNC manufacturer CHIRON enters AM with metal 3D printer

CHIRON GROUP, a global manufacturer of CNC equipment, made its first foray into additive manufacturing with the development of its first 3D printer, the AM Cube, a laser metal deposition system. Designed for manufacturing large and complex components, the AM Cube expands upon the company's existing core competencies that focus on metal machining and automation. Targeting applications in aerospace and energy, among others, the system is also capable of 3D printing near net shape parts, as well as coating and repairing components. With the inclusion of additive manufacturing technology within its product portfolio, CHIRON aims to provide a complete package of manufacturing solutions.



Materials

Japanese researchers develop 3D printed metal-organic framework solids

Kyoto University researchers 3D printed solid structures made of four different metal-organic frameworks (MOFs) by using a modified 3D printer for the controlled deposition of inks. In their [study](#), the team proved the viability of 3D printing MOF structures that maintain porosity and relevant mechanical properties. The researchers plan to print more viscous pastes which may improve the final robustness of the 3D printed parts as well as the volumetric uptake. Furthermore, trials with more porous powders will be taking place to increase the gravimetric uptake of the 3D printed parts in accordance with U.S. Department of Energy requirements as a prerequisite for hydrogen and natural gas vehicles. The study is expected to lead to the preparation of highly porous MOF-based solids with designs adaptable to their applications: microreactors, absorbent beds or separation membranes with specific morphologies, among others.

ETH researchers develop universal carrier ink for 3D printing

Researchers in the Department of Engineering at ETH Zurich produced a gel from cellulose fibers and biodegradable nanoparticles that liquifies when pressed through the nozzle of a 3D printer, but then quickly returns to its original shape. Their invention paves the way for personalized biomaterial implants. Materials scientists are increasingly turning their attention to precision biomaterials, tailoring treatments to the genetic make-up of the patient. However, personalized implants are still a long way off. Based on the fact that hydrophobic substances can be introduced into the nanoparticles, and hydrophilic substances can be added to the aqueous phase with the cellulose fibers, the researchers demonstrated that their ink is also suitable for the development of drug delivery systems.

Fortify launches CKM material handling module

Boston-based 3D printing startup Fortify launched its Continuous Kinetic Mixing (CKM) system, which will complement its Fluxprint 3D printing module and enable functionality in printed photopolymers. The CKM system is a material handling module for polymers filled with fiber and particle additives. The CKM material handling system incorporates additives into polymers to improve mechanical performance, as well as thermal and electrical properties. Fortify's platform results in materials with the scalability, resolution and surface quality of photopolymers and the strength of high-performance polymers. Fortify, which in 2019 raised \$10 million in a Series A funding round, plans to ship its 3D printing platform in summer 2020 to select partners. Fortify also achieved another successful use case in the metal injection molding area. Fortify's technology was used to produce ceramic-fiber-reinforced tooling that was able to withstand the temperatures and pressures of the molding process.

Essentium and LEHVOSS develop PEEK and HTN materials for FFF 3D printing

Essentium, the Texas-based 3D printer manufacturer behind High Speed Extrusion technology, entered a partnership with chemical and mineral materials specialist LEHVOSS Group to develop high-performance materials for additive manufacturing. The materials, comprising a line of PEEK and High-Temperature Nylon, were created for production-level extrusion-based 3D printing processes. They are designed to meet the standards set by high-performance applications in aerospace, automotive, oil and gas, biomedical and electronic manufacturing industries.

Nexa3D and Henkel launch ABS resin for SLA 3D printing

Nexa3D, a California-based SLA 3D printer manufacturer, is working with chemical company Henkel to develop a line of co-branded photopolymer SLA resins, which will be distributed through Nexa3D's global channels. Through the partnership, Nexa3D joined Henkel's open platform of material partners. Both companies aim to leverage their respective expertise in SLA 3D printing technology and performance resins to create functional parts using Henkel's materials on the NXE400 3D printer. Their first material, optimized for the NXE400, is an ABS 3D printing resin developed with Henkel's Loctite material technology.

Heraeus and TRUMPF to advance applications of amorphous metals in additive manufacturing

Amorphous metal specialists Heraeus AMLOY is working with German machine tool manufacturer TRUMPF to advance the use of 3D printed amorphous parts for production. By improving process and cost efficiencies of the material in additive manufacturing, the companies aim to establish the 3D printing of amorphous parts as a production method on the shop floor. Amorphous metals, which maintain atomic structural properties akin to glass, are considered as strong as steel, while remaining lighter and more elastic. Combined with the design freedom of 3D printing, engineers are given the opportunity to create strong, lightweight metal parts with complex geometries. This could prove beneficial in fabricating parts that are subject to significant stresses and lightweight design in sectors such as aerospace and mechanical engineering. Amorphous metals are also suitable for manufacturing medical devices due to their biocompatibility.

Researchers develop highly expandable foam resin for SLA 3D printing

A team of researchers from UC San Diego's Department of NanoEngineering developed an expandable foaming resin for use with SLA 3D printers. The resin, which is capable of heat-induced expansion post-UV-curing, allows to produce parts significantly larger than the build volume of the printer used to fabricate them. The researchers set out with the goal of breaking the restraints of these geometric limitations, citing potential applications in technologically demanding fields such as architecture, aerospace, energy and biomedicine.

Dresden researchers develop magnetic “smart TPU” for FFF

Researchers from the Dresden University of Technology formulated and 3D printed a magnetic TPU-based elastomer filament using FFF technology. By utilizing a printhead and a magnetic field, the team was able to pre-structure magnetic particles in the thermoplastic elastomer matrix, giving it magnetic properties once extruded.

BigRep launches ABS & ASA materials for large format 3D Printing

German-based large-format 3D printer manufacturer BigRep added Acrylonitrile Styrene Acrylate and Acrylonitrile Butadiene Styrene to its material portfolio. The filaments are designed for use in the automotive industry, but also have applications in end-use sports and outdoors consumer products. The newly-added materials are suitable for use with BigRep's STUDIO G2 and PRO Fused Filament Fabrication 3D printers. BigRep says that the additions reflect the company's “application-focused” approach, in which it's working closely with business partners to address specific material requirements for advanced processes.

Cooksongold AM, ITA, and EOS use 3D printing to advance glass fiber production

Precious metal specialists Cooksongold AM and Sempsa JP, which are both part of the Heimerle + Meule Group, 3D printed the tip plates of a bushing, which is used to extrude glass fibers, using precious metals. The work is intended to develop and innovate glass fiber production in the future and was done in collaboration with the RWTH Aachen Institute of Textile Technology (ITA) and EOS. The platinum/rhodium alloy tip plate has since passed its initial production trials at Johns Manville, a building materials manufacturer, in Slovakia.

Weerg launches ABS-like materials for 3D printing services

Weerg, an Italian 3D printing, and service provider CNC launched Acrylonitrile Butadiene Styrene (ABS)-like grey and Tmax transparent 3D printing materials. The resins are designed to achieve the same mechanical performance as ABS materials, and to replace ABS in producing prototypes, parts, and functional components in the automotive and mechanical fields.

MakerBot expands into carbon fiber composite 3D printing

3D printing company MakerBot, a subsidiary of Stratasys, is entering the composite 3D printing market with the launch of its latest product series: the METHOD Carbon Fiber Editions. MakerBot's offering, along with its MakerBot Nylon Carbon Fiber material, will enable users to produce high-strength tools, jigs and fixtures as well as end use parts, including metal replacement parts for various applications.

Liqcreate releases 3D printing material

Netherlands-based 3D printing material manufacturer Liqcreate launched its Tough-X photopolymer resin. Liqcreate's latest material provides high durability, which lends itself to the manufacturing of spare parts and consumer goods such as insoles. Liqcreate specializes in developing and manufacturing photopolymer resins for Stereolithography (SLA) and Digital Light Projector (DLP) 3D printers. The company also offers custom resin development, enabling customers to create photopolymers with different colors and properties for any DLP, LCD or SLA 3D printer. The material manufacturer's existing range of polymers are catered for general purpose users wanting to achieve smooth surfaces, and even includes glow in the dark resins for creative clients. Liqcreate's polymer resins have been utilized in a variety of industries ranging from entertainment to consumer goods.

Nexa3D releases xCE-Black material for ultra-fast SLA 3D printing

Nexa3D released a new material for its ultra-fast stereolithography technology. The resin, xCE-Black, is a high-performance, single-cure polymer with excellent isotropic properties as well as long-term environmental stability. The single-cure material is also notable for its high flexural strength, comparable to those of dual-cure cyanate ester resins. Its thermal and environmental stability are said to be ideal for automotive and electronics applications, among others, while its strength isotropic properties are conducive to the production of injection molding tools for a wide range of thermoplastic polymers, including PP, PE, HDPE and PETG. In tests, 3D printed molds made from xCE-Black were used hundreds of times at temperatures between 230°C and 280°C without any visible mold temperature degradation or adhesion.

FELIXprinters announces high-temperature 3D printers

Dutch 3D printer manufacturer FELIXprinters is preparing to launch a line of high-temperature 3D printers. The system builds on the company's existing Pro L and XL 3D printing platforms but has a higher temperature capability, offering broader material compatibility. FELIXprinters says the 3D printers are nearly ready for commercial use.

Materialise launches specialist 3D printing advisory service for businesses

AM software provider Materialise launched its 3D printing advisory service, Mindware. The premium service is designed to offer businesses tailored, technology-neutral advice and insight regarding the implementation of 3D printing. By addressing the many business challenges associated with this, clients will be able to formulate manufacturing strategies and move forward with AM as the latest addition to their toolkit.

Roboze launches additive manufacturing service for demanding applications

Italy and U.S.-based 3D printer manufacturer Roboze launched a distributed additive manufacturing service specifically for high-performance applications. Known as Roboze 3D Parts, the service has been described by the company as a network for helping businesses in reducing their costs by shortening the steps in the supply chain, digitalizing inventory, and producing and delivering components on demand. The parts, designed for high-end applications with tough requirements, are made from composites and advanced polymers such as PEEK, CARBON PEEK, EXTEM (TPI), CARBON PA, and ULTEM AM9085F.

Falcontech set to ramp up “Super AM Factory” with 50 Farsoon metal 3D printers

Falcontech, a manufacturing service provider for the aerospace industry, will equip its “Super AM Factory” with 50 Farsoon metal 3D printing systems. By first installing 20 Farsoon machines by the end of 2020, the Chinese aerospace specialist plans to enhance its manufacturing capacity, facilitating series production on a grand scale. Falcontech covers everything from materials, manufacturing, and post-processing to applications and supporting services (all with an AS9100 certification). The company has been operating SLM machines for seven years, and has recently focused on expanding its series production capabilities – this is where the Super AM Factory comes in.



Printing Techniques & Capabilities

SUTD and NTU collaboration yields reversible 4D printing

A collaborative research project between Singapore University of Technology and Design and Nanyang Technological University resulted in a 3D printed material changing its shape and back again numerous times without electrical input. When the shape of a 3D printed object changes over time, it is referred to as 4D printing. Reversible 4D printing refers to the ability to then change back to the original 3D printed shape. Harvard University scientists previously experimented with smooth and complex surfaces by 4D printing structures that, when placed in saltwater, take on the shape of a human face.

Aerosint and Aconity3D develop multi-material metal 3D printer

The specialist recoater developed by Belgium-based Aerosint will be deployed in a 3D printer made by Aconity3D, capable of dual-powder layers for laser powder bed fusion systems. The Formnext Startup challenge winner previously entered a partnership with German metal processing specialist, Aconity3D. A joint sales agreement between the two companies was initiated whereby the recoater will be an optional add-on to the Aconity MIDI+. The Aerosint team believes the dual powder recoating capabilities of the system will have disruptive effects in a range of applications from heat exchangers to wear-resistant cutting tools and rocket nozzles.

GH Induction introduces 3D printed coil service

GH Induction, an expert in induction heating systems, introduced a service organization revolving around 3D printed inductors. The service, named SERVINDUCTORS, aims to help customers of the Valencia-headquartered company transition from conventional to 3D printed coils, saving on various costs.

GKN Additive achieves 80% weight reduction with hydraulic block redesign

GKN Additive 3D printed a hydraulic adapter block which was redesigned to weigh 80% less than its traditionally manufactured counterpart, with a weight reduction from 30 kg to 5.5 kg. The U.K.-based technology conglomerate employed Design for Additive Manufacturing (DfAM) principles to reduce material use, resulting in a lower weight and cost while also improving functionality. DfAM principles are useful in all verticals of industry, not only production tooling or heavy machinery.

Researchers propose 3D printed MIMO antennas to improve 5G networks

Researchers at Queen Mary University of London and the Institute for Communication Systems at University of Surrey looked at use of 3D printing to manufacture low cost Multiple Input Multiple Output (MIMO) antennas for 5G communication systems. These proposed MIMOs, fabricated using 3D printing, can deliver beams in multiple directions, providing continuous, real-time coverage without the use of phase shifters. They can operate at the 28 GHz 5G band with their wide bandwidth performance exceeding 4 GHz. As such, the researchers found that these antennas provide a low-cost choice for enabling 5G and mm-wave applications with 3D printing. 3D printing also facilitated complex design choices allowing the direction of the antenna's beam to be altered, and for its directivity to be increased.

Scientists can 3D print insect-like robots in minutes

UC San Diego researchers found a way to 3D print insect-like flexible robots cheaply, quickly and without using special equipment. Inspired by insect exoskeletons, which have both soft and rigid parts, the researchers printed “flexoskeletons,” or rigid materials 3D printed on to flexible and thin polycarbonate sheets. Much like insects, there are features that increase rigidity only in specific areas, a contrast with existing soft robots that often have soft features tacked on to solid bodies. Each flexoskeleton component takes about 10 minutes to print, and a assembled bot should be ready in less than two hours. An individual part costs less than \$1. The goal is to create an assembly line that prints whole flexoskeleton robots without any need for hand assembly. A swarm of these small robots could do as much work as one massive robot on its own.

Purdue University research yields distinguishable 3D printed microrobots

Researchers from Purdue University's School of Mechanical Engineering discovered a method to develop trackable 3D printed microrobots. The research team's process of patterning the microrobots is expected to make them suitable for biomedical applications such as non-invasive diagnosis and drug delivery, where individual tracking is key.

Researchers develop porous free metal 3D printing method, highest tensile strength yet

Metal additive manufacturing researchers from Texas A&M University found a way to 3D print steel free from porosity. Of all the combinations and variants of modern steel, martensite shines due to its high strength, ductility, relatively low weight and cost-effective production. The 3D printing of complex structures can have an effect on the strength and durability of any material, but the research team developed a set of guidelines and parameters that allow for the additive manufacturing of a low-alloy martensite into defect-free parts without sacrificing geometric freedom. Its guidelines simplify the art of 3D printing metals so that the final product is without porosities, which is an important development for metal additive manufacturing industries that make parts as simple as screws to more complex ones like landing gears, gearboxes or turbines.

U.K. researchers create low-cost electro spray and electrospinning device using FDM 3D printing

Researchers from the University of Edinburgh used FDM 3D printing to fabricate a low-cost electro spray/electrospinning device intended for biomedical applications. Although leveraging different techniques, both electro spray and electrospinning methods use analogous technology for the production of nanostructures. The researchers identified that the commercial setup for electro spray and electrospinning methods can cost between \$17,000 to \$300,000, despite being fairly simple to establish. As a result, many researchers resorted to unsafe, homemade solutions. As a potential answer, the researchers developed and shared an FDM 3D printing process enabling the fabrication of a safe, modular electro spray/electrospinning setup.

Insect-like robot uses artificial neurons to modify gait in real time

A research team from the universities of Seville and Cadiz developed NeuroPod, an automaton that simulates the activity of a six-legged insect. The model, which walks, trots and runs, uses efficient and cost-effective materials. It could therefore pave the way for the creation of prostheses or structures for the rehabilitation of spinal cord injuries at a reduced cost compared with those currently in use. The research team developed a robotic model based on insects' movements which reproduces their walking, trotting and running patterns in a robot with negligible loss of balance or intermediate delays in the change of gait, as occurs naturally in living beings. The skeleton is created with 3D printing and contains 18 servomotors, which simulate the nervous and motor systems. These devices are equipped with a decoder that converts mechanical motion into digital pulses interpreted by a movement controller.

