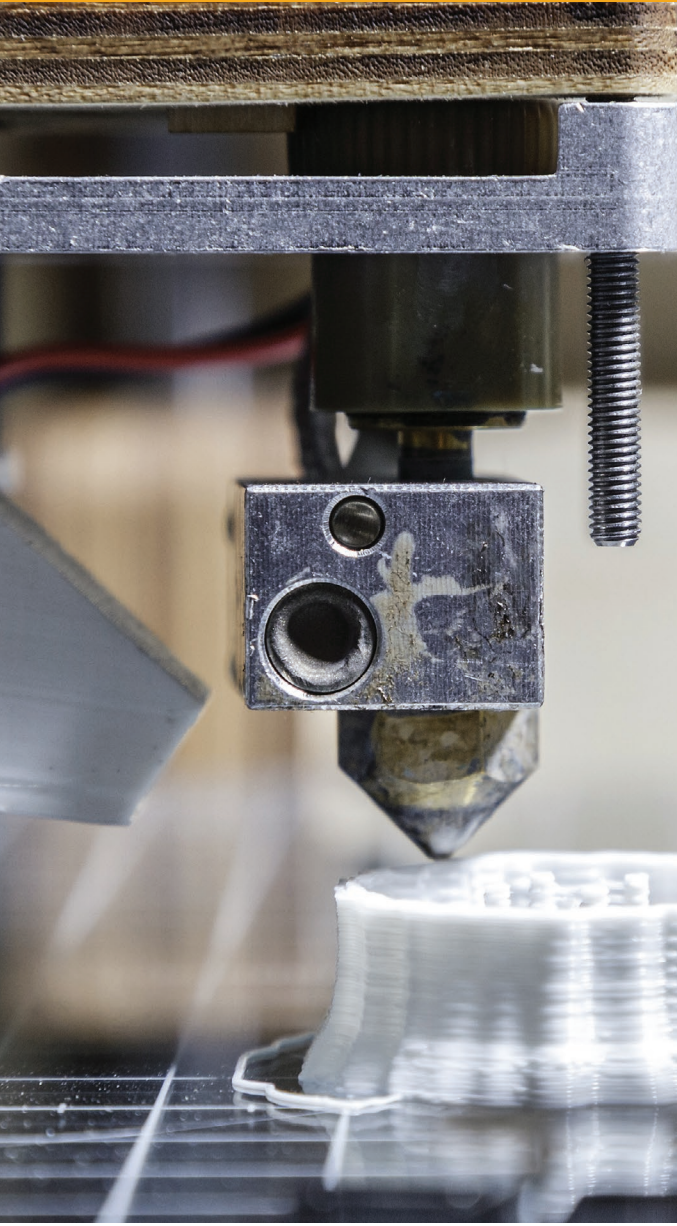


3D PRINTING - A FAST-MOVING MARKET



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 September 1, 2020 to December 1, 2020.



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General and Services

Zortrax launches inCloud remote 3D printing management system

Polish 3D printing solutions provider Zortrax's inCloud print management system and cloud-based service enables remote control and management of one or more of its printers, which can increase efficiency and make the systems easier to operate by single-device users and businesses in offices and large 3D printing farms. Prior to inCloud's release, Zortrax tested the service by having staff manage 200 3D printers at its headquarters. Similar companies, including MakerBot and Ultimaker, also improved their supply chains and streamlining workflows during the COVID-19 pandemic.

Swiss-based JellyPipe expands B2B 3D printing marketplace to UK and Ireland

Switzerland-based JellyPipe, an online B2B marketplace connecting customers with 3D printing solution providers, resellers and service providers, is expanding its presence beyond continental Europe to UK and Ireland. The platform served over 5,500 clients since its founding in 2018, primarily in Germany, Austria, Switzerland and Italy. The company is focusing on recruiting 3D printing solutions and service providers in the UK and Ireland to onboard onto their platform.

Teton offers smart slice 3D printing simulation for Ultimaker Essentials

Teton Simulation Software released its Smart Slice for Ultimaker Essentials, which is meant for enterprise customers and includes Cura Enterprise, Ultimaker Digital Factory and an Ultimaker Marketplace for plugins. Teton's Smart Slice product can optimize print settings, speed and material. The software analyzes models to determine if it is over-designed or under-designed. The package then looks at whether the part is structurally sound, and looks at the part's mass and print time to see if it can optimize those factors.

3Dsimo introduces suite of 3D printing pens and tools

Prague-based 3Dsimo is a manufacturer of multi-functional tools for makers, which launched a website with a new design. The company also released a series of products. The first product is the most versatile tool in the portfolio. The 3Dsimo MultiPro 7in1 has seven changeable tool-heads, which are easy to switch out and ready to work after a short period. Second, the 3Dsimo Kit 2 4in1 also has a 3D pen tip, burning tip, soldering tip and foam cutting saw. Additionally, it released the Basic 2, which is a 3D pen designed for children over eight. The pen prints at a lower temperature than previous pens. This product has no additional print heads and there is only one material that users can work with due to lower nozzle temperature. This pen can print only from PCL plastic, but there is no risk of burns caused by hot nozzles.

Authentise releases 3D printing material tracking software

Authentise released a "major feature update" in the form of its Material Management module. Because issues with materials usage and limited knowledge about how to reuse powders persist, the Authentise team expects its feature to positively impact the 3D printing industry. With simple tools for tracking powder, along with learning how to blend and test, users have increased access to information, machine and test data as well as basic manual operator inputs.

Dr. Joshua Pearce’s open-source Cerberus can 3D print PEKK for sub-\$1,000

A team led by Michigan Technological University’s Joshua Pearce, known for his work in open-source 3D printing, released the design plans for a low-cost, high-temperature open-source FDM printer. The three-headed machine called the “Cerberus” can be built for less than \$1,000 and can print multiple high-performance materials such as PEKK and Ultem/PEI. The self-replicating system is compatible with just one 500°C hotend, with the other two options set to be released.

MELD introduces latest solid-state metal 3D printer, the L3

Virginia-based MELD Manufacturing Corporation, a subsidiary of Aeroprobe Corporation, introduced another system to its range of metal 3D printers, the L3 MELD. Combining the features of the larger MELD K2 printer with a lower cost and smaller size, but bigger than the MELD B8, the L3 model has a 14.2-cubic-foot build model, and a 51 x 23 in table for fixturing parts. MELD’s AM technology does not melt the material when it’s repairing, coating, joining or 3D printing metals and metal matrix composites. It’s a solid-state process, so the printers heat the materials so they deform enough to be shaped, without worrying about hot-cracking or porosity issues. The MELD process uses less energy than melt-based ones, but the company says it is able to print full-density parts with low residual stress. No post-processing techniques, like sintering or hot isostatic pressing, are needed once the part is off the build plate. MELD’s 3D printers are designed to be easier to use in real-world manufacturing situations, and its machines can also produce bigger parts at a higher rate of speed in a variety of metal materials, from titanium and aluminum to steel, copper and nickel-based super alloys.

BIQU releases its 3D printer, the lightest of its class

BIQU, a Chinese company that manufactures 3D printer components, announced its printer with the BIQU BX Direct Extruder FDM 3D printer, which is the lightest in its class. The BIQU BX is a plug-and-play direct extruding printer that uses fused deposition modeling, which is a 3D printing technology that prints a figure by depositing the thermoplastics layer by layer. According to its Kickstarter page, the printer “is an out-of-box-all-level-user-friendly DIY creative task achiever that is perfect for hobbyists, makers and professionals alike.”

RPS launches Neo450 industrial SLA 3D printer series

SLA system manufacturer RPS launched its industrial Neo450 series of 3D printers. Available in two models, the Neo450e and the Neo450s, the machine is based on the company’s debut Neo800 3D printer. With a large-format build volume of 450 x 450 x 400mm, the Neo450 is primarily intended for prototyping, rapid tooling and master patterning applications.

Braskem uses Spare Parts 3D's DigiPart software to optimize its 3D printing supply chain

Brazilian petrochemical company Braskem adopted French 3D software start-up Spare Parts 3D's (SP3D's) DigiPart program to optimize its inventory supply chain. Working with SP3D in a pilot project earlier in 2020, Braskem used its DigiPart software to filter through the value, Minimum Order Quantity and lead time data of its spare part inventory. The company assessed the necessity of 15,000 components and identified 47% of these as surplus to requirements. Braskem aims to leverage the technology to manage its supply of emergency parts, and to reduce its expenditure on holding heavy amounts of stock.

Sinterit releases powder tools for cleaner SLS 3D printing

Sinterit released its Dedicated Powder Tools, meant to help ensure better powder management. The R&D team at Sinterit worked to complete projects aiming to improve the user experience for its Lisa and Lisa Pro printers. One of these projects is the Dedicated Powder Tools set, which helps users prepare their powder prints at twice the speed.

Raise3D launches ideaMaker 4.0 slicing software

Scientists from the University of Barcelona and Universitat Politècnica de Catalunya designed and 3D printed an enhanced, more reliable UHF-RFID (Radio Frequency Identification) tag. The team's inventory tracking device features a biconical antenna design with embedded wire strips to improve its overall bandwidth, and a dielectric coating to prevent its signal from being interfered with. Summary testing showed that the tag could be integrated seamlessly into existing networks, potentially enabling its use as a stock management tool within areas such as the medical, construction or automotive sectors.