Zhejiang researchers develop modular 4D printed assembly

Researchers in China studied a prospective modular method of 4D printing that aims to overcome the geometrical limitations of the process. The advantage of 4D printing, based on a digitally controlled 2D-to-3D transformation, is that it forgoes the layer-by-layer fabrication process of 3D printing, resulting in a faster production method. However, the accessible shapes that can be produced via 4D printing are limited. The researchers explain that the modular structure not only carries the advantages of 4D printing, but also enables the manipulation of the printed shapes and the integration of multiple distinct materials through the interfacial bond exchange between material modules.

Beijing researchers develop antibacterial filament for low-temperature FDM

Researchers from the Beijing University of Chemical Technology developed a starch-infused polycaprolactone-based composite filament for use with low-temperature FDM machines. The filament was then further functionalized via the addition of bioactive ingredients, giving it antibacterial properties.

Method created for efficient painting of complex 3D printed objects

Engineers at Rutgers University in New Jersey developed an automated post-processing method for painting complex 3D printed objects. The spray coating process can reach the most inaccessible areas of a component. The method, which can save manufacturers time and money in the post-processing stages of production, can also provide opportunities to create “smart skins” for 3D printed parts. Using electrospray deposition, a spray coating process, Rutgers engineers devised a technique that possesses the ability to conformally coat complex 3D objects without changing the location of the spray needle or orientation of the object, making them ideal for post-processing additive manufactured parts.

Researchers create ultrafast nozzle-based 3D printing technique

Researchers in Spain devised a method of ultrafast 3D printing with submicrometer features using electrostatic jet deflection technology. The team created the electrostatic jet deflection method in order to overcome the limitations of existing additive manufacturing technology in relation to production speed. From their tests, the researchers found that electrostatic jet deflection can 3D print objects with submicrometer features by stacking nanofibers on top of each other at layer-by-layer frequencies as high as 2000 Hz.

Laser-based metal 3D printing reduces defects by combining simulations and X-ray imaging

Researchers at Lawrence Livermore National Laboratory developed a strategy for reducing or even eliminating defects in parts built through a common, laser-based metal 3D printing process. The team collaborated with Air Force Research Laboratory to identify dynamics involved in the laser powder bed fusion additive manufacturing (LPBF-AM) process, which uses a laser beam to melt metal powder layer-by-layer to form 3D parts. The newly discovered mechanisms produce “spatter,” which potentially lead to pore formation and defects. Researchers used computer models to create a “digital twin” of the process to perform virtual experiments of builds at the microscale. The team used high-speed X-ray and optical imaging under LPBF-AM conditions to develop a stability criterion resulting in a “power map” – a scanning strategy that adjusts the laser’s power output along the laser track to stabilize the melt pool and establish a “intelligent feed-forward,” a design process that combines advanced modeling and simulation with experimental analysis to teach 3D printers to efficiently create parts without defects.

University of Illinois researchers create ‘walking’ biobot by combining 3D printed hydrogel skeleton with rat spinal cord

Researchers from the University of Illinois merged a 3D printed hydrogel skeleton with the spinal cord of a rat to create a functional walking ‘spinobot.’ The method of powering the biobot involves the application of glutamate, a neurotransmitter released by nerve cells in the brain, as a stimulus to drive a patterned muscle contraction in the rat spine, which in turn moves the bots ‘feet.’ Not only does this method drive movement, but the spinobot appears to mimic the partial development of the peripheral nervous system. This could serve to widen the potential for future designs that incorporate spinal sensory inputs as control mechanisms.

Optomec advances aluminum Directed Energy Deposition additive manufacturing

Aerosol Jet Printing and Laser Engineered Net Shaping company Optomec announced an advancement in the capability of its LENS Directed Energy Deposition 3D printers. The development means that Optomec's range of metal 3D printers can now be used to deposit any aluminum alloy, including those recently developed with improved properties for additive manufacturing. This presents opportunities to expand on the applications of the technology in the transportation and aerospace industries.

TU Graz engineers create metal 3D printer that uses LED instead of lasers or electron beams

Engineers at Graz University of Technology, Austria, developed a metal powder additive manufacturing system that relies on LED instead of laser sources to melt powder. The 3D printer uses a process known as selective LED-based melting (SLEDM). While selective laser melting and electron beam melting, in which metal powder is melted by means of a laser or electron beam, SLEDM instead uses high-power LED light sources to melt the powder.

3D printed lenses enable ultra-long-distance spectroscopy

Researchers at the University of Warsaw, Poland, designed micrometer-sized lenses using a Direct Laser Writing (DLW) 3D printing technique. The 3D printed lenses can be fabricated on top of various materials, including fragile graphene-like materials. The research team, based in the Faculty of Physics, explains that the lenses can replace bulky microscope objectives that were previously required for performing spectroscopic measurements of single nanometer-sized light emitters, like quantum dots or atomically thin 2D materials.

Soft robotic finger fabricated using multi-material 3D printing

Researchers at Zhejiang University of Technology, Tianjin University, Nanjing Institute of Technology and Ritsumeikan University created a soft robotic finger that integrates a self-powered curvature sensor using multi-material 3-D printing technology. The new robotic finger is made of several materials, including a stretchable electrode, polydimethylsiloxane, AgilusBlack, VeroWhite and FLX9060.

Universitat Politècnica de Catalunya BarcelonaTech develops characterization of 3D printing for ceramic fuel cell electrolytes

A Master's thesis researcher associated with the Universitat Politècnica de Catalunya BarcelonaTech developed methods of digital fabrication using ceramic as a versatile material for creating solid oxide fuel cells – electrochemical devices capable of transforming chemical energy to electrical energy. Striving to 'bring science and society closer together,' the research aims to develop energy devices that offer better efficiency, as well as offering clean energy that can be generated with less effect on our environment. Fuel cells are categorized regarding the types of electrolytes contained within, from low temperature (the alkaline fuel cell (AFC), the proton exchange membrane fuel cell, and the phosphoric acid fuel cell (PAFC)) to high temperature (operating at 500 – 1000 oC as two different types, the molten carbonate fuel cell (MCFC) and the solid oxide fuel cell (SOFC)).

FSU researchers develop innovative technique for 3D printing using magnets

Researchers from Florida State University's High-Performance Materials Institute and the FAMU-FSU College of Engineering have developed and investigated a new technique for 3D printing that could produce much stronger materials that could be used in a variety of engineering applications. The research shows the possibility of using magnetic fields near a 3D printer to change the alignment of fibers inside an object as it was being printed. This tweak in the mechanical properties of the material could greatly improve its overall quality and strength.

HENSOLDT and Nano Dimension announce “major breakthrough” in high-performance electronics printing

Military sensor specialist HENSOLDT and AM electronics provider Nano Dimension announced the 3D printing and assembly of a double-sided ten-layer PCB (printed circuit board). The “major breakthrough” is a step toward developing high-performance electronic components through additive means. HENSOLDT hopes to develop the work further and apply the technology to military applications such as radar and optronics.

Texas researchers use plasma technology to address FDM “weak spot”

Texas A&M University researchers collaborated with 3D printer manufacturer Essentium to develop a method to weld adjacent layers together in a 3D printed part more effectively. To overcome the “weak spot” of 3D printing in the imperfect bonding between the individual printed layers that make up components, the team integrated plasma science and carbon nanotube technology into standard 3D printing to weld adjacent printed layers more effectively, resulting in 3D printed parts with increased reliability. To improve the layer fusion process, the team leveraged carbon nanotubes and electricity to coat the surface of each printed layer with the nanomaterials. The carbon nanotube coatings could be heated using electric currents, enabling the 3D printed layers to bond together effectively. The research group used plasma technology that could carry an electrical charge to the surface of the printed part. The technique allows electric currents to pass through the 3D printed part, heating the nanotubes and welding the layers together. The team added both the plasma technology and the carbon nanotube-coated thermoplastic material components to conventional 3D printers, and found the strength of 3D printed parts was comparable to injection-molded parts.

UpNano able to 3D print ISO test specimens with sub-micrometer resolution

Austria's UpNano, which was spun out from TU Wien, made a breakthrough in nano-scale 3D printing by producing test specimens large enough for material characterization according to ISO standards. The specimens were produced using with its 2-Photon Polymerization (2PP) 3D printing technology, which can produce details as fine as 200 nanometers. It had previously been considered impossible to 3D print specimens of the right scale for ISO tests using a 2PP 3D printer and photopolymer while maintaining a resolution in the sub-micrometer range. UpNano used its universal performance material, UpPhoto, and its NanoOne 3D printer to 3D print 30 bending test specimens in under 10 hours and 12 tensile test specimens with more complex structures in under nine hours. The test specimens and their rate of production are ideal for material specification testing in accordance with ISO standards.

Slovakian team develops hybrid PETG composites for 3D printing

Slovakian researchers are looking to use more affordable materials in 3D printing, presenting a new hybrid polymer composite made up of expanded graphite, carbon fibers, and 'combinations thereof' in ratios up to 10% for additive manufacturing and 3D printing. With 3D printing becoming more accessible and affordable, a variety of printing materials are available, including composites that increase in popularity as additives enhance polymers and other materials. The researchers developed a glycol-modified PET copolymer (PETG) that is synthesized by partially replacing the ethylene glycol (EtGly) units of PET with 1,4-cyclohexanedimethanol (CHDM) units, making it amorphous when the CHDM content is in the range of 32%–62%." While the mechanical properties are similar to PET, the PETG adds tensile toughness, transparency, flexibility, high processability and chemical resistance. The team aimed to develop a composite that could be used in FFF 3D printing, replacing virgin polymers with the same quality but better affordability.

German researchers use electric pulses to finely post-process metal 3D printed parts

Researchers at Germany's Saarland University developed a non-contact technique for transforming 3D printed metal parts into high-precision technical components for specialist applications. The method uses electrochemical machining to post-process additive manufactured metal components into precision-finished parts with complex geometries and dimensional tolerances of a few thousandths of a millimeter. The process aims to improve the implementation of 3D printed metal parts in applications with strict dimensional requirements in industries such as automotive and aerospace.



Manufacturing & Construction

Messina researchers develop high-strength lightweight cement mix for concrete 3D printing

Canterbury University is developing high speed and accurate 3D printing which could be used to study the effects of COVID-19. The researchers are working on a prototype of a 3D printer that uses hybrid laser beams to speed up production without reducing accuracy. In light of the current COVID-19 pandemic, the technology could be used to quickly print in-vitro organ models to study the virus' effects, or to screen drugs that might potentially cure it.

ANCA working with CSIRO to develop hybrid additive manufacturing platform

ANCA, a Melbourne-based manufacturer of CNC grinding machines, developed a hybrid 3D printing system for manufacturing custom-designed machining tools. Prior to taking its platform to market, ANCA will collaborate with Australia's Commonwealth Scientific and Industrial Research Organization and Sutton Tools to improve the 3D printing process. It will receive support and funding from the Advanced Manufacturing Growth Centre, a non-profit organization dedicated to growing advanced manufacturing in Australia.

3D printing four small houses in four days

Denmark-based COBOD and PERI 3D printed the walls of four houses in four days at the bautec 2020 exhibition. The company printed walls for 3.5 houses and two bautec logos at a rate of eight square meters per hour. COBOD is a construction-scale 3D printing company, which, together with PERI, set out to demonstrate in real time an alternative to traditional methods used in concrete construction. In traditional construction, lead times are difficult to predict and control, and there are off-site transportation issues and on-site safety issues. Civil engineers use casting or precast procedures on the jobsite to make structural objects that support bridges, homes and buildings.

RobotStudio brings 3D printing capabilities to ABB robots

ABB introduced the 3D printing capabilities of its PowerPac software to its RobotStudio simulation and offline programming software, giving users the ability to program ABB robots for additive manufacturing. While traditional 3D printing methods require programming the printing paths, which involves plotting millions of points and trajectories, ABB's PowerPac software can translate any standard slicer software design into ABB's simulation environment and robot code. An operator can progress from the CAD design stage to final modeling of a product in roughly half an hour. PowerPac will support a variety of processes, such as welding and printing with granules or concrete, making it suited for low-volume, high-mix printing.

Researchers in China use 3D printing to reinforce bulk metal glass composites with metal frame

Researchers from China developed a potential method for the fabrication of strong metallic BMG composites, using a combination of ultrasonic vibration-assisted thermoplastic forming and 3D printing. Bulk metallic glasses (BMGs) are a unique class of materials that possess an amorphous atomic-level structure and desirable mechanical, chemical and physical properties. However, the application of the material was hindered by its intrinsic brittleness and processing limitations at ambient temperature. The researchers 3D printed titanium alloy frames, which were then thermoplastic formed with a bulk metallic glass matrix under ultrasonic vibration, forming sandwich-structured bulk metallic glass composites. Reinforced by the titanium alloy frame, the BMG composites exhibited a fracture toughness higher than that of monolithic BMG.

Eight industrial partners set to work on modular hybrid manufacturing system

A joint research project funded by the German Federal Ministry for Education and Research will see the development of a highly efficient modular hybrid manufacturing cell. The eight-partner ProLMD project was initiated four years ago, with the initial aim of producing hybrid manufacturing processes that combine conventional methods with the laser material deposition AM process.

QUIKRETE and Contour Crafting partner to fight homelessness with concrete 3D printing

U.S.-based concrete specialists QUIKRETE and Contour Crafting Corporation (CC Corp) will collaborate to develop a proprietary concrete to be used with CC Corp's concrete 3D printing technology. The partnership will see the automated construction of residential, commercial, industrial and government buildings around the U.S., starting with Los Angeles.

Concrete choreography project reframes concrete typology with 3D printing

International researchers continue to explore and refine 3D printing within architecture and progressive techniques regarding extrusion of cement during an 18-month project. The Concrete Choreography project is comprised of nine prefabricated concrete columns and centers around 3D concrete printing. The project team integrated not only technology development but also computational design and robotics, meant to 'reframe the challenge' of digital fabrication on the large scale in high resolution. With the project group exploring features for a concrete typology, the columns represent the culmination of a studio course brief for the Master of Advanced Studies in Architecture and Digital Fabrication at ETH Zurich.

3D printing used in unconventional brick production

East China's Shanghai Municipality applied the technology in a riverbank renovation project of the Suzhou Creek, a river passing through the city center. 3D printing had been used in brick production of the project. The printing machine sprayed and overlaid high-strength mortar material according to computer patterns. The printing process was controlled by a computer program, with an error range of three to eight millimeters.

**M&A and Investments****Siemens Mobility further invests in Stratasys 3D printers for 30-year rail maintenance project**

Having previously utilized Stratasys' 3D printing systems to fabricate spare parts for the German and U.K. rail industries, Siemens Mobility Services increased its investment in Stratasys' 3D printing technology to expand its rail maintenance operation in Russia. Two industrial-grade Stratasys Fortus 450mc 3D printers will be used for spare part production to support the 13 additional high-speed Velaro trains. Siemens Mobility will be building for Russian train company RZD. The 13 trains will be added to an existing fleet of 16, with a 30-year agreement to maintain and service the trains also in the deal.

Align Technology announces plans to acquire Exocad for €376M

Align Technology, a Californian 3D scanner and dental clear aligner manufacturer, will acquire Exocad GmbH, a German CAD/CAMs software company. With Exocad's expertise, Align Technology aims to strengthen its digital dentistry platform and make the digital workflow easier for doctors. Align will pay approximately €376 million (\$413.25 million). The majority of Exocad is owned by a global investment firm, the Carlyle Group, which invested in the CAD/CAM software company in 2016, through a €657 million (\$722 million) fund. Carlyle Group states that Exocad doubled revenue and EBITDA since 2016.

3D LifePrints closes £1.2M investment funding round to expand medical 3D printing business

3D LifePrints, a U.K.-based medical 3D printing organization, closed an investment round of £1.2 million (\$1.52 million) led by Fenwall Investments. The investment will be used to expand 3D LifePrints' existing foothold in the U.K.'s medical sector and overseas and follows on from previous investments in 2017 and 2018.

SouSmile raises \$10M to push invisible aligners in Brazil

SouSmile, a direct to customer dental company, raised \$10 million in Series A funding from a number of private investors, including Global Founders Capital, Kaszek Ventures and Canary. The secured capital brings the São Paulo-based company's total funding to \$11.4 million. The two-year-old startup will be using the investment money to grow its invisible aligner brand, which utilizes 3D scanning technology to tailor each aligner to the customer. The company currently operates in five retail stores across São Paulo and Rio.

ZMorph raises \$1.2M in funding ahead of 3D printer launch

ZMorph, the Polish manufacturer responsible for the ZMorph VX multitool 3D printer, raised PLN 5 million (\$1.2 million) in funding as part of a recent financing round led by private investment firm Warsaw Equity Group. Additionally, the company partnered with Opt Lasers, a manufacturer of laser heads based in Poland, to launch a 6 W laser engraving head kit for ZMorph 3D printers. Opt Lasers' laser head kit is designed as an upgrade to its standard 2.8 W laser head equipped on the ZMorph VX.

Arris Composites raises \$48.5M to fund expansion in the U.S. and China

California-based Arris Composites, a developer of continuous carbon fiber composites, secured \$48.5 million in Series B funding in order to continue its expansion in Southeast Asia and the US. Operating in stealth mode until 2019, Arris Composites raised a total of \$58.5 million in funding over two rounds of investment. A VC firm from Taiwan, Taiwan Capital, led the second round of investment, supported by returning investors New Enterprise Associates (NEA) and Valo Ventures.

Boxlight announces acquisition of Robo3D and MyStemKits

Boxlight Corporation, a provider of interactive technology solutions for the global education market, closed the acquisition of Robo 3D, a brand of 3D printers, and MyStemKits, the largest online collection of K-12 STEM curriculum for 3D printing. The purchase price was approximately \$600,000 in the form of cash, assumed liabilities and a note payable.

Velo3D, a supplier of 3D printers to SpaceX, raises \$28M

Despite fundraising in the middle of a worldwide pandemic that managed to shut down a significant portion of global manufacturing, the developer of a metal composite 3D printing technology, Velo3D, managed to raise \$28 million in funding. Over the past fifteen months, the company had bookings of \$29 million and revenue of \$15 million. It's managed to land one of the most technically demanding contracts in the manufacturing industry, supplying 3D printers to SpaceX.

Equispheres raises \$30M in Series B funding

Equispheres, the Canadian additive manufacturing powder producer, raised CAD \$30 million in Series B investment. The funding round was led by advanced materials and sustainable technology investor, HG Ventures, the firm's first foray into additive manufacturing. Government agency Sustainable Development Technology Canada (SDTC) and federal bank Business Development Bank of Canada were also among the participants, as well as other undisclosed contributors.

3D printer startup Nanofabrica raises \$4M led by Microsoft venture arm

Nanofabrica, a startup that develops 3D printers for the manufacturing of electronic and optical parts, raised \$4 million in a funding round led by Microsoft's venture arm M12 and NextLeap Ventures. The funding will be used to further the startup's research and development work as well as expand its sales. To date the company raised a total of \$7 million.

Azul 3D raises over \$8 million in seed funding for high area rapid printing technology

Azul 3D, an Illinois-headquartered 3D printer manufacturer, completed its second stage of seed financing, where it raised \$5.4 million in funding. The company's total investments now stand at over \$8 million, although details of the investors involved in the latest round were not revealed. Azul 3D states that it will use the cash to advance its proprietary high area rapid printing (HARP) 3D printing technology, a large-scale SLA process originally developed at Northwestern University. As well as launching its first commercial HARP 3D printers, Azul 3D will leverage the funding to expand its operations to prepare for product launch, recruit senior leadership and build its manufacturing facility.

HİDROMEK reduces costs of machinery end-use parts with LOOP PRO 3D Printer

HİDROMEK, a manufacturer of construction machinery based in Turkey, is using the LOOP PRO 3D printer to produce end-use parts for its agricultural vehicles. Seeking to reduce its downtimes and avoid the associated costs that can occur, HİDROMEK opted to leverage 3D printing in its vehicle manufacturing processes to help reduce the time and costs of traditional production methods. Using the FFF 3D printer LOOP PRO, HİDROMEK was able to fabricate fully functional parts without the need for substantial post-processing. The decrease in time spent post-processing reduced the costs of implementing each end-use part into the vehicles.

Nano Dimension raises \$35.9M in direct stock offering

AM electronics provider Nano Dimension has announced the sale of 17.95 million of its American Depositary Shares (ADSs) at \$2 per share in a registered direct offering. The sales are locked in with definitive agreements but, once complete, will total around \$35.9 million for the Nasdaq listed company. From this, a small portion will be deducted for placement agent fees and other smaller offering expenses. The sole placement agent in this case is ThinkEquity, a division of Fordham Financial Management. Nano Dimension has stated that it intends to use the raised proceeds for working capital and a number of other general corporate and operational purposes.

Protolabs expands 3D printing capabilities with £10.5M facility

Digital manufacturing company Protolabs has invested £10.5 million (\$13.2 million) in the construction of a 3D printing facility. Built to accommodate a growing demand for Protolabs' technology, the 5,000-square-meter factory in Putzbrunn, Germany, will increase the company's production capacity by 50%. A recent surge in customer demand for complex components in high-requirement applications led the company to focus on moving from prototyping into production.

Kumovis closes €3.6 million Series A funding round with PEEK medical 3D printing

Kumovis, a German medical 3D printing startup, raised €3.6 million (\$4.1 million) in a Series A funding round. The round was led by two additional partners in Renolit SE, the manufacturer of thermoplastic films, and Solvay Ventures, the venture capital fund of Belgian chemical company Solvay. Both of Kumovis' seed investors, namely High-Tech Gründerfonds and Ffilipa Venture Capital, participated in the round too. Leveraging the investment, Kumovis plans to enter new markets, accelerate growth and enable medical device manufacturers to utilize its high-performance polymer 3D printing technology.

**Scoolpt and Stavebni sporitelna Ceske sporitelny building society
3D print first floating house in Czech Republic**

The Czech Republic is preparing to break ground on its first 3D printed house next month. The stylish housing structure was designed by Michal Trpak of sculptural architectural studio Scoolpt, and will be constructed in collaboration with the Stavebni sporitelna Ceske sporitelny (Buřinka) building society. The 3D printed house, whose most distinguishing feature is that it floats, demonstrates how 3D printing technologies can be used to create housing more sustainably than traditional means. Construction on the 3D printed house, called Prvok od Burinky (Protozoon) will begin in June. The house will measure 43 square meters. The layout will consist of three rooms: a living room with kitchen, a bedroom and a bathroom. The house is also designed to be partially self-sufficient and is suitable for year-round habitation. The printed shell of the house is reportedly three times stronger than traditional concrete. And though the house is suitable for many settings, the first build will be anchored to a pontoon.

**Miscellaneous Partnerships****Due Pi Greco expands from prototyping to production with Stratasys Carbon Fiber 3D printing**

Due Pi Greco, an Italian product development service provider, leveraged FDM 3D printing technology from Stratasys to expand its use of additive manufacturing from prototyping to production. The company implemented a total of five Stratasys FDM 3D printers alongside Nylon 12CF, ULTEM 9085 resin, ST-130 and ASA materials into its product development process. As such, Due Pi Greco was able to create production applications for different industries, replacing traditional, more expensive methods with additive manufacturing.

Sigma Labs to integrate PrintRite3D with Materialise MCP Controller

AM quality assurance software developer Sigma Labs will deepen an existing collaboration with Materialise. Building on a memorandum of understanding, the companies will cooperate to integrate Materialise's MCP Controller with Sigma Labs' PrintRite3D software. As part of the agreement, the partners entered into a binding joint sales agreement to begin beta customer commercialization of the integrated product.

Sintratec expands distribution in Benelux with Bender AM

Switzerland-based SLS 3D printer manufacturer Sintratec expanded its distribution network to include Bender Additive Manufacturing, a Dutch industrial specialist. The partnership strengthens Sintratec's presence in the Benelux region as well as Western Europe more broadly. Bender AM was founded in 2014 as a subsidiary of Bendertechniek B.V., a metal and plastics processing specialist. The company, formed in an effort to keep up with the advanced additive manufacturing industry, is a key distributor of 3D printing products and materials in the Dutch and Flemish markets. The company is adding Sintratec's compact SLS systems to its portfolio, which also includes products from EOS, Gefertec, Lithoz, Cooksongold and 3D-MicroPrint.

ERIKS and Ultimaker scale up 3D printing capacity for OEM and MRO Industries

Desktop 3D printing company Ultimaker announced that ERIKS, a provider of technical components and services to all sections of industry worldwide, scaled up the 3D printing production capacity for its OEM and MRO customers. ERIKS equipped its production facilities in Alkmaar, The Netherlands, with multiple Ultimaker S5 Pro Bundles, to co-engineer with customers and offer them support in identifying, designing and printing applications. A special Clean Manufacturing Facility offers EC1935/2004 manufacturing to customers of ERIKS in need of food-safe parts.

Sartomer and Sirrus to develop fast-curing 3D printing resins

Sartomer, a subsidiary of French advanced materials company Arkema, partnered with Ohio-based chemical startup Sirrus to develop fast-curing resins for 3D printing. The resins are based on the copolymerization of methylene malonates and methacrylates, which is said to enhance the speed of the UV-curing process.

DSM and JuggerBot 3D partner to advance pellet extrusion 3D printing

Dutch multinational chemical company Royal DSM partnered with Ohio-based JuggerBot 3D, a 3D printing engineering and consulting firm, to explore the potential of fused granulate fabrication (FGF) technology. The collaboration will lead to the development of pellet 3D printers and materials, intended for production applications. Citing an increase in demand for large-scale additive manufacturing, DSM and JuggerBot seek to leverage the advantages of pellet materials. FGF has the potential to meet these performance and size demands, while overcoming the constraints of some other 3D printing technologies.

Würth Industry signs distribution agreement with Markforged

3D printer manufacturer Markforged signed a distribution agreement with Würth Industry of North America (WINA), a distributor of supply chain solutions for fasteners, MRO and safety equipment. Würth Industry will distribute Markforged's 3D printing systems to customers in the U.S. from the manufacturing, oil and gas, heavy equipment and transportation sectors. Markforged's 3D printing solutions will complement Würth's existing portfolio of supply chain solutions for OEMs, including kanban solutions for streamlined manufacturing. The distribution firm provides products and services to its customers, including metal 3D printed production parts and tools, rapid prototyping and digital kanban solutions for inventory management.

Arcelor Mittal partners with Additive Industries for 3D printing steel spare parts on-demand

Metallurgy giant Arcelor Mittal and Additive Industries partnered to explore 3D metal printing for the steel industry using one of Additive Industries' MetalFAB1, one of the largest four-laser 3D metal printing systems available. 3D printing of spare parts is practical as it offers on-demand, on-location production which reduces the need for stocks. It also shortens the production cycle as well as affording flexibility to ArcelorMittal plants.

Indian Navy partners with think3D to 3D print spare parts on demand for vessels

The Indian Navy partnered with Indian 3D printing service bureau think3D to produce spare parts on demand using additive manufacturing, for both on and off-shore scenarios. The availability of spare parts was a recurring problem for the Indian Navy due to the use of old, imported machinery. Collaborating with think3D, the Indian Navy sought to solve this problem by instead 3D printing spare parts and replacing them on demand. think3D supplied various 3D printed spare parts to the Indian Navy, all of which were tested and incorporated into its machinery. One particular case study revolves around the replacement of centrifugal pump impellers, key components for a ship's operation, using 3D printing.

Formnext + PM South China partners with Germany's ACAM and VDMA

Formnext + PM South China, an additive manufacturing industry event that is scheduled to have its debut in September 2020 in Shenzhen, partnered with the Aachen Center for Additive Manufacturing and the Verband Deutscher Maschinen-und Anlagenbau, two advanced manufacturing groups in Germany. The collaboration between the China-based event and the German groups aims to bring some of the most cutting-edge AM, powder metallurgy and advanced ceramic technologies from Germany to the Chinese market.

MTC and Lucideon aiming to make U.K. a center of excellence for ceramics 3D printing

The Manufacturing Technology Centre (MTC) signed a memorandum of understanding with Stoke-based materials consultancy Lucideon to support the development of 3D printing ceramics. Lucideon specializes in materials technology and processes across a host of industries. It aims to combine materials science with 'innovative ideas and commercial know-how' to enhance the productivity, cost and product performance of the companies it deals with. The MTC meanwhile is the U.K.'s National Centre for Additive Manufacturing (NCAM) and boasts not only a wealth of 3D printing expertise, but an extensive network of contacts and a growing portfolio of additive manufacturing equipment. Pooling together their respective expertise, the pair hope their collaboration can help to establish the U.K. as a center of excellence for ceramic additive manufacturing. They will work to develop ceramic additive manufacturing technologies and a series of applications.

SondaSYS expands 3D printer distribution to North America

Polish 3D printer manufacturer SondaSYS is expanding its distribution network to North America with LeoSparq. LeoSparq, which specializes in custom automation, will look after all SondaSYS sales and service activities in the U.S. and Canada from its head office Oakville, Ontario. SondaSYS produces a range of 3D printing systems covering selective laser sintering, selective laser melting and stereolithography. Its flagship model, the second generation SL02 which builds on the original SL01, is reportedly the only SLS 3D printer on the market with a built-in option to change the build chamber volume. The company's R&D department is also reportedly working on a smaller SLS system aimed at the medical market.

AMT and Leering Hengelo launch PostProDP systems for automated de-powdering

Post-processing system manufacturer, Additive Manufacturing Technologies, partnered with blasting equipment manufacturer, Leering Hengelo, to launch two de-powdering systems for 3D printed parts. The PostProDP and the larger-capacity PostProDP Pro are designed to automatically clean excess powder off laser powder bed fused parts.

CAD MicroSolutions set to break 3D printing speed barrier with Nexa3D partnership

CAD MicroSolutions, a service partner and distributor of 3D technology in Canada, signed an Elite Reseller Agreement with Nexa3D to distribute the NXE400 in Canada, reaching a milestone in its ability to innovate and accelerate the Canadian additive manufacturing industry. Through Nexa3D's partnership with CAD MicroSolutions, the NXE400 will enable the Canadian engineering and manufacturing community to break the size and speed barriers of traditional additive manufacturing. The Nexa3D NXE400 will be added to the CAD MicroSolutions Additive Manufacturing Customer Experience Centre, home to design and manufacturing brands including SOLIDWORKS, 3DEXPERIENCE, HCL CAMWorks, HP JetFusion, Markforged, Ultimaker, BigRep, Formlabs, Nano Dimension, SWOOD, SMAP, DriveWorks, GOM, Materialize Magics, DyeMansion and Nexa3D.

REHAU successful in 3D printing electronic touch sensor using DragonFly LDM

Nano Dimension, a specialist in AM electronics, and REHAU, a polymer manufacturer, 3D printed a 3D touch sensor. Using Nano Dimension's specialized DragonFly LDM (Lights-out Digital Manufacturing) 3D printer, REHAU was able to functionalize one of its premium polymer materials via the integration of an AM electronic circuit.

Empire Group adds Boston Micro Fabrication's PμSL 3D printing technology to product development service

Following Boston Micro Fabrication (BMF)'s global launch of Projection Micro Stereolithography (PμSL) 3D printing technology, Massachusetts-based Empire Group will offer the technology as part of its product development services. The technology was developed and commercialized to enable manufacturers to produce small parts at resolutions as low as 2μm. Empire is investing in BMF's S140 platform, which can achieve resolutions down to 10μm, to meet the needs of existing customers and attract customers who require highly accurate and precise components. The PμSL process emerged as a result of research and development at the Massachusetts Institute of Technology. It leverages a combination of high-precision optics, advanced digital microdisplay technology and a movement platform which alters the position of the vat rather than the light source or lens. The University of Nottingham has also invested in the technology.