REGENHU unveils bioprinters and software to revamp business

REGENHU launched its R-GEN Series next-generation 3D bioprinters and software. At 160 kilograms, the tabletop R-GEN 100 occupies less than a square meter and can accommodate up to five printing tools with individual temperature control capability. As well as a vacuum sample mounting system, four different printing work zones with temperature control options, needle and substrate calibration systems, and light-curing for in-process material crosslinking, users can adjust parameters in real-time. The R-GEN 200 has similar capabilities, but at 600 kilograms it occupies a larger workplace and comes with a computer, a type II biosafety enclosure, built-in anti-vibration systems, an ultraviolet germicidal lamp and a configurable workbench. With SHAPER, the bioprinting management software, the platforms are designed to cover the biofabrication process, including step-by-step monitoring and comprehensive, real-time adaptation of bioprinting parameters to ensure print quality and repeatability more efficiently. The series will give researchers the use of complex design architectures for multiple applications, from engineered tissues, such as skin, bone and cartilage, to drug discovery, as well as help to produce personalized pharmaceutical compounds.

Markforged launches Digital Forge cloud 3D printing platform

Markforged launched its industrial 3D printing software platform, the Digital Forge. The cloud-based platform is designed to interconnect all Markforged systems used globally. The Digital Forge uses fleet federated learning, an interconnected form of machine learning that relies on data from other nodes, or other printers, in an expansive network. By sharing and receiving printer data on an ongoing basis, the platform itself gets “smarter” each day, enabling users to leverage the latest advancements over the cloud.

Desktop Metal expands machine shop metal binder jetting system globally

Desktop Metal’s Shop System is being produced in volume and shipped to customers globally. Unveiled in 2019, the Shop System is an end-to-end system comprised of a single pass binder jetting printer, a drying oven, a powder station with built-in powder recycling, a furnace and integrated powder handling accessories. For ease of use, parts can be produced through the system’s software interface, while optimized engineered powders and processing parameters ensure part quality and repeatability. The Shop System’s single-pass print carriage can produce complex metal parts up to 10 times the speed of legacy Powder Bed Fusion technologies. The machine can reach speeds of up to 800 cc per hour at 75-micron layer thickness to produce batches of hundreds of printed parts in five hours. The system’s high-resolution printhead enables parts with fine-feature detail and surface finishes as low as four-micron roughness average to be printed. With a 1600 native DPI, the printhead can produce parts with a 400 percent higher resolution than other binder jetting systems.

Meltio Engine transforms CNC machines into hybrid 3D print systems

Meltio developed an additive manufacturing head that can be fitted to virtually any existing CNC milling machine, gantry system or industrial robot arm. It is a metal printing head with a deployment system that extends when it’s time to lay some metal down and retracts when it’s time to get a cutting tool in the spindle and start machining. The Engine prints a range of metals, including stainless steel, Inconel and titanium, using up to six lasers to melt and deposit wire or powder feed or both simultaneously, without needing to change the head. Processes for copper, aluminum, molybdenum, tungsten, gold, Invar and X9 are under development.

RYUJINLAB launches low-cost metal 3D printing service for public

3D printing technology company RYUJINLAB is launching a metal 3D printing service for the public to access, the first ever in Korea. The company said while 3D printing remains cost prohibitive for many, it hopes more people will use the technology to help reduce waste and over-production.

Visitech launches first-of-its-kind DLP for powder bed fusion 3D printing

Visitech launched a series of products that apply digital light processing (DLP) not just to photopolymer resins, as typically with DLP 3D printing, but for infrared powders, similar to selective laser sintering (SLS). The technique uses a DLP projector to cast near-infrared rays onto a bed of polymer to fuse entire layers at a time. Until now, the vast majority of powder bed fusion (PBF) systems use a laser to sinter particles of polymer powder point by point. Visitech is adding a third option to those wishing for an alternative to SLS for polymer PBF.

Automated post-processing for resin 3D printing launched by Nexa3D

The company launched a post-processing solution, xCure, for photopolymer parts. The curing system is designed for the company's flagship high-speed digital light processing 3D printer, NXE400. It can cure three NXE400 build plates simultaneously, or a single part up to 16 liters in volume, using single click-rotate and push-button functionality. The system aims to provide optimal curing through three operational modes (UV only, Heat only and UV+Heat) and has a heating capacity between 30° to 60°C with 1°C increments. It offers predictive and prescriptive capabilities for material-specific curing, resin-specific pre-sets for all NXE400 materials, and 360° of light and thermal coverage.

DSM introduces EcoPaXX AM4001 GF bio-based pellets for 3D printing

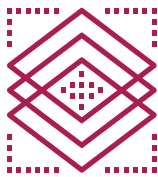
Royal DSM introduced EcoPaXX AM4001 GF (G), a high-performance material for fused granulate fabrication or 3D pellet printing. This 3D-printing optimized version of the EcoPaXX material used in end-use parts is a fit-for-purpose material that the company said delivers sustainability. EcoPaXX AM4001 GF (G), a polyamide PA410, combines the features needed for additive manufacturing automotive tooling and structural parts with pellet printing or fused granulate fabrication, a technology for printing industrial parts fast and economically. The material has thermal and mechanical properties with low moisture uptake, high chemical resistance and good surface properties as well as 42% bio-based content based on ISO 16620-1 2015(E). DSM's proprietary PA410 technology in EcoPaXX ensures lower moisture uptake than classical PA6/66 whilst being a sustainable, easy to print and post-process, bio-based material.

Stratasys to enhance full-color, multi-material 3D printing with KeyShot launch

Stratasys announced full KeyShot 10 rendering software integration with its J55 and J8 series printers, which allows the systems to accurately simulate color, material and finish in prototypes. The J55 and J8 are full-color and multi-material printers that have only been limited by design inputs. Luxion's KeyShot software, which supports the 3MF file format, can produce ready-to-print files with accurate colors and bump/displacement maps to three-dimensionally simulated textures like fabric and wood. Additional enhancements are planned for 2021.

3D printer builds parts from zirconia

Aon's 3D printer builds parts from an environmentally friendly liquid ceramic. It recommends its zirconia slurry and industrial printer for producing communications devices and for applications in the aviation and automotive sectors. Based on digital light processing technology, the INNI-ROBO ACP-M11B prints objects up to 25 by 25 by 25 mm with wall thicknesses of 25~100 microns. Print resolution is 1,280 by 800 microns.

**Materials****Harvard team develops shape memory material for smart 3D printed fabrics**

Researchers at Harvard University's John A. Paulson School of Engineering and Applied Sciences created a material from keratin that can be 3D printed into complex shapes and pre-programmed with reversible shape memory. With applications in bioengineering and smart textiles, the development is ideal for engineering stiff water-triggered shape-memory devices with tensile strength and complex geometrical transformations. Furthermore, the processability of the material through additive manufacturing platforms allows for the production of complex architectures with structural features in the micrometer range, which makes the material suitable for a range of bioengineering applications.

Multi-material 3D printing combines different metals, ceramics into single part

The Fraunhofer Institute for Ceramic Technologies and Systems (IKTS), part of the Fraunhofer family of German research institutes, developed a multi-material ink jetting system capable of 3D printing multiple metals or ceramics in a single build. To demonstrate the power of the process, the Fraunhofer IKTS researchers 3D printed a ceramic satellite with built-in ignition. The technology is similar to other polymer inkjet 3D printing technologies, like PolyJet from Stratasys. Choosing ceramics for their ability to withstand the high heat experienced by satellite engine combustion chambers, the Fraunhofer team 3D printed an ignition system made up of three different materials: an electrically conductive ceramic, an electrically insulating ceramic and a support material that disintegrates during post-print sintering in a furnace. The German institute imagines other applications for the technology, including consumer goods such as a two-tone ceramic watch the team made for an individual customer, or industrial parts.

Practical 3D printing resin optimized for visible light

Researchers from the University of Texas at Austin developed a resin made up of elements including a monomer, a photoredox catalyst (PRC), two co-initiators and an opaquing agent. The PRC absorbs visible light from LEDs on the printer, prompting the transfer of electrons between the co-initiators. This causes the monomer to harden. The opaquing agent confines the process to the areas exposed to the light, improving the printing resolution. In tests, the scientists were able to print mechanically uniform stiff and soft objects, with features smaller than 100 micrometers.

Polymaker qualifies industrial polycarbonate materials for MakerBot LABS' METHOD X 3D printer

3D printing material provider Polymaker qualified three polycarbonate (PC) materials for Stratasys subsidiary MakerBot LABS, available to print on its METHOD X 3D printer. The PCs, including Polymaker PC-PBT, PolyMax PC-FR and PolyLite PC, can be printed with MakerBot LABS' Experimental Extruder. Bringing the METHOD's portfolio of materials to nine, the additions aim to help METHOD X users exploit the strong mechanical and thermal properties of PC while reducing issues such as warping and curling.

NIST scientists develop electron beam method of 3D printing soft materials at nanoscale

Researchers at the National Institute of Standards and Technology (NIST) developed a method of 3D printing gels and soft materials. Instead of using a UV laser or visible light to initiate their gel like most modern soft material 3D printers, the research team used electron and X-ray beams to cure a range of photoresins. These shorter-wavelength lasers proved to be more focused than conventional beams and enabled the fabrication of gels with a high level of structural detail, at sizes as small as 100 nanometers. The technique could allow for the creation of complex microscopic structures.

Fabrisonic 3D prints bulk metallic glasses to make wear-resistant surfaces

Fabrisonic develops Ultrasonic Additive Manufacturing (UAM), which uses sound waves to join layers of metal foil before CNC'ing the final part. It allows for the mixture of materials, production of gradient parts and consistent part properties. Because there are also no lasers or hot chambers, users can embed sensors and other sensitive components on or in Fabrisonic parts. The company presented a method through which UAM can make wear-resistant surfaces out of bulk metallic glasses.