DOMO Chemicals strengthens additive manufacturing play with ZARE

DOMO Chemicals, an engineering materials producer, is partnering with 3D printing service provider ZARE to bolster its position in the additive manufacturing market in response to growing demand from customers in the automotive and consumer electronics industries. Through the partnership with ZARE and its parts product capabilities, DOMO's offering will be a reference for OEMs and tier parts suppliers, which is said will help it move further up the value chain of 3D printed parts with solutions that materialize high performing components for very demanding markets." For ZARE, the collaboration will enable designers to evaluate the benefits of AM and DOMO's materials through their services. DOMO already supplies materials for use in selective laser sintering following its 2019 acquisition of Solvay's Performance Polyamides Business and Sinterline Technyl brand. Following that acquisition, DOMO established its HUB by Sinterline 3D printing services to support customers from design and material selection through to parts testing.

M. Holland Company enhances 3D printing offerings with Braskem's polypropylene

M. Holland Company, an Illinois-based distributor of thermoplastic resins, is partnering with Braskem to exclusively distribute its polypropylene filament for 3D printing applications. The material includes a proprietary formula that allows for high stability, low warpage and consistent extrusion, making it ideal for prototyping. After trial testing Braskem's polypropylene materials, additive manufacturing engineers at M. Holland demonstrated repeatable and dimensionally accurate outcomes. The partnership will bolster M. Holland's offerings from existing 3D printing supply partners, including [BASF](#), [Henkel](#), [Owens Corning](#) and [3DXTech](#), allowing it to better support clients in creating prototypes and developing other applications.

France's Cetim one of first to adopt Desktop Metal Shop System

Cetim, a technical center for the mechanical industry in France, is partnering with Desktop Metal to promote and accelerate the global adoption of metal additive manufacturing across industrial sectors by identifying market opportunities for AM and supporting innovation across Cetim's customer network. As part of the tie-up, Cetim will become one of the first adopters of Desktop Metal's Shop System metal binder jetting platform. The partnership follows successful implementation of Desktop Metal's Studop System at Cetim's facility in Cluses, France, which will continue to use the system for rapid prototyping and low-volume production while adding Desktop Metal's capability for low-volume prototyping or mid-volume runs of complex metal components. The shop system is a metal binder jetting technology designed specifically for machine shop use, enabling manufacturers to "tap into new opportunities to reduce their costs and increase revenue." Through the partnership, Desktop Metal and Cetim will work on a range of research projects involving Desktop Metal's metal AM technologies, including design for metal AM processes, post-processing and finishing technique qualification, workflow optimization and materials development.

Nexa3D expands to South European 3D printing market by partnering with 3DZ Group

[Nexa3D](#), the maker of the stereolithography production 3D printers, entered a reseller partnership with Europe's [3DZ Group](#), which offers consultancy and services in the additive manufacturing industry in the EMEA region. Nexa3D's global reseller network expansion is part of its plan to deliver a significant speed and productivity upgrade for the tens of thousands of legacy stereolithography printer users by delivering ultra-fast industrial printers at an attractive cost of ownership. 3DZ is an authorized dealer of 3D printers and 3D scanners for brands such as HP, 3D Systems and Formlabs. It is a reseller of additive manufacturing products for Spain, Italy, France, Serbia, Romania and Dubai, serving customers such as ST Microelectronics, Pedrollo, Kapriol and Toly.

First construction 3D printing deal between two large firms Sika and Pikus

Pikus Concrete is partnering with Sika to commercialize 3D concrete printing technology in the construction industry, with its first 3D concrete printer with Sika technology starting operation in Lehi, Utah. One advantage Pikus cited in Sika's technology is the increased speed of a project build, as building and dismantling of formwork is no longer necessary. Pikus has invested \$3 million in the project, including a building to accommodate the large 3D printer, the actual printer and the labor to get the process started. The company plans to invest heavily in the coming years to reach their goal of 20 printers around the U.S. by mid-2024. Pikus' strategy is to define areas where 3D printing will be most beneficial to the industry, particularly in printing items that are difficult or expensive to form.



Auto & Transportation

Porsche unveils 3D printed automotive seats with custom comfort

Luxury car manufacturer Porsche introduced a concept for sports car seating that leverages 3D printing and lattice design. The seating concept, called “3D-printed bodyform full-bucket seat,” enables customers to personalize their seat for comfort and is partly inspired by seat fittings designed for professional motorsports. For high-performance cars especially, the driver’s seat can influence the driver’s handling of the car.

CUPRA harnessing 3D printing to boost speed, safety and efficiency

CUPRA is using state-of-the-art multi-jet fusion technology to fashion parts in a fast and efficient way. For its Leon Competición racing car, engineers at CUPRA 3D printed the model’s door mirrors, air intakes and cooling intakes. The technique enables the manufacturer to reduce the vehicle’s fuel consumption while also increasing stability, speed and safety, which are important in both motorsport and road car applications.

APWORKS 3D prints titanium part for Bugatti Chiron Pur Sport

Additive manufacturing consultancy and Scalmalloy producer APWORKS 3D printed a titanium part for the latest Bugatti Chiron, the Chiron Pur Sport. An exhaust tailpipe was 3D printed in titanium to make it more lightweight and temperature resistant. The designers leveraged the capabilities of additive manufacturing to produce the exhaust tailpipe with very thin walls, thus saving additional weight in the process.



Navy, Military, Aviation & Aerospace

Amaero launches 3D printing facility in Adelaide

Metal additive manufacturer Amaero launched its first 3D printing facility in Adelaide in partnership with the University of Adelaide. The facility, established by the university with funding from the South Australian government, contains three Renishaw AM 400 3D printing machines and ancillary equipment. Amaero joined the site as an industry partner. Amaero expects South Australia to continue developing as an aerospace hub.

Titomic signs partnership with U.S. Ascent Aerospace

Australian industrial scale metal additive manufacturing company Titomic signed a partnership agreement with U.S.-based Ascent Aerospace for the execution of commercial opportunities to deliver the unique capabilities of Titomic’s Kinetic Fusion for Ascent’s associated aerospace customer base.

Titomic delivering 3D printed demonstrator parts to Airbus

Australian metal AM company Titomic signed an agreement with Airbus through which its Titomic Kinetic Fusion (TKF) technology will be used to demonstrate high-performance metal parts for the European aircraft manufacturer. By developing TKF AM parts process parameters and material properties for Airbus, Titomic is taking a significant step in the validation of its AM process for aerospace applications.

U.K. defense agency plans to 3D print high explosives

The Defence Science and Technology Laboratory, an executive agency sponsored by the Ministry of Defence (MOD) of the U.K., started to develop 3D printed explosives. The project aims to create possibilities for various explosive effects using intricate designs enabled by 3D printing, and also to reduce transportation and storage costs. Applying additive manufacturing to produce formulations is part of the MOD's Future Energetics Project, established to train experts and develop technologies.

University of Delaware to use Roboze ARGO 500 3D printer for joint U.S. Army research

The University of Delaware selected the Roboze ARGO 500 3D printer to facilitate collaborative research of high temperature composite 3D printing with the U.S. Army. The University's Center for Composite Materials aims to use the industrial FFF system to expand its research while accelerating the manufacturing of finished parts and mission-critical components for the U.S. defense unit.

University of California, Irvine develops carbon nanostructure stronger than diamonds

Researchers at the University of California, Irvine and other institutions architecturally designed plate-nanolattices, nanometer-sized carbon structures that are stronger than diamonds as a ratio of strength to density. The scientists report success in conceptualizing and fabricating the material, which consists of closely connected, closed-cell plates instead of the cylindrical trusses common in such structures over the past few decades. Nanolattices hold great promise for structural engineers, particularly in aerospace, because it's hoped that their combination of strength and low mass density will greatly enhance aircraft and spacecraft performance.

University of Houston researcher develops algae-based 3D printing ink to create habitats and other basics in space

Master's student Anastasia Prosina submitted 'Algae-Based Printer Ink As the Way to Foster In-Situ Resource Utilization in Habitation Structures' to Sasakawa International Center for Space Architecture, offering a proposal for building long-term habitats in space, on the moon or on Mars. Numerous concepts were developed for extended life in space, from autonomous construction to the use of realistic materials to a range of challenges requesting innovative ideas. The project focuses on using regolith, often mentioned for use in building 3D printed habitats, but more uniquely, with the addition of algae.

U.S. Air Force produces on-demand surgical retractor using 3D printing

A research team from the U.S. Air Force produced a surgical retractor using 3D printing. The medical instrument is designed to be used in logistically challenging hostile environments where it is not possible to restock medical supplies using conventional methods. It has been produced as a proof of concept, with the aim of establishing a digital library of 3D files, which could be used to produce 3D medical instruments. This would enable deployed medical personnel to download and produce a range of medical equipment, on-demand, anywhere in the field.

ADDere completes 3D printing, assembly of rocket combustion chamber and nozzle

ADDere has 3D printed a rocket combustion chamber and nozzle and merged them seamlessly into a full-size rocket thrust chamber assembly. The scale available with the ADDere laser wire additive manufacturing system provides an alternative to assembling a number of components with varying production processes, which allows for more advanced shapes than were previously available. The ability to integrate components at these sizes helps reduce part count and various fastening methods.

China completes 3D printing tests in space

China has successfully completed its first 3D printing tests in the microgravity of space. A “space 3D printer”, developed by the China Academy of Space Technology (CAST), alongside a 3D printed CubeSat deployer, was launched on China’s large carrier rocket – the Long March-5B. A few minutes after the rocket’s maiden departure, an experimental spacecraft (carrying no crew) separated from the rocket and entered orbit. Accompanying the experimental spacecraft was a test version of a cargo return capsule which carried the 3D printer. The capsule returned to Earth with the 3D printer and two 3D printed samples. China’s 3D printing test involved producing continuous carbon fiber reinforced polymer composites. According to CAST, this is the first time this has been done in space by anyone.

Relativity verifies its 3D printing process works to build a rocket, moves closer to first launch

Relativity Space passed a milestone toward its goal of launching a rocket that is almost entirely 3D printed. The Los Angeles-based space start-up conducted a series of tests using a 3D printed tank, which the company increasingly pressurized until it burst. The object of the test was to determine what pressure the vessel is capable of holding. While the tank was a fifth the size of the one that will be used for Relativity’s Terran 1 rocket, it was structurally representative of the pressures and stress that it would undergo during a launch. The company’s rocket development is still on track for its first launch in 2021, despite pandemic-related delays in the space industry.

nScript 3D bioprinted a human knee meniscus in space

Microdispensing company nScript and aerospace company TechShot completed the first functional 3D bioprinting experiment in space. Using the BioFabrication Facility on board the ISS, with the help of the non-profit Geneva Foundation and the Uniformed Services University of the Health Sciences, they 3D bioprinted a human knee meniscus as part of the 4D Bio3 program. The breakthrough experiment is part of a long-term plan to manufacture advanced soft tissues and whole organs in the microgravity of space.

Rocket Crafters completes testing of 3D printed hybrid rocket engine

U.S. space technology startup Rocket Crafters concluded testing of its Comet Series Hybrid 3D printed rocket engine. Having completed 49 laboratory tests, the latest test firings were designed to be a large-scale proof of concept for Rocket Crafters' STAR-3DTM hybrid rocket engines, ahead of a planned test flight later in 2020. Rocket Crafters' patented approach to engine design combines 3D printed solid rocket fuel grains and liquid propellants, in an attempt to harness the benefits of both approaches. While solid propellants burn continuously until they run out, 3D printing allows the fuel to be printed in a specific pattern, in order to determine how the propellant burns. In addition, 3D printing improves the consistency and reliability of the solid propellant fuel and mitigates against issues of excessive vibrations created by conventional propellants. According to Rocket Crafters, the hybrid engines are cheaper, quicker and safer to develop than their liquid propellant counterparts, and also have the ability to be throttled and restarted.

GE additive, GA-ASI collaborate on first test flight involving metal 3D printed part

General Atomics Aeronautical Systems, a U.S. aeronautics company, completed its first test flight with a metal 3D printed part featured onboard its SkyGuardian Remotely Piloted Aircraft system. Working with AddWorks, the consultation service of 3D printer OEM GE Additive, the manufacturing team met its short-term objective of qualifying the 3D printed part - a NACA inlet made in Titanium Ti6Al4V – and worked on additional application development and qualification efforts. Those additional efforts are continuing into 2020 and beyond.

Italian, Russian agencies collaborate on cosmic telescope 3D printed parts

A collaborative project by the Italian Space Agency, the Russian Space Agency Roscosmos and the Istituto Nazionale di Fisica Nucleare revealed it 3D printed certified parts for a cosmic UV telescope that was recently deployed to the International Space Station. The telescope, named Mini-EUSO (Multiwavelength Imaging New Instrument for the Extreme Universe Space Observatory) is being used to study terrestrial and cosmic UV emissions from the ISS. The structure was launched into space recently, aboard a Soyuz rocket, and has been installed on the ISS' Russian Zvezda module. 3D manufacturing was reportedly a pivotal part of the project's success, reducing costs by a factor of ten and speeding up development by about a year.

U.S. Army uses predictive maintenance to assess performance of 3D printed steel parts

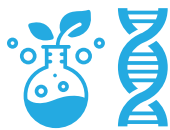
The U.S. Army CCDC Army Research Laboratory (ARL) discovered a method of predicting the performance of 3D printed parts and understanding any imperfections that can affect their performance. As detailed in a study published in the International Journal of Advanced Manufacturing Technology, the method detects and monitors the wear and tear of 3D printed maraging steel through sensor measurement. Such measurements can help the military predict when parts will degrade or fail, and need replacement, allowing them to maintain readiness.

U.S. Army researchers create 3D printed customized ear plugs for soldiers

Researchers from the U.S. Army Aeromedical Research Laboratory have used 3D printing to produce and test customizable earplugs for members of the U.S. Armed Forces. It's currently mandatory for soldiers to wear some kind of hearing protection device, and those that are routinely exposed to hazardous noise are enrolled in the Army Hearing Program. The initiative works to prevent hearing loss through a range of clinical hearing services, but soldiers are by no means the only vulnerable group. In the U.S., an estimated \$242 million is spent each year on workers' compensation claims due to reported hearing impairments.

Phillips Corporation to share additive manufacturing expertise with U.S. Army

Phillips Corporation, Federal Division, a service provider and distributor of machines and ancillary equipment to the U.S. federal government, has executed a Public Private Partnership Agreement to support the Army Center of Excellence for Advanced Manufacturing at the Rock Island Arsenal-Joint Manufacturing and Technology Center. As part of the partnership, Phillips federal applications engineers will collaborate with their Army counterparts to explore the potential of additive manufacturing in developing solutions to meet the Army's current and future supply chain challenges.

**General Life Sciences****Radiation-free solution announced for 3D printing before surgery**

A European partnership received funds to develop an end-to-end radiation-free solution for 3D printed orthopedic models for pre-operative planning. The partnership, which includes the University Medical Center Utrecht, MRIguidance and Axial3D. This solution aims to reduce surgery time and improve clinical outcomes. It will be designed using imaging software, 3D printing expertise and clinical validation. There are many advantages with pre-operative planning using 3D anatomical models, including improved surgical outcomes, reduced time in theatre, less blood loss, a lower infection risk and less associated complications. However, 3D printing of bony pathologies currently requires imaging with harmful radiation and a laborious and time-consuming workflow. Therefore, this partnership aims to overcome these limitations, and create widespread adoption of 3D printed models for patient-specific orthopedic treatment.

Biomaterial discovery enables 3D printing of vascular structures

A study by the University of Nottingham and Queen Mary University of London details the 3D printing of graphene oxide with a protein which can organize into tubular structures that replicate vascular tissues. This development reportedly offers opportunities in biofabrication by enabling simultaneous top-down 3D bioprinting and bottom-up self-assembly of synthetic and biological components in an orderly manner from the nanoscale. The team is biofabricating micro-scale capillary-like fluidic structures that are compatible with cells, exhibit physiologically relevant properties, and have the capacity to withstand flow. This could enable the recreation of vasculature in the lab and have implications in the development of safer and more efficient drugs, meaning treatments could potentially reach patients much more quickly.

Wake Forest researchers create microscopic model of the human body

Researchers at the Wake Forest Institute for Regenerative Medicine in North Carolina 3D bioprinted a microscopic model of the human body containing most of the vital organs. The miniature system will be used to detect potentially harmful effects of drugs before they are trialed with humans. The team expects the sophisticated lab model to bring experimental drugs to the market sooner, mitigating some of the costs associated with clinical trials, and reducing animal testing.

3D Systems develops system for 3D printing of orthodontic models

3D Systems introduced a digital manufacturing system for high-precision, vertical stacked 3D printing of orthodontic models. It comprises the company's NextDent 5100 3D printer, NextDent model 2.0 material, and a proprietary, high precision stacked build available in 3D Sprint software. With this system, dental labs and clinics can produce 30 orthodontic models in one print, with the potential to deliver 120 models in an eight-hour period depending on size and geometry. The software is designed to prepare and optimize CAD data and then manage the additive manufacturing process. The autostacking feature provides one-click automated preparation and placement of models on the build plate, including smart nesting and proprietary support structures.

Shapemode distributes Sisma 3D printers into dental segment

Based in Milan, Shapemode provided prototyping, sales and assistance for DWS brand SLA technology 3D printers, for several years. Shapemode also distributes Sisma 3D printers, including the Everes DLP technology-based 3D printers for the jewelry and dental segments. The operation is targeted towards the needs of the dental sector, a key adoption segment for additive manufacturing that stands to benefit from the speed and cost-effectiveness of the Everes line of AM systems, enabling Shapemode to better meet its customers' needs.

Coherent and exocad collaborate to streamline digital workflows for dentists

Coherent, a powder bed fusion system manufacturer, and exocad, a dental CAD/CAM software developer, entered a partnership that they believe will simplify and improve the digital workflow of dental professionals. The collaboration will see the development of a simple data interface between exocad's DentalDB software and Coherent's DENTAL COCKPIT slicer, making the production of metal dental restorations more efficient.

Singaporean research details the 3D printing of chitinous bio-composites

A study from the Singapore University of Technology and Design explores the 3D printing of chitin-based bio-composites prepared via urban food waste bioconversion. The study aims to develop a more sustainable circular manufacturing cycle by utilizing ubiquitous, biodegradable raw materials. The research team believes that bioinspired manufacturing, which copies the natural life cycle, could potentially aid in the shift to a more sustainable society. Most polymers used in current FFF systems are not biodegradable and cause significant environmental damage over time. A circular manufacturing system where materials are produced, manufactured into products, biodegraded, and reused could mitigate much of this environmental damage.

FabRx launches M3DIMAKER 3D printer for personalized medicine

FabRx, a biotech spin-out from University College London in the U.K., released its M3DIMAKER system, the first pharmaceutical 3D printer developed for the production of customized medicine. The pharmaceutical 3D printer is designed to produce personalized 3D printed tablets called Printlets. The hardware can print pills with a precise dose of medication as well as print “polypills” with several medications integrated into a single tablet. The ability to combine drugs into a single pill could make it easier for patients with complicated medication regimens to manage their prescriptions.

Scientists develop ‘flexoskeletons’ that cost a dollar to 3D print

Engineers at the University of California San Diego developed a method that doesn’t require any special equipment and works in just minutes to create soft, flexible, 3D printed robots. The innovation comes from rethinking the way soft robots are built: instead of figuring out how to add soft materials to a rigid robot body, the UC San Diego researchers started with a soft body and added rigid features to key components. The structures were inspired by insect exoskeletons, which have both soft and rigid parts – the researchers called their creations “flexoskeletons”. The method allows for the construction of soft components for robots in a small fraction of the time previously needed and for a small fraction of the cost.

Researchers develop handheld 3D bioprinter for treating skeletal muscle injuries

A group of biomedical engineers and researchers, primarily associated with the University of Connecticut, developed a handheld 3D bioprinter that can help surgeons completing musculoskeletal surgical procedures. The bioprinter allows surgeons to deposit hydrogel-based scaffolds, or materials to help support cellular and tissue growth, into the weakened sections of skeletal muscles. The technology could be used in the treatment of volumetric muscle loss, particularly in instances where standard reconstructive surgery has proven inadequate. The researchers created a handheld bioprinter, a partially automated, extrusion-based device capable of continuously extruding biomaterials and includes an integrated light source for crosslinking of the extruded bioink. Additionally, it is capable of printing photocrosslinkable hydrogels such as gelatin methacryloyl (GelMA) for VML injuries immediately in situ. GelMA is a collagen-derived biomaterial that closely mimics the extracellular matrix (ECM) of native skeletal muscles. Significantly GelMA can be used as a bioadhesive, as it adheres to body tissues.

Researchers use 3D printed coatings to create personalized drug release profiles

A group of researchers from Greece and Italy [explored](#) the use of 3D printing as a coating technology for customizing the release rate of drugs for patient-specific delivery. Using semi-solid extrusion 3D printing technology to partially coat the tablet, the researchers set about tuning the release of two Active Pharmaceutical Ingredients (APIs) within the tablet. The team were able to customize the selected APIs release profile by modifying various parameters of the 3D printing coating process using experimental design techniques. By tuning these parameters, the researchers were able to achieve different dissolution profiles for the tablets, thus customizing their release rate.

Saremco Dental AG releases CROWNTEC resin for 3D printed permanent dental restorations

Swiss dental resin manufacturer Saremco Dental AG released a photopolymer resin for 3D printed permanent restorations such as crowns, inlays, onlays, and veneers. Prior to its release, the CROWNTEC resin was subjected to routine conformity assessment services and premarketing by global certification firm TÜV SÜD, a notified body according to the EU's Medical Device Directive. A prior iteration of the resin was also the subject of research at the University of Zurich, Switzerland, which showed that the UV-curable CROWNTEC may be a worthy competitor to traditional ceramic dental crowns. The work by the University's Center of Dental Medicine pitted the resin against three traditional particle-filled composite ceramics in a battle of fracture load testing.

MIT engineers use conducting polymers to 3D print soft and flexible brain implants

Researchers and engineers at Massachusetts Institute of Technology (MIT) are using 3D printing to develop soft, flexible brain electrodes using a conductive polymer liquid material. Carrying out [research](#) into the 3D printing of conducting polymers, MIT engineers are working on developing soft neural implants that conform to the brain's contours and monitor activity over longer periods, without aggravating surrounding tissue. Brain implants, typically made from metal, can cause inflammation and the buildup of scar tissue. The use of 3D printed flexible polymer electronics can potentially provide a softer, safer and faster alternative to existing metal-based electrodes designed to monitor brain activity. Therefore, the research could also be useful for developing brain implants that stimulate neural regions to ease symptoms of epilepsy, Parkinson's disease, and severe depression.

Shanghai Jiao Tong University School of Medicine 3D prints scaffolds for tendon-to-bone interface engineering

Researchers from China's Shanghai Jiao Tong University School of Medicine are [exploring](#) complex developments in tissue engineering. In fabricating a tendon-to-bone interface, the researchers delved into a method for improving biomechanics in the shoulder. Considering that rotator cuff tears are such a common issue, usually as a result of injuries, but also due to degenerative disorders, there is a need for improved techniques in restoring functionality to patients. Currently, there are 'significant challenges' in surgical repairs; in fact, the researchers cite data that re-tears occur 20% to 90% of the time. With a biomimetic interface, there is the potential for overcoming current challenges. 3D printed scaffolds offer the benefit of customized structures, prevention of scaffold delamination, controllable pore sizes for better cell growth, use of poly with excellent biocompatibility and biomechanical properties.

Researchers in Asia create implantable blood vessels using 3D cell printing

Researchers in Korea and Hong Kong used a modified 3D cell printing technique to fabricate a biomimetic blood vessel that was implanted in a living rat. According to the researchers, their approach to tissue-engineered biomimetic blood vessels outlined in their [study](#) provides a promising route for the construction of durable small-diameter vascular grafts. These 3D cell printed vascular grafts, which are used to redirect blood flow from one area of the body to another, have the potential to be used in future treatments of cardiovascular diseases.

Rapid Shape and VOCO announce dental 3D printing partnership

3D printing vendor Rapid Shape and dental materials specialist VOCO entered a partnership as they aim to provide customers with increased flexibility and optimal results. Rapid Shape brought a series of 3D printing systems to market designed specifically for dental professionals, while VOCO developed a portfolio of dental 3D printing materials. With their partnership secured, VOCO's materials will now be accessible to users of Rapid Shape machines. Among Rapid Shape's offering to the dental market are the D20+, D30+, D20 II, D30 II and D40 II, which enable dental professionals to print parts at varying scales. Now certified against the second and third generations of these platforms, VOCO's V-Print splint is suitable for the production of therapeutic splints, V-Print SG is able to print surgical guides with good dimensionally stability, and V-Print Model can print dental models with high precision. By aligning their products and expertise, Rapid Shape and VOCO believe they can grow their reputations in the 3D printing and dental fields and provide services of increased quality to their customers.

Canadian researchers become the first to evaluate Ti-5553 alloy for 3D printed bone implants

Researchers from Ontario-based Mohawk College and McMaster University have become the first to investigate the suitability of a titanium alloy, Ti-5553, for 3D printed bone implants. As it stands, most 3D printed implants are created using Ti64 powder, but the research team wanted to see if the unconventional alloy's topography, coupled with complete design freedom, could encourage osseointegration – the ingrowth of bone into an implant.

EU-backed Project NESSIE uses 3D printing to accelerate vaccine production

Researchers from the EU-backed initiative named Project NESSIE, created a technique for purifying vaccines that could lead to reduced costs and enable vaccines to become more readily available to countries in the developing world. Austrian ceramic 3D printing specialist Lithoz together with Genlbet and CERPOTECH began the project in 2019 with research organizations SINTEF and IBET. The consortium aims to accelerate the production of complex vaccines and reduce the associated costs. The structured substrates for downstream processing of complex biopharmaceuticals project has a €1 million budget and is supported by M-era.Net and national funding agencies.

Evonik launches PEEK filament suitable for 3D printing medical implants

German specialty chemicals company Evonik introduced its Vestakeep i4 3DF implant grade polyether ether ketone filament into its portfolio of 3D printing materials. Having met ASTM F2026 requirements, the industry standard for surgical implant applications, the material will allow for the production of 3D plastic surgical implants using Fused Filament Fabrication technology.

UCL researchers 3D print abuse-deterrent opioid tablets

A team of researchers from University College London have 3D printed opioid tablets (tramadol) with alcohol-resistant and abuse-deterrent properties. The work aims to combat the growing global health crisis of opioid abuse caused by the over-prescription of high-strength painkillers by providing a safer method of drug administration.

Welsh engineers produce custom lightweight wheelchair head supports using 3D printing

A team of researchers from Swansea University, Cardiff Metropolitan University and Morriston Hospital proposed a method of 3D printing highly-customizable lightweight head supports for wheelchair users. The engineers pitted their design against a common commercially available head support in a battle of mechanical strength testing and the results indicate the usefulness of AM for individualized accessories.

European partners set to develop handheld eye scanner containing 3D printed optics

The Medical University of Vienna is set to lead a five-year European project which will see the development of a partly 3D printed mobile ophthalmic imaging device. The engineers and scientists working on the handheld device aim to miniaturize photonic chip technology, bringing down its cost in the process. The project partners hope that by the end of the five years, Optical Coherence Tomography will no longer be bound to a stationary clinical setting, but will instead be capable of fitting into a jacket pocket.

Virginia Commonwealth University professor uses 3D printing to advance cancer research

Researchers from the University of Minnesota and Virginia Commonwealth University (VCU) College of Humanities and Sciences used 3D printing to create live models of tumor cells, which could enable cancer researchers to better understand the disease's progression. The new technique allows for the precise placement and control of living cells, to more effectively mimic the key steps of cancer dissemination. At VCU, the team is using this approach to enable the university's Massey Cancer Center investigators, to maximize cancer cell growth for study, and evaluate the effectiveness of anticancer immunotoxins.

Researchers develop nanoengineered bioink to 3D print functional bone tissue

Scientists in the Department of Biomedical Engineering at Texas A&M University are seeking to advance the field of 3D bioprinting functional tissues, by conducting research into the development of new biomaterials. The team has [created](#) a highly 3D printable bioink, which can be used as a platform for generating anatomical-scale functional tissues. The new material developed by Gaharwar's research group, known as Nanoengineered Ionic-Covalent Entanglement (NICE) bioink, has been designed to overcome the deficiencies of current bioinks in relation to structural stability.

Beijing researchers 3D print implants capable of inhibiting HPV infection

Researchers from Tsinghua University, Beijing, have [3D printed](#) a personalized cervix tissue implant to counteract human papillomavirus (HPV). By loading the porous structure of the cone-shaped polyurethane implant with an anti-HPV protein, the team was able to quantitatively control the release of the protein and inhibit HPV growth near the site of the cervix. The researchers set out with the aim of developing a non-destructive anti-HPV implant that could also encourage tissue growth at the site of conization.

Korean researchers 3D print highly-sensitive, wearable biosensors

A team of researchers from Sungkyunkwan University used a commercially available inkjet printhead to fabricate wearable medical biosensors for personalized health monitoring. Using a soft, flexible silicone elastomer with a sugar scaffold, the team was able to print high-resolution features in a lightweight, electrically conductive package. The moldable biosensors are being used to detect actively changing body strain signals as well as passively changing electromyography, electrodermal activity, and electroencephalogram signals.

3D printing low-cost robotic mechanical prostheses for amputees

Researchers in Brazil have published a [study](#) aiming to improve the characteristics and accessibility of robotic mechanical prosthesis with 3D printing. Mechanized prostheses have the potential to provide a viable low-cost alternative for simulating the functions lost by disabled people. However, its high value means these devices have low purchasing power, rendering them inaccessible. The researchers detail the use of 3D printing to improve upper limb mechanical prosthesis with anthropomorphic characteristics implemented through programming, while importantly focusing on ensuring a low financial cost for the device.

**COVID-19 Support and Medical Personal Protection Equipment****Materialise shows 3D printed door opener for coronavirus containment efforts**

Materialise, a Belgium-based pioneer in 3D printing, designed a 3D printed door opener that makes it possible to open and close doors with your arm, removing the need for direct contact with door handles. The company is offering the printable design for free and calling upon the global 3D printing community to 3D print the door opener and make it available all around the world. The 3D printed door opener can be attached to existing door handles and features a paddle-shaped extension that allows people to open and close doors with their arm instead of their hands. For safety reasons, not all doors can remain open and by removing the need to touch door handles, the 3D printed door opener can help to reduce the spread of the virus.

U.K. manufacturers to use 3D printing to build ventilators for NHS

U.K. manufacturers such as Vauxhall and Airbus are planning to repurpose their factories and utilize 3D printing technology to create parts for ventilators to treat coronavirus patients. Prime minister Boris Johnson appealed to companies to help in a “wartime” effort to help produce 20,000 ventilators in as little as two weeks in a call that noted a response from over 60 firms. The car factory’s paint shops could be used for production of the ventilators as they have similar controlled-environment conditions to those required for the manufacture of medical equipment.