UCSD researchers 3D print shape-shifting liquid crystal elastomers

Materials science and engineering researchers from UC San Diego studied the qualities of liquid crystal elastomers (LCEs) to determine how to make shape-shifting 3D printed structures out of the material. The results will lead to easier shape control and manufacturing of structures such as artificial muscles, soft robots and wearable devices. Their inspiration for a material featuring varying degrees of actuation, or the ability to contract and degree of stiffness, came from real-life examples, such as a squid's beak, which is stiff at the tip but more malleable and soft where it connects to the cephalopod's mouth. After the researchers determine how to tune material properties more accurately, they'll focus on modifying the LCE ink so 3D printed structures can be made that are reprogrammable or even self-repairing.

Formlabs launches resins for dental, engineering, manufacturing applications

Formlabs launched two proprietary materials for engineering and manufacturing applications: a reformulation of its existing Draft Resin, for quick design iterations and prototypes as well as dental products and Rigid 10K Resin, which provides resistance and stiffness for engineering and manufacturing purposes. The company said the resins can be used to print parts from the initial design phase to the end product. Formlabs states that the formulation of its Draft Resin, which comes in a new grey color, makes it possible to print parts up to four times faster than other available resins, all while improving part quality and without losing accuracy. When compared to the standard Formlabs Grey Resin, which can 3D print eight models in just under 10 hours, Draft Resin can do the same in 90 minutes. The Draft Resin reportedly features an improved surface finish, in addition to improved post-processing requirements, such as nominal support removal and wash and cure times. It suits for fast design iterations, initial prototyping, high throughput jobs and live 3D printing demos. This reformulated Draft Resin can also be used for dental and orthodontic applications.

Infinite Materials Solutions launches water soluble 3D printing support material for high-temperature thermoplastics

AquaSys 180 was built for what the company calls exceptional temperature stability that it claims no other water-soluble material can withstand, making it suitable to support Polyether ether ketone (PEEK), Polyether ketone ketone (PEKK), Polyetherimide (PEI) and Polyphenylsulfone (PPSU) when used in material extrusion processes. The company said this development represents an advancement for users of Fused Deposition Modelling technologies who wish to process high-temperature thermoplastics without manually removing supports or dissolving them with solvents. With AquaSys 180, users can dissolve support structures with warm tap water to leave a finished part with minimal residue.



Printing Techniques & Capabilities

Intel develops \$50 3D printed OpenBot to advance robotics accessibility

Researchers at Intel Labs developed a smart robot that anyone with a smartphone can build, using open source code, a 3D printer and \$50. The smartphone isn't only used to control the robot, as with devices such as MobBob or Qualcomm's Micro Rover, but it's also the "brains" of the robot, leveraging the advanced features and operating systems in smartphones to enable high-quality sensing and computation, while improving affordability, accessibility and scalability.

Researchers introduce LITA method of carbon fiber 3D printing

University of Delaware researchers are combining thermoset polymers with carbon fiber to make a composite for a [technique](#) localizing in-plane thermal assisted (LITA) 3D printing. Carbon fibers are positioned with spaces to be filled with a liquid polymer that "wicks" into the material structure. Polymers may also fill the fibers if they're porous enough. The fibers are then heated, curing the liquid polymer and allowing for a 3D printed structure to form. One of the beneficial aspects of LITA 3D printing is that because curing occurs earlier in the process, it isn't required later, saving users up to several hours and additional energy. The process offers "reliability and repeatability in making complex shapes." Robotics are also employed in a system comprised of a printhead that holds carbon fibers, a Joule heater and distributes resin. These materials and the technique may be applicable in infrastructure such as building bridges, as well as aeronautics in creating parts for planes. The researchers expect this technique will also cut down on labor, tooling and costs associated with defects.

UpNano uses nano-resolution 2PP technology to 3D print mes-range parts in minutes

A high-power laser, an optimized optical pathway, an adaptive resolution technology and smart algorithms for laser scanning allowed UpNano to achieve high-resolution 3D printing with 2PP technology. This resolution can be also achieved on centimeter (mes-range) size parts. Parts with nano- and microscale resolution can be printed across twelve orders of magnitude. This was accomplished by the UpNano GmbH from Vienna (Austria), a spin-out of TU Wien, which developed a high-end 2PP 3D printing system that can produce polymeric parts with a volume ranging from 100 to 10¹² cubic micrometer. The printer allows for nano- and microscale resolution. The company also demonstrated this capability by printing four models of the Eiffel Tower ranging from 200 micrometers to four centimeters, representing its minuscule structures within 30 to 540 minutes.

Self-learning robot autonomously moves molecules, facilitating molecular 3D printing

Researchers from Germany and Korea [created](#) an AI system that can learn how to selectively grip and move molecules through the autonomous use of a scanning tunneling microscope (STM) which is used for imaging surfaces at the atomic level. Researchers from Forschungszentrum Jülich, Jülich Aachen Research Alliance, RWTH Aachen University, Technische Universität Berlin, the Max Planck Institute for Informatics and Korea University participated in the project.

Origami inspires 3D printed soft robotics

Researchers from China were inspired by origami structures and materials in the [development](#) of more complex robotics. They sought to program materials into a robotic system, examining foldability and the required mechanical properties. The team began with a foldable origami spring and then moved on to metamaterial characters, exploring properties derived from geometries that fold. Their prototype was capable of crawling behavior due to 3D printed materials that collapsed as needed.

Blackstone Resources 3D prints safer, cheaper, higher energy density solid state lithium batteries

Swiss Holding company Blackstone Resources is focused on the battery metals market and invested in next-gen battery technology through its German subsidiary, Blackstone Technology GmbH. While traditional battery cell designs use liquid or polymer gel electrolytes, solid-state batteries use solid electrodes and a solid electrolyte. They can be safer to use, as they don't require flammable liquid electrolytes, but are also more costly. Blackstone, using its 3D printing process to make batteries, has multiple advantages compared to conventional forms of manufacturing, in addition to a more than 20% increase in energy density and more production flexibility in terms of the cell format. Additionally, by fabricating batteries with 3D printing, Blackstone can reduce the amount of materials that don't store any energy, like aluminum and copper, by up to 10%. The company plans to produce 3D printed solid-state battery cells and created and tested its first SSB prototypes. Blackstone is also developing its technology so it can 3D print SSBs for mass production. By using automated 3D printing to make SSB lithium-ion batteries, Blackstone can save up to 70% of the capital expenditure it uses to produce them and show that it's capable of creating the battery casings, composites and solid-stated electrolytes that are necessary for mass producing solid-state lithium-ion batteries.

ExOne announces entry-level metal 3D printer, launches capability to print particulate binders

The ExOne Company announced InnoventPro, which will reportedly be the most advanced entry-level binder jetting system, capable of 3D printing a variety of powders, including metal, ceramic and composite, along with the company's NanoFuse particulate binders. Binder jetting is a 3D printing process that uses a digital file to quickly inkjet a binder into a bed of powder particles, including metal, sand or ceramic, creating a solid part one layer at a time.

Korean researchers 3D print walking starfish robot using tensegrity structures

Researchers from the Ulsan National Institute of Science and Technology, South Korea, produced a walking starfish-shaped soft robot using 3D printing and sacrificial molding. The five limbs of the starfish are complex tensegrity structures. Acting like tendons in a biomechanical system, these structures are programmable with varying stiffnesses and flexibilities, meaning they can be actuated to induce controlled movements. In this case, the actuation mechanism is a magnetic tendon, which can cause the rest of the tensegrity structure to contract and relax to move the robot in a certain direction.

Researchers develop method to bioprint functional centimeter-scale organoids

Researchers at the Swiss Federal Institute of Technology Lausanne developed an approach to print centimeter-scale tissues with high physiological relevance, that look and function almost like their full-sized *in-vivo* counterpart. The mini-tissues could allow scientists to study biological processes and test treatment approaches in ways that were previously not possible, opening avenues for drug discovery, diagnostics and regenerative medicine. The approach, called “bioprinting-assisted tissue emergence,” uses organoid-forming stem cells as building blocks that can be deposited into extracellular matrices conducive to spontaneous self-organization. By moving the microscope stage and monitoring, the process through the microscope lens, the researchers were able to deposit into the gel a line of intestinal stem cells that measured centimeters in length.

Researcher develops closed-loop control system for additive manufacturing

Eindhoven University of Technology is developing a closed-loop control system for additive manufacturing. The work focuses on the resin-based SLA process and responds to how most 3D printers don't utilize sensor data to correct print jobs in real-time, essentially operating on an open-loop whereby the predefined print parameters determine the quality of the part.

Japan-based researchers develop hybrid 3D printing technique, creates plastic-metal structures

Metal and plastic additive manufacturing technologies were previously incompatible because their melting points are different. Current 3D printers employ either plastic or metal only and the conventional method to metal coat 3D plastic structures is not environment-friendly with poor results. Researchers at Waseda University in Japan developed a method to 3D print structures made of both metal and plastic thanks to a custom-made thermoplastic and commercially available fused filament fabrication printer. This hybrid 3D printing technique could extend the use of 3D printers to 3D electronics for future robotics and Internet-of-Things applications.

Researchers develop ferroelectric metamaterial for photopolymerization 3D printing

Researchers from the University of New York at Buffalo and MIT say composite resin is a leap toward making synthetic materials more affordable and suitable for advanced applications, such as acoustic shields, shock absorbers and electronics. The team utilized imidazolium perchlorate (ImClO_4) as the ferroelectric component of the material. With the aim of 3D printing a scaffold-supported crystalline lattice made of ImClO_4 , the scientists mixed a powdered form of the material with a UV resin and water in a commercial LCD 3D printer. The reprogrammable nature of the material's stiffness and how much it resists deformation meant the researchers were able to tune it to filter different subwavelength vibration frequencies. The printed part was also seen to self-correct deviations in its geometry during the printing process.