HP and partners mobilize 3D printing solutions to battle COVID-19

HP and its global digital manufacturing community are mobilizing their 3D printing teams, technology, experience and production capacity to help deliver critical parts in the effort to battle the COVID-19 pandemic. More than 1,000 3D printed parts already delivered to local hospitals. HP’s 3D R&D centers in Barcelona, Spain; Corvallis, Oregon; San Diego, California; and Vancouver, Washington are collaborating with partners around the world in a coordinated effort to increase production to meet the most urgent needs. Initial applications being validated and finalized for industrial production include face masks, face shields, mask adjusters, nasal swabs, hands-free door openers, and respirator parts. HP is also coordinating with government, health, and industry agencies in numerous countries to ensure a synchronized and effective approach.

3D printing company Formlabs expects to bring swabs for COVID-19 to market

Formlabs will receive an exemption from the U.S. Food and Drug Administration for its swab designed for use in COVID-19 test kits. Global supply chains for test kit components including swabs and chemical reagents have hampered the ability of governments to increase testing to a point where they can adequately ascertain the scope of the outbreak of the novel coronavirus within their borders. The company is currently finishing up human trials and gearing up to expand capacity at its Ohio manufacturing facility. The company said it will be able to supply 100,000 swabs per day.

Ultimaker makes 3D printing network available to hospitals needing supplies

Ultimaker is making its network of 3D printing hubs, experts and designers available to hospitals in need of tools and applications that are short in supply during the COVID-19 pandemic, and launched two initiatives. First, hospitals that face acute shortages of critical parts and that approved 3D print designs and material specifications already available can connect with 3D printing experts nearby to send their 3D print requests to be printed. Ultimaker makes in-house 3D printing capacity available as well. A continuously updated map shows which 3D printing hubs are available nearby. Secondly, if a hospital needs help designing parts and tools that run out and are in limited supply, Ultimaker is making a team of designers and application engineers available to support in designing and creating the desired part. This part is printed by the nearest 3D print hub and sent to the hospital as soon as possible. After testing and receiving approval of the hospital, the part is available for further 3D printed production.

Ford helping to 3D print respirators, ventilators

Ford Motor Company, partnering with firms including 3M and GE Healthcare, is lending its manufacturing and engineering expertise to quickly expand production of urgently needed medical equipment and supplies for healthcare workers, first responders and patients fighting coronavirus. In addition, Ford plans to assemble more than 100,000 face shields per week and leverage its in-house 3D printing capability to produce components for use in personal protective equipment.

Danish charity network to 3D print protective visors

Danish AM Hub, a group of Denmark-based entrepreneurs, started a charity network that stands ready to make up to 20,000 protective visors a day using 3D printers, to meet rising demand from doctors and nurses combating the coronavirus outbreak. With hospitals in Denmark and other countries stretched as they treat a rising number of patients infected with the coronavirus, traditional supply chains failed to meet global demand for facial masks and other protective gear. The initiative started after the Danish Medicines Agency urged companies to come up with ideas on how to obtain extra protective equipment such as visors, face masks and hand sanitizer.

U.S. agencies to collaborate on wide-scale 3D printing of ventilator parts and medical supplies

The FDA will be working with government and public-private partners to distribute and evaluate 3D designs and models in a bid to provide needed hardware and parts. In association with the National Institutes of Health, the Department of Veterans Affairs, and America Makes, the cooperative effort aims to help hospitals and others provide components close to the patient or at the point-of-care. This could include ventilator valves and other parts, as well as personal protective equipment such as face masks and rigid plastic shields. America Makes, the National Additive Manufacturing Innovation Institute, includes member organizations from industry and academia as well as government and non-government agencies. It will act as a matchmaker between the needs of the healthcare industry and the designs and capacity of the 3D printing community.

Siemens opens AM network up to medical providers

Siemens is making its Additive Manufacturing Network and in-house 3D printing capabilities available to medical providers across the globe to help accelerate the design and manufacturing of in-demand medical components. Siemens hopes its resources will help to meet the growing demand for 3D printed medical equipment in the face of the COVID-19 pandemic. Hospitals, health organizations and medical professionals can register for free access to the Siemens AM Network, which connects users to designers and 3D printing service providers for streamlined production. The Siemens AM Network covers the whole AM value chain, from design upload and simulation to printing and finishing services.

Correcting and replacing Stratasys coalition for face shield production with 3D printing numbers over 150 organizations responding to pandemic

A coalition of companies and universities assembled by Stratasys to produce face shields leveraging 3D printers now numbers more than 150. Among others, the list includes Boeing, General Atomics, Medtronic, Dunwoody College of Technology, the University of Central Florida, and the University of Minnesota. In an effort to confront the COVID-19 pandemic, Stratasys set an initial goal to produce 5,000 face shields at no cost to recipients through its own and partner resources by March.27. This includes both a 3D printed visor and a clear plastic shield that covers the entire face. Stratasys said that number will be exceeded and the coalition should be able to produce more than 27,000 face shields over the following two weeks.

Crealty's 3D printed buckle makes wearing face masks more comfortable

Chinese 3D printer manufacturer Creality is fabricating thousands of buckles that make face masks less painful to wear for medical workers treating coronavirus patients. Small bars on either side of the plastic buckle hold the elastic taut behind the mask-wearer's head, so that it doesn't put painful pressure on their ears. Face masks are a key part of protecting front line medical workers from contracting coronavirus, but wearing Personal Protective Equipment for an extended period of time can be very uncomfortable for the wearer.

Mumbai-based startup Boson Machines makes 3D printed face shields for doctors

The co-founders of Boson Machines, a Mumbai-based startup that printed 3D face shields for doctors and health workers, are providing support to medical professionals by printing face shields. The company got into 3D printing of face shields five days back after it was approached by Mumbai's Jaslok Hospital. Unlike N95 masks, which only cover the nose and mouth, face shields are attached to the wearer's head and have a transparent PVC film that covers most of the user's face and ears.

Michigan 3D printing company DreamLab Industries switches focus to making masks

The 3D printers at DreamLab Industries are running constantly as the Traverse City startup with five employees churns out face masks for use amid the coronavirus pandemic. However, the demand is far outpacing what the company can print, so it's taken to a crowdfunding campaign to buy more 3D printers. More than \$4,000 was raised as of March 30. DreamLab made 4,000 masks so far. Nearly 20,000 were ordered from hospitals as well as regular citizens.

3D printable face shields for healthcare workers created by Wicklow tech firm

An Irish tech company designed 3D printable visors to protect healthcare workers during the COVID-19 pandemic. Calt Dynamics, based in Co Wicklow, began working on the prototype visor in response to the shortage of Personal Protective Equipment for healthcare staff around the world and is sharing its design with a major U.S. manufacturer.

Alstom 3D printing hub in Barcelona committed to the fight against COVID 19

Alstom's 3D printing hub in Barcelona is coordinating initiatives being implemented at a Group level to contribute to the fight against the COVID-19 global pandemic. Engineers and developers based in Santa Perpetua site at Barcelona began coordinating and implementing different initiatives to produce pieces, supply consumables and design solutions. Alstom's hub is working in coordination with the 3Dcovid19.org network to manufacture visors for face shields and ventilators valves, that are being delivered to different hospitals.

Germany's space agency shifts its 3D printing resources to producing protective medical equipment

DLR, German's space agency and NASA equivalent, is providing support to the global shortages of personal protective equipment used by frontline healthcare workers in their efforts to treat those affected by COVID-19. DLR tested converting its on-site 3D printers, typically used for producing aerospace-grade parts, to creating medical equipment including protective face masks and ventilators.

Technology leaders, designer launch maker mask initiative to offer first medically approved design for 3D printing of protective masks to assist with COVID-19 response

Maker Mask, a nonprofit initiative organized by leaders in technology, industry and government, announced the availability of the first medically-approved design for 3D printer protective masks to help fill the need for high-quality personal protective equipment due to the COVID-19 pandemic using community-based, small batch production. Maker Mask is making these respirator-style masks available to the public and government free-of-charge through an open source model.

Nissan plants in Tennessee 3D printing headbands, face shields in fight against COVID-19

Nissan North America's Nashville location is helping the fight against COVID-19 by 3D printing headbands and face shields for healthcare workers. The company is using manufacturing and engineering expertise to print the equipment which will be donated to local healthcare centers and their staff working on the front lines. Manufacturing is already underway at the Smyrna Plant and at the Decherd Powertrain Assembly plant. The company expects to produce over 3,000 face shields by April 3 and will print headbands and assemble face shields to the tune of 1,000 per week. Nissan suspended vehicle production along with other automakers in the U.S. Senior manager of Philanthropy for Nissan North America Parul Bajaj says the company is proud to help in this time of crisis.

Jaguar Land Rover boosts PPE production with 3D printing

Jaguar Land Rover is using its prototype build operations and 3D printing facilities to start manufacturing PPE equipment for the NHS. Production of protective visors for key workers, utilizing its CAD design expertise, is an answer to the government's call for more medical equipment to fight the coronavirus pandemic. Thought to be the only reusable NHS-approved visor of its kind, the design developed in consultation with a team of NHS healthcare professionals for efficient rapid prototype printing at the Advanced Product Creation Centre in Gaydon. It comes as a national shortage of PPE for NHS staff on the frontline in the fight against COVID-19 resulted in many key workers suffering injury from wearing uncomfortable equipment for long hours or going without vital protective wear.

Airbus uses 3D printing to make PPE equipment

Airbus manufacturing sites in Spain joined forces to produce visor frames using 3D printing, providing healthcare workers with PPE equipment in the coronavirus pandemic. Over 20 3D printers have produced hundreds of visors, and were dispatched to hospitals close to the Airbus facilities in Spain. Airbus leverages a patented design to manufacture the visor frames, using PLA plastics.

Parisian hospital system installs 60 Stratasys 3D printers to fight COVID-19

The University Hospital Trust (AP-HP) in Paris, the largest hospital system in Europe, installed a fleet of 60 industrial-grade Stratasys 3D printers to aid in its fight against COVID-19. The machines, which were delivered within 24 hours of ordering on March 31, will enable the French hospital system to produce PPE and other medical parts on site and on demand. Sixty F123 Series 3D printers were delivered by France-based Stratasys reseller CADvision and are installed at a 150-square-meter facility within AP-HP's Cochin Hospital in Paris. The industrial-grade FDM machines are used to print all manner parts for COVID-19 relief efforts, including face shields and masks, electrical syringe pumps, intubation equipment and respirator valves.

Air Force using 3D printers to create N95 face masks for medical personnel

The Air Force is starting to use 3D printers to create reusable, plastic N95 masks for the local medical community amid the COVID-19 pandemic, according to the service. The 312th Training Squadron's Special Instruments Training course instructors, based out of Goodfellow Air Force Base in Texas, are using a model crafted by a neurosurgeon and a dental company after seeing posts about other groups using the design in a Facebook group called Air Force Quarantine University.

SLM Solutions partners with medical device company Canwell Medical

SLM Solutions entered a strategic partnership with Canwell Medical, a medical device manufacturer in China. Through the alliance, Canwell Medical will use SLM machines to develop 3D printed surgical implant products. SLM Solutions will provide technical and application assistance, as well as research and development support to further accelerate Canwell Medical's product certification and serial production. Canwell Medical is a designer, manufacturer and supplier of orthopedic implants, instruments and orthopedic rehabilitation for medical instruments. The company, based in Zhejiang province, has become a prominent player in the Chinese orthopedic market as well as in the broader Asia Pacific region.

TygerMaties 3D prints protective gear in fight against COVID-19

When the Division of Orthopaedic Surgery at South Africa's Stellenbosch University (SU) started a 3D printing laboratory about two years ago to assist surgeons in planning and rehearsing surgical procedures, they had no idea the lab would be put to use in a pandemic. Staff and students are working to 3D print and assemble visors to be distributed and used as protective gear for those working on the frontline of fighting the COVID-19 crisis. Dr. Rudolph Venter, an orthopaedic surgeon and lecturer in Clinical Anatomy at SU's Faculty of Medicine and Health Sciences (FMHS) came up with the idea after the virus broke out in South Africa.

InkSmith launches company to address shortage of medical equipment

InkSmith, the Ontario-based tech startup that created personal protective equipment (PPE) for healthcare workers, launched a company to address the equipment shortage. The company previously announced the move, introducing its company, The Canadian Shield by InkSmith, which will focus solely on the production and distribution of face shields. The InkSmith team shifted its efforts from educational technology to protective face shields. InkSmith is an education tech company that typically develops products such as 3D printers, virtual reality kits and headsets, laser cutters and robotics kits. The company received approval from Health Canada on March 24 to manufacture PPE face shields. The company called the face shields it was producing the Community Shield and the Canadian Shield. The equipment is intended for single-day, single-person use. The Canadian Shield company reportedly has the capacity to produce 50,000 face shields per day. To achieve this, Canadian Shield opened a facility in Kitchener, Ontario.

Railway suppliers employ 3D printing to defeat COVID-19

Siemens and Alstom are using their 3D printing capabilities to produce items to protect passengers, staff and medical practitioners during the coronavirus pandemic. Russian Railways (RZD) is testing 36 attachments for door handles, provided by Siemens, that enable doors to be opened with an elbow or lower arm rather than by hand, reducing the risk of spreading germs or a virus like COVID-19. Siemens installed the prototypes in several Desiro trains operating in the Moscow area, with further implementation across other fleets planned. Siemens purchased two Stratasys 3D printers to assist with the maintenance of RZD's fleet, which also includes several Velaro high-speed trains.

FIT presents FiT Filter carrier, a 3D printed mask solution against COVID-19

Like other AM companies, the FIT Additive Manufacturing Group responded to the COVID-19 pandemic by proposing a solution that leverages AM rapidity. The German firm developed a special filtration system named FIT filter carrier for the general population, which can be combined with almost any filter material to form an emergency mask. The filter carrier/holder can be used several times by simply and quickly changing the filter. A smaller model especially for children is in development. The data set for a 3D printable model can be also downloaded free of charge from the company's homepage.

GE Additive and TriHealth convert hard hats into PPE with 3D printed adapter

Workers at GE Additive created a 3D printed component that transforms a hard hat into a protective face shield, which can be worn by frontline medical staff to protect against COVID-19. The face shield, created in collaboration with Ohio-based TriHealth, can help to extend the lifespan of medical-grade N95 masks, which are in critically short supply. The GE Additive team came up with a 3D printed adapter part which can convert a standard hard hat and visor into a face shield that wraps around the wearer's entire face, protecting it from potentially infectious droplets. The hard hat configuration is said to offer "additional protection and comfort" to doctors and nurses who will be wearing the PPE for long hours. The face shield was developed by GE Additive after TriHealth, a Cincinnati-based healthcare provider with four acute care hospitals, reached out for help in March.

IndyCar teams 3D printing medical face masks

One program, developed by 3D printer manufacturer Stratasys, has CGR, Andretti Autosport, Arrow McLaren SP, Team Penske and more of its customers aligned and producing medical face shields using the company's rapid-printing technology found within their respective shops. Together, Stratasys engaged over 1,200 clients to mass produce face shield components for use by the medical community in dealing with the coronavirus pandemic. The production process has teams shipping the pieces they've printed to Stratasys, where assembly and shipping takes place; the first batch of 500 face shields was sent to the Mayo Clinic in late March. A total of 30,000 face shields were printed and sent to date, with the number expected to reach 120,000 by the end of April.

An African university is using 3D printing to solve medical equipment shortages

Amid complaints of the shortage of personal protective equipment (PPE) among health workers in South Africa who are on the frontlines of the COVID-19 fight, the University of Pretoria is putting some of its most sophisticated technology to work in tackling the shortage of PPE. The university is using its 3D printing technology to manufacture visor frames for face shields.

Tapestry announces additional community support initiatives

Tapestry, a New York-based house of modern luxury accessories and lifestyle brands, announced additional community support initiatives to address the ongoing COVID-19 health crisis. In addition to its previously committed \$2 million to support New York City small businesses, Tapestry, through its Coach Foundation, intends to expand investment in communities affected by COVID-19, while the Kate Spade New York Foundation will be making a donation to support frontline workers and provide emergency funds to existing grantees. Tapestry launched an initiative to manufacture medical equipment for healthcare workers by repurposing its existing 3D printing capabilities in New York.