Drawback of drop on demand 3D printing alleviated by superhydrophobic sieve method

Researchers from the Centre for Nanoscience and Engineering at the Indian Institute of Science, Bangalore, created a drop impact 3D printing technique that uses a superhydrophobic sieve in favor of a nozzle to dispense droplets. Most microdroplet printing technologies use a nozzle-based dispensing technique within which the nozzle focuses the applied force and determines the droplet size. However, nozzles can become clogged and unwanted products of the droplet-formation process can occur. The method mitigates these issues and is more accessible than existing droplet printing techniques due to its ease of operation and economy.

Leiden University physicists use 3D printing to create microswimmers at micron scale

3D printing of active matter has been limited to particles larger than 10 microns, and projects tend to stick to creating quite simple shapes. Physicists at Leiden University used the Nanoscribe Photonic Professional GT two photon polymerization system to create a set of simple spherical particles between the sizes of one and 10 microns to determine the smallest spherical size that could be printed using the technology. With the proof of concept determined, the researchers produced more sophisticated geometries, including the classic 3D benchy, a helical pasta-like screw and a spaceship.

Fabrisonic combines strengths of UAM, PBF processes to create intricate patterns

Fabrisonic leveraged Powder Bed Fusion to create fine organic patterns that can be embedded into large structures through its patented Ultrasonic Additive Manufacturing (UAM) process. By combining the strengths of these two processes, Fabrisonic developed the solution needed to create a part consisting of organic stainless-steel geometry, dissimilar metal transition and embedded sensors that are encapsulated in the metal. Fabrisonic's engineers and designers aim to combine the benefits of other forms of AM with the benefits of its UAM method.

MIT researchers demonstrate under-extrusion 'DefeXtiles' 3D method

An MIT team developed a process that uses the stringing behavior that occurs in extruded polymers, to fabricate clothing items featuring small gaps, providing them with enhanced flexibility. With the technique, which doesn't require any software or hardware upgrades, it could be possible to 3D print garments as a means of reducing waste in the fashion industry. The process would allow consumers to "try on" clothes before ordering online. The researchers' alternative DefeXtiles method utilizes under-extrusion, which is seen as a defect within FDM 3D printing, as a means of creating thinner and more flexible textiles. These defects are caused when too little material is extruded to form a solid layer, but there is enough to allow periodic interlayer adhesion.

PostProcess develops VAD tech as automated polymer powder removal solution

The gross depowdering process for 3D printed polymer parts is encumbered with excessive labor and part breakage. Common processing methods are manual or semi-automated, using vacuums or blasting high-pressure air for removing powder. Such approaches are not well-suited to the complex geometries for which additive is utilized, nor capable of enabling production volumes. The opportunity to scale with these traditional depowdering methods is limited as they are unable to support end-to-end digitalization by providing closed-loop feedback for the complete additive manufacturing workflow. In response, PostProcess Technologies introduced variable acoustic displacement, an automated polymer powder removal solution based on its full-stack approach. This solution for the decaking of selective laser sintering and multi-jet fusion 3D printed parts is focused automating production volumes via software-driven technology.

3D printed sensors by igus can signal need for replacement parts

[igus](#) researchers [developed](#) a method of printing sensors into tribo-components such that they signal need for a replacement long before failure is expected to occur. The component can provide a warning if overload is expected or if the wear limit is approaching. This is a predictive maintenance property within its printed sensor layer. Called “isense,” the layer technology measures for changes in electric resistance and can be 3D printed using an electrically conductive material that adheres to tribological filaments or powders in the [igildur](#) material products family. It’s expected to be a cost-effective solution with broad scope industrial applications to apply 3D printing for smart components, spare part supply chains, part repair or replacement. Not only can it be used to design and manufacture such parts but can be used in combination with digital twin technologies and integrated sensors, to make real-time predictive maintenance and performance optimization for individual parts possible.

Farsoon Europe, TIGER Coatings create flame-retardant material for polymer laser sintering

The material, TIGITAL 3D-Set 371, is part of the PPP371 thermoset material solution family from TIGER. The polymer is the result of the collaboration involving TIGER’s expertise in thermoset material engineering and surface finishing solutions in combination with Farsoon’s open additive manufacturing platform for industrial applications. TIGER previously [collaborated](#) with RICOH in Nov. 2019, to develop improved thermoset materials for SLS 3D printing, processing and application-specific solutions. TIGER claims that its TIGITAL PPP 371 material family not only provides better thermal and mechanical properties, electronic isolation, dimensional stability, chemical resistance and more, but also can be printed at low temperatures to produce parts in a range of colors.

China-based researchers 3D print RF probe heads to enhance routine, unconventional MR experiments

Using 3D printing, Xiamen University researchers developed a method to build customized radio frequency (RF) probe heads with greater adapted coil structure precision than currently possible with conventional manufacturing techniques. The researchers' [experiments](#) are reportedly the first to explore this type of method for the fabrication of integrative probe heads for magnetic resonance systems. The researchers combined computer-aided design, 3D printing and liquid melting injection techniques to create the integrative MR probe heads. Both Fused Deposition Modeling and Stereolithography technologies were also used, which consisted of an RF coil with micrometer-scale conductive wires, customized sample chambers and RF circuit interfaces, wrapped inside a single printed polymer block. A 3D Systems' ProJet 3510 SD 3D printer was used to fabricate one version of the MR prototypes via FDM with a printing resolution of 30µm.

University of Nottingham researchers model and 3D print graphene electronic devices

Researchers at the University of Nottingham [developed](#) a technique for 3D printing graphene using an inkjet technology that maintains the materials electrical properties, opening up possibilities for an array of electronic components, such as transistors and sensors. To print the material, graphene inks made up of graphene flakes and ethyl cellulose, were dispersed into a mixture of cyclohexanone/terpineol and printed onto a substrate using a drop-on-demand method. The layers were then annealed in a vacuum oven at 250°C to remove the solvent and breakdown the additives within the ink. The team found that the greater the number of layers, the lower the electrical resistance. To demonstrate the possibilities of the material, the team 3D printed a phototransistor made up of graphene electrodes printed onto a semiconducting crystal.

LLNL scientists 3D print custom glass lenses via direct ink writing technology

A team of researchers from Lawrence Livermore National Laboratory (LLNL) used multi-material 3D printing, namely direct ink writing (DIW), to fabricate customized gradient refractive index glass optics. The approach allows for several optical functions to be programmed into flat glass components, functions that would otherwise require curved lenses. The LLNL scientists believe their approach can offer previously unseen design flexibility for stable glass-based parts and see potential applications in military optics and VR eyewear.



Manufacturing & Construction

Kamp C reports 3D print of two-story house in one piece

Kamp C reportedly became the first in the world to 3D print a two-story house in one piece, using the largest 3D printer in Europe. The house in Westerlo, Belgium, is a demonstration for this style of 3D printing, displaying different styles. It's also a way to measure how the home, which was built using greener practices than typical constructions, maintains over time. Kamp C's 3D printed house is part of the European C3PO project, supported by the European Regional Development Fund. The project brings together scientists and businesses to advance 3D printing in Flanders.

Sinterit 3D printing offers manufacturers flexibility in COVID-19 conditions

According to Polish 3D printer manufacturer Sinterit, the new post-COVID-19 business landscape will require flexibility rather than outright change from 3D printing companies. Sinterit is developing its printing solutions to address its customer's needs for fast, flexible and cost-effective services and systems. The Lisa PRO system provides the benefits of an industrial SLS 3D printer in a smaller model, making the printing process simpler to change materials during production, easier to operate and faster to clean. When utilized within prototyping applications, the speed of the Lisa PRO enables customers to be flexible and change direction when needed. By conducting prototyping activities, Lisa PRO users reduce reliance on third parties to manage this process, making the supply chain more secure.

CRP Technology 3D prints sensor housing box for IMAL using Windform materials

3D printing materials and services provider CRP Technology deployed its proprietary Windform XT 2.0 polymer to fabricate an end-use sensor housing box for one of its clients. Commissioned by the machine part producer IMAL, the quality control component was created using additive manufacturing, and later finished using CNC machining. By deploying its end-to-end manufacturing service, CRP was able to rapidly produce the parts that IMAL required, with strong resistance qualities and a high level of surface finish. The final product left new-adopters IMAL impressed with the precision that could be achieved via CRP's 3D printing solutions.

Vertico opens Eindhoven 3D concrete printing facility

3D concrete printing specialist Vertico opened a concrete printing facility in Eindhoven in the Netherlands to accelerate its architectural and commercial building applications. The facility will see the application of industrial robots, a technology that Vertico has pioneered. The company is focusing on fine detailing and architectural applications, as opposed to more thicket printing applications for larger structures.

PERI constructing Germany’s first “market-ready” 3D printed residential building

Germany-based construction company PERI Group is constructing the country’s first “market-ready” additive manufactured residential building. PERI’s two-storey house, located in Beckum, North Rhine-Westphalia, is built using Danish manufacturing firm COBOD’s 3D printing technology. The project is part of the region’s “Innovatives Bauen” (Innovative Construction) program, and reportedly represents the first time that the technique has been used in Germany.