Coach, Kate Spade parent leverages 3D printing to make COVID-19 medical supplies

The parent company of Coach and Kate Spade will repurpose its existing 3D printing capabilities to manufacture medical equipment for healthcare workers fighting COVID-19. Tapestry Inc. said the employee-initiated volunteer program will include printing disposable parts required for respirators and ventilators, test swabs and face shields. Resources also will be made available to engineers and specialists working on COVID-19 related development projects to create 3D printed parts for R&D prototypes.

Mondelēz International uses 3D chocolate-making technology to create medical visors for NHS and frontline staff

Mondelēz International joined forces with engineering company 3P Innovation to help produce thousands of medical visors to protect frontline NHS staff during the global COVID-19 crisis. Mondelēz is repurposing its 3D printing technology, which is normally used to make chocolate sculptures at Bournville, the home of Cadbury, to help print the medical visors. 3P Innovation launched an industry-wide initiative to bring together businesses and individuals who can help produce, assemble and distribute the visors to hospitals, doctors' surgeries and clinics across the U.K. Mondelēz is helping to produce the hard-plastic bands, which connect the top and bottom of the visor. It also invested money into the project so that 3P can buy injection mould technology, which will mean that the visors can be mass produced.

Prisma Health and J&J supply 3D printed VESper ventilator splitter at no cost to healthcare providers

Prisma Health is collaborating with Ethicon, part of the Johnson & Johnson Medical Devices Companies, to make and distribute a ventilator expansion device, called the VESper Ventilator Expansion Splitter. The VESper Ventilator Expansion Splitter is authorized for emergency use only to allow a single ventilator to be fitted with the Ventilator Splitter to be used for two rescuable patients for ventilatory support during the COVID-19 pandemic until individual ventilators are available. Due to the predicted dire ventilator shortage, Prisma Health received an Emergency Use Authorization (EUA) from the U.S. FDA for the device in response to the urgency for more ventilators as a result of the pandemic.

3D printed swab partnership plans 1M nasal swabs weekly, including bulk packages available to consumers

Resolution Medical teamed with Carbon to make over a million 3D printed nasal swabs a week to address the shortage for COVID-19 testing. It will offer the swabs online in boxes of 1,000 to U.S. consumers.

Boeing 3D prints reusable face shields for healthcare workers

Boeing delivered the first set of reusable 3D printed face shields to support healthcare professionals working to stop the spread of COVID-19. The Department of Health and Human Services (HHS) in the U.S. accepted the initial shipment of 2,300 face shields. In turn, the Federal Emergency Management Agency (FEMA) is delivering the shields to the Kay Bailey Hutchison Convention Center in Dallas, Texas, which was established as an alternate care site to treat patients with COVID -19. Boeing is set to produce thousands more face shields per week, gradually increasing production output to meet the growing need for personal protective equipment (PPE) in the U.S., with distribution of additional face shields to be coordinated with HHS and FEMA, based on immediate needs. Boeing is producing face shields with additive manufacturing (3D printing) machines at its sites across the U.S., namely: St. Louis, Missouri; China Lake, El Segundo and Huntington Beach, California; the Puget Sound region of Washington; Mesa, Arizona; Huntsville, Alabama; Philadelphia, Pennsylvania; Charleston, South Carolina; San Antonio, Texas; Salt Lake City, Utah; and Portland, Oregon.

SpaceX, Blue Origin, Virgin Orbit and ULA are helping in the fight against coronavirus

To help with the shortage of face shields for healthcare professionals, Blue Origin is using 25 of its 3D printers that normally make rocket parts to crank out hundreds of visors used for protective face shields. The employees volunteering to work on the project spend their days developing Blue's rocket engine known as BE4 and their free time making the shields at their headquarters in Kent, Washington. Virgin says its team is working on prototyping and testing ventilators for hospitals. Working with medical experts at the University of California, Irvine and the University of Texas Austin, Virgin Orbit created a mass-producible "bridge ventilator" to help in the COVID-19 effort. Because their goal was to make a machine with parts that are easy to obtain, their design is powered by a windshield wiper motor. Virgin hopes to begin producing 100 a week at its Long Beach, California, facility and ramp up from there. SpaceX CEO Elon Musk directed his other company Tesla to put their 3D printers to work making ventilators out of Tesla car parts. The ventilator is powered by the Tesla Model 3 Infotainment System complete with a touchscreen that tracks the pressure, flow and volume of the breath a patient would take assisted by the ventilator. SpaceX built 75 face shields and delivered them to Cedars Sinai, a major hospital in Los Angeles. According to an internal email shared with CNBC, the company is also ramping up to make a hand sanitizer that "complies with CDC guidelines and is effective at killing the COVID-19 coronavirus."

Goodyear uses 3D printing capability to deliver in-demand medical gear

A Luxembourg initiative was created to seek manufacturing companies and private persons that could contribute to the production of components used in face shields for medical personnel during the COVID-19 pandemic. It was reported that the Centre Hospitalier de Luxembourg alone needed 500 masks to distribute among staff. The idea to collectively work in the 3D printing area for the fast production of needed parts originated with a Luxembourg-based Facebook group. This group, "3D Print – Let's Fight Corona Luxembourg," issued a plea via social media, Goodyear representatives noticed, and groups of associates went to work, using Goodyear and private 3D printers. The result was face shield parts being delivered for immediate use, and Goodyear's 3D printers are continuing to print face shield parts. In normal operating circumstances, Goodyear uses 3D printing for the manufacture of manufacturing/engineering components, testing samples and models of equipment being developed.

As 3D printing of protective gear ramps up, a free mask designed in Seattle is the first of its kind to get federal approval

Former Microsoft executive Jonathan Roberts knows that not all 3D printed personal protective equipment being produced for the nation's coronavirus response is created equal. The past few weeks thrust 3D printing technology into the spotlight as entrepreneurs and well-doers scramble to convert factories, shops and even home basements into makeshift assembly lines to produce personal protective equipment (PPE) for healthcare workers. Once best known for a Texas company's nationwide distribution of blueprints for homemade handguns, 3D printing is viewed as a potential lifesaver in the race to get masks, visors, shields and other PPE to those needing them most. Amid concerns about the effectiveness of PPE made from 3D printers, Roberts used his connections at Seattle-based nonprofits and tech firms to fast-track a solution both with federal approval and broad distribution. His Maker Mask, a free, 3D printable respirator mask that covers the mouth, as opposed to hooded versions, became the first of its kind to receive National Institutes of Health certification for COVID-19 response.

Ogden 3D printing company shifts to making face shields that protect against COVID-19

The Business Depot Ogden is home to a major operation producing personal protective equipment for healthcare workers and others in essential jobs. Short on sales because of COVID-19 closures, WhiteClouds, a 3D printing and fabricating business, shifted its production to make face shields. The company usually produces a variety of products, from architectural models to footwear to character thrones for comic conventions. Business for WhiteClouds plummeted after mid-March, when trade shows like South By Southwest started canceling. WhiteClouds is still selling some of its regular products, and they're finishing up work they started prior to the pandemic, but most employees shifted to making the shields. About 70% of these orders are for healthcare settings, while 30% were purchased for use in industrial settings, like food production facilities. In response to the request of a professional association, the company also developed a special shield for orthodontists that allows them to use equipment with a magnifying lens while wearing the face shields. The company will start producing that soon. WhiteClouds also produced face shields for the state of Utah, but state officials did not immediately respond to requests for more information about how those face shields will be used.

Cirrus Aircraft 3D printing respirators to aid hospitals

Cirrus Aircraft designed a powered respirator it can 3D print at a “fraction” of the cost hospitals typically pay as the manufacturer joins a host of Duluth, Minnesota-based companies providing support to healthcare workers during the pandemic. The powered air purifying respirator, or PAPR, blows air into an enclosed hood and provides more complete protection than an N95 mask. Like those masks, they were hard to find. A few prototypes were sent to St. Luke’s and Essentia Health, and the battery-powered blower will be tested over the next few weeks. Once approved for hospital use, the company will make nearly 200 of them after local hospitals requested about 160. A full PAPR setup costs up to \$2,000, and Cirrus said “the design our team came up with costs a fraction of the typical 3M unit supplied to hospitals.”

AFIT using 3D printing to develop N95 face shields

The Air Force Institute of Technology’s additive manufacturing laboratory were printing face shield prototypes for the National Air and Space Intelligence Center to extend the longevity of N95 masks. The 88th Medical Group at Wright-Patterson AFB is testing the prototypes to determine if they are approved for use. The first iteration of the N95 shields were 3D printed flat and then shaped to fit over the N95 mask. The shields are intended to prevent abrasion and keep liquids or particulates away from the mask. The second round of prototypes have been a face shield comprised of a headband with top and bottom structural supports. These hold a thin piece of clear acrylic or similar material to keep particles and fluids away from masks, as well as minimize indirect breathing to one another.

3D printing specialist supplies face shields for NHS

Additive manufacturing specialist Ricoh 3D, based in Telford, supplied 250 specially designed face shields for Black Country hospitals including New Cross, Walsall Manor and Russells Hall. Ricoh responded to a plea from retired footballer Steve Bull for full face protection for doctors and nurses at New Cross to help in the battle against COVID-19. The company used its innovative technology to design and produce the reusable face shield, which was tested by staff at The Royal London Hospital who commented on its comfort over existing equipment. Ricoh is in discussions with medical establishments and NHS Trusts across the U.K about supplying the face shields. It has the capacity to produce upwards of 40,000 a week.

MakerCause launches to create 3D printing collaboration network in partnership with MaketheMasks to support COVID-19 efforts

Unique Software Development launched the “MakerCause” initiative at makercause.com to centralize efforts to produce 3D printed respirator masks, face shields and nasopharyngeal swabs to support healthcare workers, first responders and individuals with suppressed immune systems during the COVID-19 pandemic. This launch coincides with the formation of a partnership with MaketheMasks, an initiative by the inventors of the Montana Mask, a 3D printed respirator mask that is in wide use across the country.

NAWCAD Lakehurst uses 3D printing to make face shields

The U.S. Naval Air Warfare Center Aircraft Division (NAWCAD) Lakehurst in New Jersey is using an additive manufacturing process to make face shields. The 3D printing face shields are being manufactured to meet the request placed by the U.S. Navy's Mercy-class hospital ship USNS Comfort. Currently stationed in New York City, the ship is helping ease the burden on local area hospitals while caring for coronavirus patients. A total of 500 face shields will be supplied by the air warfare center. The additional units are for use by the ship's personnel. The first batch of 160 items have been produced and supplied in partnership with the Naval Air Systems Command (NAVAIR) AM team.

Ferrari is 3D printing parts to convert snorkels into respirators

Ferrari is doing its part to combat the global coronavirus pandemic by producing parts to convert snorkel masks into respirators and personal protection equipment for healthcare workers. The section of the Maranello factory that would normally be building prototype vehicles has been shifted to using 3D printing to rapidly turn out thermoplastic valves and fittings. The parts are designed to fit with full-face mask-style snorkels. One of the producers of the masks, Mares, assisted Ferrari in the design process to make sure the parts fit properly with their products.

Materia uses Sintratec S2 3D printing system to support COVID-19 crisis

Materia Srl used the Sintratec S2 3D printing system in the fight against the coronavirus. With 3D printed adapters, diving masks can be transformed into respiratory devices. Sintratec supports these efforts as far as possible and provides the company with the necessary printing material free of charge. Materia was one of the first companies in Italy to acquire a Sintratec S2 for its production. The SLS compact system was to be used primarily for engineering and prototyping purposes and to be applied in shipbuilding for example. Following the calls of the national health system for alternative resources, diving equipment company Mares developed an adapter for snorkeling masks in cooperation with Materia Srl. By means of a 3D printed component the "Sea Vu Dry+" model, normally part of underwater equipment, can be transformed into a functional face mask, suitable for artificial respiration in cases of respiratory failure. Sintratec, the Swiss manufacturer of the 3D printing system, was also able to make a contribution through its Italian partner CMF Marelli: to support the company in production, Sintratec provided print-ready Sintratec PA12 powder, from which the mask adapters are made, free of charge.

Supporting COVID-19 Responders: Worcester Polytechnic Institute expands STEM program in Africa to address an anticipated shortage of critical medical devices

Worcester Polytechnic Institute (WPI) is expanding an existing science and engineering training program in Sub-Saharan Africa to help provide critical medical supplies to address the expected spike of COVID-19 cases. As part of its longtime Math and Science for Sub-Saharan Africa (MS4SSA) initiative, WPI has arranged for 3D printers and other materials to be sent to six countries to facilitate the manufacturing of masks, face shields, and parts for simple automated ventilators. WPI will also share designs and offer online training sessions to ensure safe and effective production.

Idaho 3D printing firm makes tens of thousands of PPE

Slant Concepts, which previously designed a series of STEM products meant to teach young people about robotics, and its secondary company designed a Prusa RC2-compatible face shield and immediately began printing parts for it. Less than two weeks later, the company had produced approximately 15,000 complete sets, which have been distributed to hospitals and other medical facilities across the country. Slant 3D team members also have produced hands-free door openers and key chains, as well as emergency ventilator components that are not FDA-approved and are just for emergencies.

ExOne and University of Pittsburgh produce promising reusable respirators using 3D printed metal filters

Leading sand and metal binder jet 3D printer manufacturer ExOne and the University of Pittsburgh are working together to develop reusable metal filters that fit into plastic respirator cartridges. ExOne's binder jetting 3D printing process can be used to produce metal parts with specific porosity levels that can effectively filter out contaminants while allowing airflow. Leveraging its technology, the company was able to develop the reusable and porous metal filters in two metals: copper and 316L stainless steel. The plastic respirator cartridge was designed by the Mechanical Engineering & Materials Science department in Pitt University's Swanson School of Engineering.

Dubai 3D printing company pitches in to fight COVID-19

One of the companies that has offered its expertise is Proto21, a 3D printing company that is manufacturing items to protect the safety of frontline workers. Proto21 has transformed its 3D printing labs into a manufacturing hub for various personal protective equipment such as face shields, ventilator splitters and valves for snorkel masks. The company has already collaborated with Dubai Police to manufacture more than 1,000 reusable 3D printed face shields for its frontline officers. Produced using biocompatible and durable materials, the face shields meet global standards for protection. The entrepreneurial venture established two years ago is also manufacturing thousands of 3D-printed face shields every week to supply other organizations in the forefront of the COVID-19 fight, in addition to ventilator splitters, components used to increase the capacity of ventilators.

DOD uses 3D printers to ease COVID-19 ventilator shortage

Developers from the Army Research Laboratory are collaborating with civilian partners to manufacture low-cost, emergency ventilators using 3D printers. The handheld gas ventilator, dubbed the Illinois RapidVent, is roughly the size of a water bottle. Due to its size and portability, the ventilator may also be ideal for soldiers in battle beyond the COVID-19 pandemic, said Tonghun Lee, a Champaign, Illinois-based ARL researcher. Also, airmen at Goodfellow Air Force Base, Texas, are using a 3D printer to create N95 surgical masks.

ZVerse releases face shield for service industry workers

After producing millions of shields for the healthcare industry, ZVerse is introducing a new generation of protective face shields for workers in service industries, including restaurants, retailers, salons, grocery stores, food plants and the elective medical sector. The futuristic shields serve as a deterrent to COVID-19 and a more functional alternative to cloth face masks. Made in the U.S. with a patent pending, the protective shield called ZShield Flex utilizes an adjustable neck-mount instead of mounting to the head – a design innovation that makes the shield unlike anything that currently exists on the market. In a study conducted by the University of Iowa, face shields may replace masks as a more comfortable and effective deterrent to COVID-19.

Amazon redeploys drone employees to make medical face shields

Amazon.com is mass-producing face shields for healthcare workers using engineering tools and expertise borrowed from its drone unit, the latest retooling of the retailer's resources to fight the coronavirus pandemic. The company says it will sell the face shields on its website at cost, at a price to be announced, starting "in the next few weeks." Amazon has already given some 10,000 units of its newly designed face shields to healthcare organizations and plans to donate an additional 20,000. The reusable shields are expected to be listed at a significantly lower price than models currently available.