WASP showcases 3D printed bio-building at “We Are Nature” event

Italian 3D printer manufacturer WASP partnered with the Rossana Orlandi gallery in Milan to showcase the Gaia, a 3D printed eco-house created with sustainable natural materials. WASP discussed the research behind the construction of Gaia which was unveiled in 2018. Gaia was created using the firm’s CRANE WASP 3D printer, using soil as the main binder of the printable material. Natural waste materials such as vegetable fibers derived from the rice production chain were also used in the mixture, which was compiled of 25% local soil, 40% straw chopped rice, 25% rice husk and 10% hydraulic lime, made workable through the use of a wet pan mill.

QOROX, CyBe partner on 3D printed park benches for New Zealand city

New Zealand-based QOROX and Dutch technology provider CyBe Construction partnered to supply the first robot to 3D print concrete objects on a commercial scale to Hamilton in New Zealand. The companies are working with Hamilton City Council to create 3D concrete printed park benches, which will be the first example of this construction technique in the country. The benches are a waka design that were printed by QOROX’s 3D printer in just over 30 minutes.

3D apartment building under construction in Germany

COBOD, a company focused constructing buildings on demand, started construction of a 3D printed three-story apartment building in Germany. The PERI Group, a manufacturer and supplier of formwork and scaffolding systems, is using COBOD’s BOD2 system to 3D print the walls of the structure. The building will measure 380 m² and consist of five apartments. The complex will be manufactured on-site and rented once complete, making it the first 3D printed commercial apartment building.

Korea’s HITECH uses HP technology for unique architectural designs

Korean 3D printing company HS HITECH used multi-jet fusion technology from HP 3D printing to create unique architectural designs to help designers and engineers create while also being able to support large quantities of customized products. HS HITECH operates as a manufacturer of electronics and semiconductors. The company also formed a joint venture with Z3DLab, a company that developed a process to 3D print metal-ceramic composites using SLM technology. HS HITECH and Z3DLab established a 3D printing center in Korea to work on the optimization of 3D printing processes.



M&A and Investments

LightForce Orthodontics raises \$14M for custom 3D printed braces

Venture-backed startup LightForce Orthodontics, which makes what is reportedly the world's first customized 3D printed orthodontic bracket system, completed a \$14 million Series B funding round, which will help the company develop its digital platform and product offerings. LightForce uses 3D printing to provide orthodontic patients with personalization. The startup's [technology](#) helps create custom braces by 3D printing brackets that fit each tooth, which can mean less time spent wearing braces and fewer appointments to the orthodontist for adjustments.

STACKER funds industrial office F1 3D printer on Kickstarter

Minnesota-based STACKER closed a Kickstarter campaign for the STACKER F1 3D printer and a line of F-Series accessories. The initial \$100,000 goal was met within the first 24 hours of the campaign, and over 700 backers pledged a total of \$290,010 to bring the STACKER F1 to life. STACKER created the F1, with its 285 x 285 x 285 mm build volume, so it could be used in schools, research labs, offices, printer farms, makerspaces, hospitals, businesses and at home.

Photocentric invests in 3D printed battery research division

3D printer and materials manufacturer Photocentric launched a division dedicated to the development of eco-friendly 3D printed electric batteries. The firm committed a "significant investment," which includes its research team, to designing more energy-efficient storage devices. Having previously led other grant-funded projects, the company is dedicating additional resources to optimizing 3D printed fuel cells for automotive applications. By utilizing its 3D printing technology, the firm may develop car batteries with enhanced storage capabilities.

nTopology closes \$40M round to enhance 3D printing software

nTopology raised a total of \$40 million, its latest round of funding. Global venture capital and private equity firm Insight Partners led the Series C funding round. Additional support came from Grant Verstandig and existing nTopology venture partners Canaan, DCVC, Haystack and Root.

Aspect Biosystems to deliver two bioprinters to researchers via grant program

Pioneering microfluidic bioprinting company Aspect Biosystems launched a grant program for research labs enhancing 3D bioprinting technology use. The biotechnology firm will select two winners that will receive an RX1 bioprinter at no cost for six months. The program will also provide the winners with virtual instructions and training, ongoing support from the Aspect Biosystems team, and a starter kit that includes three printheads, biomaterials, crosslinkers and buffer. The company accepted applications through mid-October 2020, and to qualify, labs must have conducted research at a university or non-profit research institute for the project.

Covestro buys DSM Additive Manufacturing

German materials company Covestro acquired DSM Functional Materials for \$1.9 billion, of which DSM aims to receive \$1.7 billion net. The purchase includes DSM's Resins and Functional Materials businesses, including DSM Niaga, DSM Additive Manufacturing and the coatings activities of DSM Advanced Solar. The sale builds on the company's approach of managing its businesses, as DSM continues to evolve, operating in the fields of nutrition, health and sustainable living.

Altana acquires TLS Technik and AMT to make metal 3D printing powder

Altana AG, a Germany-based specialty chemicals group, acquired TLS Technik, and Aluminum Materials Technologies (AMT). The acquisitions will be made by the Eckart division of Altana AG, which specializes in inks and pigments. The addition of 25-year-old TLS Technik, a producer of gas atomized metal powders for industrial 3D printing, and AMT, a company that set standards in strength and weight in developing its aluminum alloys for 3D printing, expands Altana's portfolio in industrial AM.

3DPRINTUK invests in HP MJF 5210 machine as part of £1M expansion plan

3D printing service bureau 3DPRINTUK invested in an HP Multi Jet Fusion (MJF) 5210 machine as part of a \$1.35 million expansion plan to enhance its 3D printing capabilities in London. The service bureau provides low volume manufacturing through MJF 3D printing as well as Selective Laser Sintering. The firm intends to use the 5210 for batch production applications while also providing customers with bespoke printed polymer parts.

Nano Dimension raises \$100M through share sale

Israeli electronics 3D printing company Nano Dimension sold 25 million shares for gross proceeds \$100 million. This was a 31.7% discount on the company's share price on close of trade on the day of the offering. The company was given a market cap of \$316 million. In Q3 2020, Nano Dimension reported revenue of \$438,000 and a net loss of \$20.7 million.

Syqe Medical turns to XJet for precision, heat resistant ceramics parts

Israeli pharmaceutical firm Syqe Medical is working with 3D printer and materials manufacturer XJet on high-precision, heat resistant ceramic parts for the medical sector. Syqe installed XJet's Carmel 1400 additive manufacturing system, which features the company's patented NanoParticle Jetting (NPJ) technology, to enable the production of ceramic parts through inkjet printing. Syqe Medical is the manufacturer of a Selective-Dose inhaler which enables the precise delivery of a range of therapeutic drugs to patients, based on their symptom relief requirements. First brought to market for use with medical cannabis, the technology now allows hundreds of existing and preclinical drug molecules to be considered for inhalation. The device aims to increase the effectiveness of patient treatment, helping to create optimum balance between symptom relief and adverse effects.

Battery Ventures buys Cimatron business from 3D Systems for \$65M

3D Systems agreed to sell its Cimatron business and related subsidiaries to global technology-focused investment firm Battery Ventures for \$65 million. Cimatron is an Israeli software company which operates the Cimatron integrated CAD/CAM software for manufacturing, toolmaking and CNC programming applications, and the GibbsCAM CNC programming software businesses. Battery Ventures backs companies in multiple high-tech markets at all stages, from seed and early to growth and buyout. The transaction is expected to be completed during Q4 2020.

Adaptive3D receives Series B financing from Arkema-led investors

Adaptive3D, a 3D printing resin supplier, secured Series B financing from a syndicate led by Arkema Group. Also backing the investment is West Pharmaceutical Services, a global manufacturer of containment and delivery systems for injectable medicines, venture capital firm Clear Fir Partners, and current investors Applied Ventures, and the founding family of semiconductor manufacturing firm Texas Instruments. Although full terms of the deal and the funds exchanged remain undisclosed, Adaptive3D intends to ramp up the production of its photopolymer resins used in the manufacture of tear-resistant rubbers.

Longer 3D turns to Kickstarter for Orange 4K funding

3D printer manufacturer Longer 3D took to Kickstarter to launch a funding campaign for the Orange 4K printer, which introduces 4K resolution to vat photopolymerization printers, allowing it to reach 31.5-micron resolution and finer. Not only does the use of an LCD screen allow the Orange 4K to be less expensive than previous generations of SLA and DLP machines, but 4K resolution makes it possible to utilize the sub-pixels of the screen to achieve what may be unprecedented resolution. The printer is available in two varieties, one which uses a color LCD screen and another that is monochrome.

NCAM invests in XJet to collaborate in metal and ceramic additive manufacturing

The UK's National Centre for Additive Manufacturing (NCAM) invested an undisclosed amount in the NanoParticle Jetting (NPJ) technology developed by XJet, a provider of metal and ceramic AM technologies and solutions. According to NCAM, the Israeli company was able to demonstrate the ability of its Carmel 1400C system to produce premium end-use ceramic parts with complex geometries, as well as scale up for production purposes. The components that XJet's ceramics NPJ technology can reportedly create accurate, superfine details and smooth surfaces. These types of parts can be useful in the medical and dental fields, among others.

Additive Drives receives €1.5M investment from AM Ventures Holdings

The financing round is intended to further advance the company's market launch as well as enable the development of high-performance applications.

AM-Flow raises \$4M in Series A funding round, focus on automation

AM-Flow, an industrial automation company that is focused on additive manufacturing automation, raised \$4 million in a Series A funding round. The company will use the funds to begin providing step-change automation to the AM industry and to move toward its industry 4.0 goal of the lights-out factory, where AI computer vision, motion and robotics process 3D printed parts. BOM Brabant Venture led the round with support from Materialise, Midwest Prototyping and Innovatiefonds Noord-Holland. Existing investors Miller Turner and DOEN Participaties also contributed.

Penn State receives 3M grant to investigate quality control methods for metal 3D printing

Pennsylvania State University received a grant of \$180,000 from 3M to explore quality control methods for metal 3D printing. The team will use a nondestructive evaluation method, where a part or system is tested without being harmed, to assess parts 3D printed with the binder jetting process. Renewable for up to three years for a total of \$540,000, the grant forms part of an agreement between the two parties to drive research into additive manufacturing and other activities.

**Partnerships****LTG Lofts To Go, Black Buffalo 3D partner to create 3D printed communities**

Black Buffalo 3D Corporation and LTG Lofts To Go will partner to advance production, distribution and availability of 3D printed mobile housing and commercial spaces globally. LTG's flagship offering, coodo, is a flexible and mobile modular structure used for holiday, living or working. Since 2012, LTG production partners created white aluminum/steel and grey wood coodos serving as sustainable resorts and residences, working spaces and booths for events. This partnership increases the availability of coodos and will help bring an offering to market. Black Buffalo will supply 3D construction printers along with cement "ink" to LTG developers. These construction printers will enable 3D printing of entire communities, facilities and offices onsite in days. This approach minimizes freight costs, improves sustainability and eliminates logistical challenges associated with construction and precast buildings or production.

AddiFab, GEOSearch partner to automate tooling part selection for 3D printing

Danish company AddiFab manufactures Freeform Injection Molding technology, with which users can inexpensively 3D print molds and other soft tooling. AddiFab is working with German firm CADENAS and its GEOSearch tool. The two companies hope to use GEOSearch to allow users look for and find the ideal parts to mold. Using Geometric Similarity Search, the companies can compare a file to existing files in CAD libraries.

Essentium, Magigoo launch tailored line of 3D print bed adhesives

3D printer manufacturer Essentium collaborated with Malta-based startup Thought3D to launch an all-in-one 3D printing adhesive line. Magigoo, a product line of Thought3D, optimized the range of manufacturing chemicals to work with Essentium's High-Speed Extrusion platform. The adhesives, which hold 3D prints in place during printing, will also enable Essentium customers to explore a range of engineering-grade polymers.

TRUMPF, NCS Technologies partner to distribute for TruPrint additive products

TRUMPF's Laser Technology Division announced a distributorship with NCS Technologies in order to grow their sales channel for TruPrint AM systems throughout the U.S. NCS Technologies will also represent TRUMPF's Laser Metal Deposition products but have a focus on additive systems such as the TruPrint 2000, which offers a combination of process speed and build volume. NCS Technologies is a domestic computer manufacturer and supplier of IT solutions. NCS also represents polymer and fiber 3D printing solutions and partnered with TRUMPF as provider of 3D metal printing solutions to expand and complement their portfolio.

DSM, Nedcam collaborate to develop large-format FGF 3D printing applications

Material producer DSM partnered with 3D printed part supplier Nedcam to develop applications for scalable Fused Granulate Fabrication (FGF) 3D printing. Nedcam installed a CEAD AM Flexbot robotic 3D printer at its Dutch-based Heerenveen site. Utilizing DSM materials, it plans to offer large-scale commercial 3D printing production services. As part of their collaboration, the firms will also develop and test FGF materials, processes and applications for use in the marine, renewable energy, construction and infrastructure industries.

3DCeram, Design Bureau Ivchenko qualify SILICORE ceramic for investment casting

France-based ceramic 3D printing specialist 3DCeram developed a process for producing complex foundry cores for engine turbine blades that leverages its laser stereolithography 3D printing process and SILICORE material. This approach was validated through a partnership with Design Bureau Ivchenko, a state design service provider based in Zaporizhia, Ukraine that specializes in designing and developing aircraft engines.

TU Delft partners with Materialise to 3D print sound enhancing “acoustic panels”

The Delft University of Technology (TU Delft) worked with Belgian 3D printing software and service provider Materialise to develop 3D printed sound absorbing acoustic panels. Created as part of a joint multidisciplinary research project, the fabricated tiles were designed to improve acoustic and auditory experiences of concert halls or sports arenas attendees. Leveraging 3D printing rather than conventional manufacturing methods, the TU Delft team also created the panels at a lower cost, and in more complex geometries than was previously thought possible.

RoosterBio signs CRADA with The Geneva Foundation and Uniformed Services University

RoosterBio, a supplier of human mesenchymal stem/stromal cell (hMSC) working cell banks and hMSC bioprocess systems, joined a Cooperative Research and Development Agreement (CRADA) with The Geneva Foundation, a non-profit dedicated to advancing military medicine, and the Uniformed Services University of the Health Sciences, an education institution within the U.S. DOD on behalf of USU's 4 Defense Biotechnology, Biomanufacturing and Bioprinting Center. RoosterBio will support bio-fabrication in austere environments and provide subject matter expertise in Ready to Print technologies.

CollPlant, United Therapeutics expand collaboration to 3D print kidneys

Israel's CollPlant Biotechnologies and United Therapeutics increased their collaboration further to bioprint kidneys, with the goal of transplantation. CollPlant is dedicated to "regenerative and aesthetic medicine" in relation to tissue regeneration and the creation of human organs. For bioprinting, the CollPlant team relies on their rhCollagen-based bioinks. United Therapeutics, in complement to the technology of CollPlant, is developing products to improve treatment for patients suffering from chronic and life-threatening health issues.

Azul 3D, DuPont to bring HARP 3D printing to electronics materials

Azul 3D formed a developmental collaboration with DuPont Electronics & Imaging, which serves the advanced chip packaging, circuit board, display, digital and flexographic printing, electronic and industrial finishing, and semiconductor industries. The collaboration with Azul 3D aims to bring next-gen 3D printing methods, like its High Area Rapid Printing (HARP) technology, to the electronic materials sector. HARP printers are capable of larger print areas and production speeds than most commercial systems, 3D printing parts vertically at up to 18 inches an hour; Azul 3D says its technology can compete with injection molding. DuPont and Azul 3D's plans to combine this with HARP technology allow these types of products to fine-tuned, and manufactured on-demand, at a far higher rate of speed.

Henkel verifies Loctite materials for Carbon DLS 3D printing process

Henkel will collaborate with 3D printer manufacturer Carbon to validate its Loctite-branded materials for use with Carbon's Digital Light Synthesis (DLS) 3D printing technology. Carbon customers will be able to use Henkel's Loctite 3D IND405 Clear material, as the partnership allows access to Henkel's single-component technologies within the DLS additive manufacturing process.

Poland's Zortrax partners with European Space Agency to 3D print conductive blended peek prototypes

3D printer manufacturer Zortrax partnered with the European Space Agency (ESA) to fabricate experimental parts using two different blends of PEEK filament. Zortrax was able to combine standard PEEK with an ESA conductive variant, to create proof-of-concept models that are capable of data and electricity transfer. The company created its class of amalgamated polymer to address the growing need for high-performance composite components in the aerospace sector. Zortrax's prototypes opened a development path for the firm, to create 3D printed parts with embedded electronics, while maintaining the inherent strength benefits of PEEK materials. The company is releasing the changes it made to its machine to all its commercial systems.

GE Additive, Siemens join sustainable 3D printing trade group

To promote the environmental benefits of additive manufacturing (AM) over traditional methods of manufacturing, independent metal AM provider Sintavia launched the Additive Manufacturer Green Trade Association (AMGTA), a trade group for additive manufacturers. The group says additional AM companies joined the organization to advance the technology's sustainability. The additions increase the organization membership base to 12 companies from eight countries. Joining AMGTA are:

- Taiyo Nippon Sanso Corporation, a supplier of stable industrial gases to global industries headquartered in Tokyo, Japan;
- QC Laboratories, a subsidiary of Sintavia and an industrial and commercial non-destructive testing laboratory focused on AM components;
- Sweden's Additive Manufacturing Excellence For Industry, an accelerator for the adoption of AM in Nordic industries;
- Danish AM Hub, Denmark's national meeting point for the AM ecosystem;
- EOS, the world's leading technology supplier in industrial 3D printing of metals and polymers;
- GE Additive, a world leader in additive design and manufacturing;
- 3D printing services provider Materialise;
- Siemens Digital Industries Software, a driver of design, engineering and manufacturing transformation with its Xcelerator digital enterprise portfolio;
- German provider of industrial metal 3D printing machines SLM Solutions;
- Stryker, a medical technology company; and
- The National Manufacturing Institute Scotland, a group of industry-led manufacturing research and development facilities.

ASTM's agreement with NASA to support 3D printing

The three-year contract, between ASTM International's Additive Manufacturing Center of Excellence (AM CoE) and NASA, is worth up to \$750,000. AM CoE aims to conduct strategic R&D to speed up the development and adoption of innovative technologies, such as additive manufacturing, as well as advance standards for AM technologies. The AM CoE's first project will focus on qualification procedures for laser beam powder bed fusion (LB-PBF) AM processes.

French sporting goods retailer Decathlon adds more 3D printing capabilities with HP

HP strengthened its partnership with DECATHLON ADD LAB (ADDitive Manufacturing LABoratory), the brand's research center dedicated to 3D printing solutions. The laboratory is equipped with two HP JetFusion 5200 3D printers, four processing stations and six manufacturing units making it possible to print on different materials. Thanks to HP's 3D technology, DECATHLON can provide its partners with 3D printed spare parts of its products for repairs. Besides repairs, the center meets several needs including prototyping, design validation, manufacturing of small tools and small production runs.