More than 10,000 respirators assembled at Ford's Vreeland facility in Flat Rock

Ford Motor Co. responded to the need for powered air-purifying respirators after the COVID-19 pandemic became a huge public health threat earlier this spring. Thanks to a group of dedicated workers in Flat Rock, more than 10,000 respirators were assembled, with the ability to make 100,000 or more if necessary. The first Ford-built powered air-purifying respirators, developed in close collaboration with 3M, are on their way to help protect healthcare workers fighting COVID-19.

Boeing South Carolina 3D printing face shields for medical workers

Boeing South Carolina is producing reusable face shields for medical workers on the front lines of the COVID-19 pandemic. They are using their 3D printing technology to make the plastic face shield parts. It takes 11 hours to make the frames. Daniel Thomas, Boeing SC's Designated Expert for Rapid Prototyping, aims to provide a temporary solution to lack of personal protective equipment (PPE) until a more permanent solution is found. The face shields will be donated to hospitals with shortages across the country, in coordination with Federal Emergency Management Agency (FEMA). The frames are being produced at Midbody Innovation Cell at the Airport Campus, Interiors Responsibility Center, and Boeing Research and Technology, both at the North Campus.

UAE startup relies on blockchain technology to flatten COVID-19 curve

UAE-based startup incubator, in5, is helping to design blockchain-based methods to contain the COVID-19 pandemic in the country and thus flatten the curve. Liber Health, supported by in5, is one of the platforms used for patient identification supported by blockchain technology. They are creating a contactless system to recognize the biometric ID data and analyze suspected COVID-19 symptoms. Liber Health hopes that by tracking patients that have been in contact with suspected COVID-19 cases, they can help individuals apply quarantine measures as soon as possible. Liber Health plans to expand conversations with major public and private sector entities, primarily in UAE, to implement the technology and reduce the number of COVID-19 infections.

3D Alliances and Fieldbit team up to offer AR platform for field service

One of the trends that the COVID-19 pandemic accelerated is that of remote work and – in 3D printing – that translates to remote installations and remote support. To help 3D printing companies better address this market demand, consulting firm 3D Alliances is working with Fieldbit, a developer and provider of a multi-source Augmented Reality knowledge platform. Through this partnership, 3D Alliances and Fieldbit will offer 3D printing companies and Value Add Resellers, a smart remote field service solution for industrial 3D printers.

PPE shortage prompts Hybrid Manufacturing Technologies to 3D print parts with ‘injection molding quality’

A new method of thermoplastic production dubbed ‘AXIOM’ – automated extrusion into an open mold – has been developed by Hybrid Manufacturing Technologies (HMT), a specialist in hybrid subtractive-additive systems. The process combines 3D printing and injection molding, which HMT says produces high-strength parts at high speeds with the flexibility of AM. HMT’s AXIOM method aims to remedy the disparities in the remedy the disparity in the material selection, surface finishes, and integrity of the polymers when comparing AM and molded parts. Prompted by the PPE shortage due to the COVID-19 pandemic, HMT sought to produce face shields to supplement traditional production channels by attaching its AMBIT XTRUDE PE-1 3D printhead to a classical CNC milling machine and extrude materials usually incompatible with 3D printing. HMT says the produced parts had an “improved surface finish” and increased integrity as a result of a lack of layer lines, resembling injection molded parts.

Rapid Manufacturing AG develops 3D printed glove remover for COVID-19 protection

Swiss 3D printing service bureau Rapid Manufacturing AG, together with Swiss creative agency Atoll and Zurich-based Pragma Engineering, developed a simple solution to address the issue of disposable glove removal: a 3D printed glove remover. The solution presented by Rapid Manufacturing AG has been made available as a free to download CAD or STL file. Alternatively, an SLS 3D printed version can be purchased by those without access to 3D printing resources.

Miele launches 3D4U for downloadable and 3D printable accessories

With the new 3D4U portal, premium domestic appliance manufacturer Miele becomes the first company in its branch of industry to offer its customers a broad range of 3D printable accessories. The company is starting by releasing data records for ten objects which can be downloaded with immediate effect and free of charge from the Thingiverse platform. These include kitchen gadgets, vacuum cleaner accessories and useful items for a handyman. Several models even have customizable motifs and parameters.

3D scanning app generates customized 3D printed mask fitter

A team from 3D scanning specialist Bellus3D teamed up with Rhode Island-based 3D printing service R&D Technologies to fine tune and scale production of the personalized 3D printed face mask fitter. The mask is customizable thanks to a special FaceApp developed by Bellus3D, which is compatible with the iPhone and free to download. This app can capture a 3D scan of the user's face and of generating a tailored 3D mask design file, which can subsequently be 3D printed. To streamline production of the custom mask frames, Bellus3D enlisted the help of 3D printing service provider R&D Technologies. The standard mask fitter is available in a range of colors and is printed from ASA plastic, with each mask fitter available for \$40. Those with 3D printers can download the STL file from the app at no charge and print their own.

3D printed robot swabs patients' throats for COVID-19

Robotics researchers from the University of Southern Denmark have developed the world's first fully automatic robot to carry out throat swabs for COVID-19. The 3D printed robot swabs patients so that healthcare professionals are not exposed to the risk of infection. The prototype successfully performed throat swabs on several people and is now set to go into operation by late June. With a 3D printed, specially designed disposable tool, the robot holds a swab and hits the exact spot in the throat from which the sample is to be collected. Subsequently, the robot puts the swab into a glass and screws the lid on to seal the sample.



Wearables

Fashion designer presents 3D printed Proximity Dress for social distancing

The concept of a mechanical, 3D printed smart dress, to safeguard one's proximity and personal space, was first explored by Anouk Wipprecht several years ago with her Spider Dress. In times of social distancing, the Dutch designers are presenting an evolution of that early work, extending her research into proxemics and the body. The new Proximity Dress creates physical barriers when a person is detected in the immediate surroundings of the wearer. These twin dresses respond based on proximity and thermal sensors and indicate strangers within the intimate, personal, social and public space around the wearer. Each dress extends itself using a robotic 3D printed hip mechanism, built into the dress, and a resin 3D printed transparent collar with integrated sensors. The dress also works as a perfect application case study for 3D printing. The hip mechanisms that are holding the servos to the mechanic hip parts are 3D printed using SLS (Selective Laser Sintering) nylon PA-11 to endure more stresses. The 3D printed transparent collar, which has a more aesthetic use, is 3D printed using an Objet Connex 500 multimaterial polyjet 3D printer and the VeroClear material from Stratasys.



Food

Biozoon 3D prints chicken drumsticks made from cauliflower

Biozoon, the company leading the 3D-printing project, first mixed fresh broccoli, cauliflower and potato puree with a variety of vitamins, calcium, carbohydrate and protein according to the needs of each diner. This mixture was then put into a 3D food printer, where it was mixed with a gelling agent to help the mixture solidify when printed into any shape they desired. The printed food was then frozen, to be reheated for serving. A group of elderly nursing home residents in Germany participated in the "Performance" European food project, testing a puree, printed into the shape of a drumstick. Each "chicken leg," was actually formed from vegetable paste shaped by a 3D printer and given a more pleasurable texture than ordinary puree, was tweaked to match the nutritional needs of the individual elderly diners. The group, who first ate this "not-chicken" meal in taste tests five years ago, were the participants of an innovative food project in Europe, named "Performance", which explored whether 3D printed food could be delivered to elderly people with problems swallowing food, also known as dysphagia.



Education

University of Auckland engineers build 3D printed robotic airship for education and research

A duo of engineers from the University of Auckland's New Dexterity research group published an academic paper detailing the design and construction of a partly 3D printed robotic airship. The authors, Gal Gorjup and Minas Liarokapis, stated that the low cost, open source design featured in the work is intended for indoor use and will be used for educational and research purposes. The Auckland engineers, therefore, decided on an airship – a lighter-than-air (LTA) craft. LTA crafts rely on internal gases that are 'lighter than air', utilizing the difference in densities to stay afloat for longer without needing any extra power. They also tend to have a soft envelope and travel relatively slowly due to a lack of high-speed rotors generating lift, so the risk of injury from collisions is minimized. The design freedom granted by 3D printing makes it perfect for highly customizable remote-controlled vehicles such as drones.

M. Holland's 3D printing group launches online solutions portal

M. Holland Company, a distributor of thermoplastic resins, launched an online solutions platform dedicated to 3D printing. This platform was built in response to COVID-19 to allow for remote access to 3D printing education and resources. The Additive Manufacturing Educational Portal allows participants to access training programs, educational courses, certifications, materials, printed parts and technical information. Although the 3D Printing group will continue to offer in-person training, this e-learning system gives business partners another way to learn skills and access 3D printing guidance and information across hundreds of processes and dozens of materials.

Researchers develop low-cost 3D printed polarimeter for classroom use

Science and technology classes, particularly at University level, often require specialist apparatus that can be costly and difficult for students to get to grips with. This is where 3D printing can offer a low-cost method of manufacturing components for technical learning tools. Paweł Bernard from Jagiellonian University and James Mendez from Indiana University demonstrated this in their paper detailing the design and construction of a 3D printed polarimeter for use in chemistry classes. A polarimeter is used to measure the angle of rotation of polarized light after it passed through an optically active substance or chemical.

Y Soft launches 3D printing solutions for education providers

Y Soft Corporation launched premium 3D lessons in the YSoft be3D Academy as well as a 3D/2D EDU bundle for schools wanting to update their 2D and 3D printing management. The YSoft be3D Academy provides an online library of 3D curriculum features, including lesson plans, guides, videos, models and presentations. Furthermore, a model database provides additional models for educators to create their own lessons. It is designed to provide everything needed to bring a STEAM subject to life utilizing 3D printing. The be3D Academy 3D lessons are available for free. Meanwhile, the Y Soft provides premium 3D lesson plans for all eDee customers, including those that purchase the EDU bundle.

Addmio launches 3D Printing for Entrepreneurs online course

Addmio, a Netherlands-based 3D printing e-learning company, is launching its first educational course, titled 3D Printing for Entrepreneurs. Based entirely online, the course condenses five years of experience on the 3D printing industry shop floor in three days.

**Environmental Efforts & Energy****ORNL presents 3D printed nuclear reactor core for a faster, more economical path to nuclear energy (May 13)**

Researchers at the Department of Energy's Oak Ridge National Laboratory are refining their design of a 3D printed nuclear reactor core, scaling up the additive manufacturing process necessary to build it, and developing methods to confirm the consistency and reliability of its printed components. Supported by DOE's Office of Nuclear Energy, the Transformational Challenge Reactor (TCR) Demonstration Program's unprecedented approach to nuclear energy leverages advances from ORNL in manufacturing, materials, nuclear science, nuclear engineering, high-performance computing, data analytics and related fields. The lab aims to turn on the first-of-its-kind reactor by 2023. The program has maintained its aggressive timeline during the COVID-19 pandemic, using remote work to continue design and analysis efforts.

Project to turn waste plastic into 3D printing additives

Manchester Metropolitan University will lead on a E.U.-funded project to turn single-use plastic waste back into valuable plastic products. The €9.6 million project, named TRANSFORM-CE and encompassing 36 partners, will use intrusion moulding and additive manufacturing to turn single-use plastic waste back into feedstock to be used in products such as chairs, tables and 3D printed products. Funded by the Interreg North West Europe Programme as part of the E.U.'s European Regional Development Fund, TRANSFORM-CE aims to divert thousands of tonnes of plastic waste from landfill across North West Europe and stimulate demand for recycled plastic at home and abroad.

Renishaw assists in building ocean turbine parts using metal 3D printing

British engineering firm and metal 3D printer manufacturer Renishaw will produce two ocean turbine parts using additive manufacturing in partnership with the Nova Scotia Community College in Canada. The components were manufactured for industrial design firm Biome Renewables, which specializes in designing wind turbines. Using metal additive manufacturing technology, Renishaw helped to manufacture a PowerCone retrofit, designed to co-rotate with the turbine's rotor, and curved propellers to reduce drag. The advantages offered by metal additive manufacturing meant that the cost to produce the parts was reduced by 80% compared to traditional techniques.

3D printed bionic corals enable microscopic algae to photosynthesize more efficiently

Researchers at the University of California San Diego and the University of Cambridge 3D printed coral-inspired structures that are capable of growing dense populations of microscopic algae. The work could lead to the development of compact, more efficient bioreactors for producing algae-based biofuels. It could also help researchers develop techniques to repair and restore coral reefs. In tests, the printed coral structures grew a commercial strain of microalgae, *Marinichlorella kaistiae*, up to 100 times more densely than natural corals.

3D printed concrete to help build offshore wind energy infrastructure

Purdue University engineers are conducting research on a way to make these parts out of 3D printed concrete, a less expensive material that would also allow parts to float to a site from an onshore plant. Wind off the coasts of the U.S. could be used to generate more than double the combined electricity capacity of all the nation's electric power plants. Building wind turbines offshore is expensive, requiring parts to be shipped at least 30 miles away from a coast.

DoE Argonne scientists use 3D printing to recycle 97% of used nuclear fuel

Scientists from the U.S. Department of Energy's Argonne National Laboratory have used 3D printing to create a new method of reusing nuclear waste, which could allow up to 97% to be recycled. The novel process could increase the percentage of fuel that scientists are able to reuse from 95% under existing processes, to 97%. While this may not initially appear to represent major progress, it could significantly reduce the amount of used fuel that needs to be stored, and the time it remains hazardous for.

University of Huelva researchers create 3D printed water purifying spirals

Scientists from Spain's University of Huelva have used 3D printing to create a spiral structure capable of removing eighteen disinfection by-products (DBPs) from drinking water. Chronic exposure to such chemicals has been demonstrated to increase health risks, including the threat of cancer, and the team's research project aims to make the purification process more efficient at removing them. The scientists' novel approach could have applications at water treatment facilities, to identify and separate the most dangerous chemicals, and make water safer to drink.

Cincinnati Zoo uses 3D printed customized feeder for meerkats

GE Additive and the Cincinnati Zoo collaborated to provide custom stump-shaped feeders for the meerkat habitat, supplying simulated tunnels and crevices in the wood in which they can dig out food. GE Additive's team observed the animals daily to better understand their habits and patterns in captivity. This data was then used to improve animal care, addressing changes in habitat, husbandry and, of course, diet. Recently, Orban and his colleagues teamed up with GE Additive's AddWorks consulting team to come up with more engaging ways to feed the animals in the zoo.

**History, Arts & Entertainment****14th century doors of the Florence Baptistery restored using 3D printing**

In Italy, 3D printing and scanning technology helped to restore the south doors of the Baptistery of Florence, built around 700 years ago. Made from bronze, the doors were suffering from deterioration due to weather and pollution. Therefore, as part of a cultural preservation project sponsored by the Opera di Santa Maria del Fiore, it was decided to replace the ornate bronze doors with exact replicas. Partnering with Prototek, an Italian 3D scanning/printing service provider, the Opera sourced an Artec Space Spider 3D scanner to digitally capture the doors for replication. The scanned data was then used to 3D print models of the different parts of the doors using the 3D Systems ProX 500 3D printer. These 3D printed parts were handed to the Ciglia e Carrai foundry, which used them to reproduce a clone of the south doors using a lost-wax casting method.

**Home Decoration****Online lighting startup Gantri shines a light on 3D printing**

Designers and design firms around the globe expressed appreciation for the advancement of 3D printing, because of its creative potential and its accessibility in terms of production costs, including Gantri, a San Francisco-based online lighting company that leverages digital fabrication to create lighting products that are both design-forward and functional. Gantri partnered with American design studio Ammunition to launch a lighting collection consisting of 3D printed lamps and wall sconces. The 3D printed lighting series consists of three design collections: Signal, Gio and Carve. Each collection shares one important thing: all of the lamps are 3D printed using Gantri's custom in-house machine and are made from a plant-based material, PLA. Each collection also includes an assortment of table lamps, floor lamps and wall fixtures.