ExOne optimizing sand 3D printers for use with Japanese ceramic product manufacturer Itochu's cerabeads

Cerabeads are a type of premium ceramic foundry sand used to create molds and cores for metal casting high-value products in the automotive, oil and gas, mining and construction industries. Compared to natural sand and other foundry media, Cerabeads deliver mold and core packages with higher-strength sandcasting packages, high heat resistance, with low thermal expansion, improved final part resolution and surface finish and reduced waste and dust, with high reclamation value. In use at more than 100 foundries worldwide, Cerabeads can be used in traditional mold-making processes with steels, iron, aluminum and other metals where tight control and surface finish is desired. ExOne will develop and optimize the process settings of its S-Print, S-Max and S-Max Pro sand 3D printers for use with Naigai Cerabeads. ExOne will continue to offer ITOCHU's Cerabeads with its 3D printing technology as an optimized package to its North American customers.

Stratasys, nTopology partnership to create 3D printing design workflows

Stratasys will collaborate with 3D printing and engineering software startup nTopology. The two are working to make 3D printing easier by offering several Design for Additive Manufacturing (DfAM) workflows for their users, the first of which is the FDM Assembly Fixture Generator for simplified fabrication of jigs and fixtures. New York-based nTopology recently closed a \$40-million funding round to enhance its nTop Platform software. By partnering up with Stratasys, the workflows of its software will form the base of the DfAM workflows, meant to be used with multiple Stratasys FDM 3D printing systems. The two companies plan to release several other DfAM workflows in the future and are also offering training videos and resources to users.

Baker Hughes, Würth to offer 3D printing, digital inventory services

The partnership will provide design and AM services across industries including oil and gas, renewables, power generation, maritime, automotive and aerospace. The program is part of Würth Industry North America's larger digital inventory and 3D printing strategy. Baker Hughes will have access to Würth's base of over 80,000 customers. NASA is among the first clients the duo will be working with. Baker Hughes is using a combination of directed energy deposition and machining to adapt and print a NASA design for use in wind tunnel testing.

Nexa3D, CASTOR roll out automated 3D printing decision support platform

Nexa3D says Ximplify, an automated 3D printing decision support portal aiming to accelerate the ability of designers and manufacturers to adopt AM at scale, is powered by Israel-based CASTOR. Ximplify can scan through a complete list of materials comprised of thousands of parts in minutes, selecting the ideal candidates for additive manufacturing. In addition to analyzing parts for the ideal process, Ximplify recommends the best 3D printer and material to maximize performance while minimizing material usage and waste and reducing energy consumption per part. The company also announced the development of its xCast digital-wax material for creating precision metal casting patterns that can be used on Nexa3D's photoplastic printer NXE400. Additionally, Castor unveiled its proprietary software, Castor Enterprise, as an on-premise solution that identifies cost reduction opportunities out of thousands of 3D printed parts to make manufacturing easier for AM oriented engineers.

Dutch 3D metal printer manufacturer Additive Industries to collaborate with Japan's Makino on hybrid process chains for industrial AM

Additive Industries and Makino, a manufacturer of milling machines, signed a LOI for a joint project to develop integrated process chains anticipating the upscaling of industrialized AM. Instead of treating additive manufacturing of metal parts and post processing as separate processes, the companies aim to develop a process chain where their technologies work together. Additive Industries and Makino will work on the development and commercialization of hybrid process chains supported by the in-depth process and machine design experience of both companies.

Jabil, Titan Robotics to advance industrial pellet-based 3D printing

3D printer OEM Titan Robotics will collaborate with manufacturing specialist Jabil to advance the capabilities of large-format 3D printing for industrial applications. This includes applications in sheet metal forming, composite layups, welding fixtures, molding and casting patterns for industries such as medical, defense, aerospace and automotive. The collaboration is set to provide customers with purpose-built high-performance pellet materials, as well as a part design validation service to ensure large and costly end-use parts are done right on the first attempt.

Siemens partners with Morf3D, Sintavia, Evolve Additive add features to Xcelerator software portfolio

Through industry partnerships with 3D printer producer Evolve Additive and service bureaus Morf3D and Sintavia, Siemens introduced Xcelerator support for AM methods, while streamlining the process for many of its clients. By working with Evolve Additive, Siemens also aims to develop a software-hardware solution that's rapid enough to drive the adoption industrial 3D printing. Although the company invested in the hardware side of the industry before, it's focused on the software element of AM. With the partnerships, Siemens aims to optimize its existing Xcelerator portfolio for both novel and high-volume 3D printing applications.

**Regulatory****TÜV SÜD provides 3D printing standards and regulations checklists for manufacturers**

To ensure protective and medical products adhere to COVID-19 quality requirements and the legal regulations medical devices are subject to, technical service company TÜV SÜD assembled checklists for 3D printing processes and provided them to manufacturers throughout the pandemic. TÜV SÜD also provides tests for additive manufacturing processes, enabling 3D printing companies to verify their conformity. In addition, TÜV SÜD partnered with several 3D printing firms, organizations and authorities to help combat the effects of the COVID-19 pandemic. Production software provider 3YourMind embedded TÜV SÜD's checklist in its workflow after creating a platform to organize supplies of essential products throughout the pandemic. TÜV SÜD also worked with 3D printer manufacturer Ultimaker on its first checklist, in addition to participating in an inter-agency collaboration between the Nanyang Technological University and Singapore's National Additive Manufacturing Innovation Cluster to guide manufacturers through relevant testing requirements. The firm is a member of the user-oriented network Mobility goes Additive which is building a database of use cases and FAQs on 3D printing face visors, masks and ventilators.

3D Systems granted 510(k) FDA clearance to 3D print surgical guides with two materials

Pioneering 3D printer manufacturer 3D Systems received 510(k) clearance from the FDA to 3D print maxillofacial surgical guides using its LaserForm Ti and DuraForm ProX PA materials. The material choices will enable users to 3D print lower profile surgical guide designs as part of its Virtual Surgical Planning service. This will serve to give its customers, surgeons, greater access and visibility to the surgical site, reducing both operating times and the risks involved with maxillofacial surgery.

3D Hubs' 3D printing warehouses introduce quality control and reduced risk

Amsterdam-based 3D Hubs started as a distributed desktop 3D printing community before becoming a 3D printing service. By adding CNC, sheet forming and other technologies, the company is similar to Protolabs and Xometry. It is setting up warehousing in Chicago and Amsterdam. Warehousing and clearance as well as small assembly operations were already offered by companies such as Syncreon and DHL. However, 3D Hubs believes an integrated service will allow it to extend its client relationships and revenue. The warehouses in Amsterdam and Chicago will be responsible for the clearance of items through customs, in addition to running a quality control center for examining all parts and ensuring they meet specifications before shipment to the customer.

ADAM receives 510(k) eligibility from FDA for 3D printed bones

Connecticut-based 3D bioprinting firm ADAM (Advanced Development of Additive Manufacturing) received 510(k) clearance for its 3D printed bioceramic and modified biopolymer bone implants. ADAM aims to enable patients to have their tissues modeled using MRI and CAT scans stored on its digital platform, which can then be 3D printed and implanted in designated clinics.

3D Systems wins FDA clearance for Vantage Ankle PSI

3D Systems was granted 510(k) clearance for its Vantage Ankle PSI patient-specific 3D printed surgical ankle instrument. The Vantage Ankle PSI aids in total ankle replacement surgery carried out by medical device manufacturer Exactech's Vantage Total Ankle System. The companies collaborated on the concept for the Vantage Ankle PSI, which is claimed to be the only available method of facilitating direct patient-specific osteotomies in the ankle.

Materialise awarded CE Marketing Certification to 3D print personalized medical devices

Materialise received CE Marking Certification for most of its orthopedic and cranio-maxillofacial products. CE Marking approval is meant to demonstrate that a medical device meets the standards of the European Medical Devices Directive. Previously, Materialise's 3D printed devices needed medical prescriptions every time they were made. The CE Marking applies to multiple products in its portfolio, including patient-specific orthopedics, anatomic models and patient-specific surgical guides and implants.

Singapore seeks to outlaw ownership of digital plans for 3D printed guns

Singapore introduced the Guns, Explosives and Weapons Control Bill that would make it illegal to own digital plans to 3D print a gun or major gun part. The Ministry of Home Affairs said the threat of terrorism remains high, and flagged the risk of lone wolves or extremist groups using weapons to carry out an attack in Singapore. Technological changes also pose challenges to enforcement, pointing to the emergence of technologies such as 3D printing and drones, and greater access to information online on manufacturing illegal guns and weapons.



Transportation and Automotive

Modular heat exchanger made via 3D printed molds

Turnage, the founder of BTI LLC, is using 3D printing to improve upon life-sized cars, 3D printing the molds used to fabricate its Modular Heat Exchanger System, named the Manhattan. The system is a “reimagining of how to construct intercoolers and radiators, changing them from fixed welded units to a system of multiple components.” While radiators are used to transfer thermal energy from one medium to another, an intercooler cools a gas after compression; the internal energy of a gas rises when it’s compressed, which lowers its density and increases its temperature. Both intercoolers and radiators, often used in the aftermarket automotive market, are fixed units that have been welded together. By using 3D printing to make molds for its intercooler and radiator end tanks, BTI can make a modular heat exchanger system that’s easy to take apart, fix and redesign, if needed.

Wabtec, HP partner on facility for railway 3D printing

As the railroad industry continues to embrace 3D printing, international businesses like Wabtec are working with other industry leaders to increase production of 3D printed parts for the rail industry within India, the second-largest market for Wabtec. Wabtec, in collaboration with HP and Redington, opened the Wabtec India Additive Manufacturing Centre which is focused on accelerating the design and production of integrated 3D printed components in India. This Centre of Excellence (CoE) will offer consulting, part identification and production for locomotives, transit entities and Micro, Small and Medium Enterprises. Wabtec as the provider of services for both freight and transit rail is also an industry leader in a growing range of solutions for applications in mining, marine science and other industrial endeavors. Within the AM space, Wabtec plans to use the CoE to further its strategy for the design and production of 25,000 industrial parts by 2025. The CoE is solidified by a combination of Wabtec’s experience in industrial manufacturing, HP multi-jet fusion technology and Redington’s supply chain. The CoE will also offer consulting services.

Continental invests in Stratasys FDM technology for ESD-compliant automotive parts

Continental AG installed a Stratasys Fortus 450mc FDM 3D printer at its Additive Design and Manufacturing (ADaM) Competence Center in Germany. Although famous for its tires, Continental also produces automotive parts and provides mobility services through its Continental Engineering Services division. The ADaM Center offers customers, internal or otherwise, additive samples, mechanical parts and series components made of both metals and thermoplastics. The Fortus 450mc will be used to manufacture prototypes, end use parts and jigs and fixtures for Continental’s own production line.

Sandvik partners with GSD Global to 3D print titanium motor nodes for e-bikes

Global engineering group Sandvik collaborated with e-bike engineering and design consultancy GSD Global to 3D print titanium motor nodes for e-bikes. GSD Global works with several bicycle original equipment manufacturers and found titanium parts such as motor nodes, which anchor the electric motor to the bike frame, are difficult and expensive to manufacture using traditional CNC methods. However, by altering the design of its motor nodes to make them suitable for additive manufacturing, the firm saw its production costs more than halved.

Thyssenkrupp, Wilhelmsen begin production of 3D printed ship parts

Thyssenkrupp formalized its joint venture with shipping maintenance firm Wilhelmsen. The firms signed a letter of intent to establish a joint venture to 3D print parts for ships. The companies worked on 3D printing for shipping since 2019. The industry has focused on prototypes, orthopedics, dental and aerospace. Thyssen and Wilhelmsen, however, see opportunities in the maritime sector for 3D printing.

MAMBO Fiberglass 3D printed boat complete at Genoa Boat Show

European tech startup moi composites unveiled MAMBO, a 3D printed fiberglass boat. The motor additive manufacturing boat has been fabricated via continuous fiberglass thermoset material to form a trimaran featuring a glossy blue hull. 3D printed with continuous fiber manufacturing, a proprietary 3D printing technology from moi, the MAMBO is meant to be durable and strong, but also lightweight.

RAM3D, Sturdy Cycles partner to 3D print titanium bikes

New Zealand-based RAM3D partnered with custom bicycle producer Sturdy Cycles to 3D print titanium components for road bikes. Sturdy Cycles had been looking to create designs and structures that couldn't be manufactured using traditional methods. RAM3D is also advising Sturdy Cycles on new designs for its bespoke bikes and involving it in the 3D printing process. Sturdy is looking to launch a Time Trial specialist bike in 2021 to line up alongside its existing 3D printed models, and may consider designing and producing a customized e-bike with help from 3D printing in the future.

Groupe Renault to include 3D printed parts in sustainability push

Car manufacturer Groupe Renault created a "Re-Factory" dedicated to sustainable automotive production. The facility, which is being built near Paris, will focus on reducing waste by recycling and retrofitting vehicles, as well as offering a 3D printed spare parts service. Through the initiative, Renault aims to achieve a negative carbon balance by 2030, and create an industrial ecosystem that encourages circular innovation.

Virginia Tech researchers integrate sensors for smart tires with help of 3D printing

Researchers at Virginia Tech developed a method to integrate self-powered, wireless strain sensors into smart tires using 3D printing and graphene. The sensors, which can provide information about tire loads, pressure, temperature and more, are energy-efficient and harvest strain energy from the tire itself to transfer wireless data. The sensors are made by a 3D printing method that uses a graphene-based ink, which is designed with a wrinkled microstructure. The wrinkles provide high flexibility and prevent the sensor from being damaged or failing due to repeated or large deformations in the tire.

Volkswagen improves prototyping with aid of Stratasys 3D printers

The carmaker installed two Stratasys J850 printers in its pre-series-center to 3D print realistic prototypes of car interiors and exteriors that mirror final production parts with up to 99% precision. Volkswagen is using these printers to produce full-color prototypes in up to seven materials that vary in flexibility, rigidity and transparency. For vehicle interiors, Volkswagen is using 3D printed parts with textured surfaces including fabric, leather and wood.

Fraunhofer researchers, FCA partner on 3D printed parts for sports car suspension

Researchers at the Fraunhofer Research Institution for Additive Manufacturing Technologies collaborated with engineers from Fiat Chrysler Automobiles (FCA) to develop a 3D printed suspension part for one of its sports cars. Through additive manufacturing, they were able to integrate the vehicle's brake caliper into its wheel carrier, while making it 36% lighter and more fatigue resistant. Given that reducing the brake system's constituent parts was found to cut down its associated costs and lead times, it could represent the FCA group's first step towards the serial 3D printing of vehicle components.

Power management company Eaton sets up 3D printing program

Eaton launched a 3D printing program within its Vehicle Group after implementing the technology during the COVID-19 pandemic. Eaton's Vehicle Group supplies transmissions, clutches, supercharger products and more to automotive and commercial vehicle manufacturers globally. The company installed metal 3D printing equipment at its Kings Mountain, NC facility, with a global deployment of polymer 3D printing technology set to be completed by Q1 2021. The 3D printing program follows the company's use of "Industry 4.0" technologies during COVID-19. This application of digital technologies enabled Eaton to support its operations remotely and continue the development of new products.

Thermwood demonstrates 3D capabilities with single hull mold for yacht

3D printing company Thermwood printed several sections from a 51-foot long yacht hull mold to show how a single hull mold may allow the manufacturing of larger vessels. The company already 3D printed a full-size pleasure boat master pattern which has been used to produce multiple boat hull molds. While this demonstrated the value of additive manufacturing for small boat tooling, much larger vessels, require a different approach. In these instances, since only a single mold is needed, it is desirable to print the mold itself rather than print a plug or pattern from which multiple production molds can be made.



Navy, Military, Aviation & Aerospace

Made in Space to send first ceramic manufacturing facility to the ISS

Space manufacturing technologies company Made In Space is scheduled to send the first ceramic manufacturing facility to the International Space Station in September. Part of Northrop Grumman's 14th commercial resupply mission, the Turbine Ceramic Manufacturing Module will be the first stereolithography printer to operate on-orbit.

Fabrisonic deploys UAM technology in NASA study to 3D print corrosion-resistant cladding

Fabrisonic leveraged its Ultrasonic Additive Manufacturing process to merge amorphous alloys into multi-metal cladding. Working as part of a NASA SBIR study, the company deployed ultrasonic energy rather than a conventional laser-based 3D printing method to combine dissimilar corrosion-resistant alloys. Using its fabrication technique, Fabrisonic joined the metals to crystalline substrates, without destroying any of their beneficial properties. The mixtures featured enhanced strength, and corrosive-resistant qualities to crystalline alloys, which could make them suited to cladding applications in the aerospace industry.

NASA project developing AM techniques for 3D printing rocket engine parts

As part of the Artemis program, NASA is returning astronauts to the Moon to prepare for human exploration of Mars. Additive manufacturing (AM) experts are pioneering methods to print the rocket parts that could power such journeys. NASA's Rapid Analysis and Manufacturing Propulsion Technology project is advancing the development of a technique to 3D print rocket engine parts using metal powder and lasers. The blown powder directed energy deposition method could reduce costs and lead times for producing complex engine components. Prior developments in AM didn't have the large-scale capabilities this technology provides.

U.S. Navy Seahawk helicopters to 3D print parts for comms gear

As part of a communications upgrade package that will be installed on over 200 Navy aircraft, a team of structural and avionics engineers turned to 3D printing technology to design and produce prototypes for two omnidirectional antenna mounts. Using additive instead of more traditional manufacturing methods provided the quickest and most cost-effective path to mass production, allowing the team to meet the deadlines delivered by the program office. Since entering service in February 2002, over 200 MH-60S Seahawk Block 3 aircraft served as multi-mission combat support maritime helicopters, used by the U.S. Navy to carry out missions such as combat search and rescue, special warfare support and airborne defensive electronic countermeasures. Since the fleet's inventory is slated to receive Full Motion Video systems, which will expand the aircraft's operational capabilities, the engineers with the H-60 Fleet Support Team at Naval Air Systems Command (NAVAIR)'s In-Service Support Center at Fleet Readiness Center East developed a solution to support and secure the modification of the aircraft. As part of the package, the team worked in conjunction with the AM team at NAVAIR headquarters to design and produce the prototypes that are in the early stages of evaluation.

Origin to 3D print F-16 parts for U.S. Air Force's AM Olympics

3D printing startup Origin was selected to participate in the U.S. Air Force Rapid Sustainment Office's inaugural Advanced Manufacturing Olympics. The event ended with a virtual showcase, held from October 20 through 23, to test the limits of innovative manufacturing techniques that can lead to faster maintenance turnaround, cheaper upkeep and more flexible flight operations. Specifically, a team of Origin engineers will take part in a challenge to quickly fabricate flight-ready F-16 fighter jet parts and get them certified for flight.

Indian space startup unveils 3D printed cryogenic rocket engine

Indian space tech startup Skyroot Aerospace unveiled a 3D printed cryogenic engine that is meant to fuel the upper stage of one of its rockets. Called Dhawan-1, the rocket engine is considered India's first privately developed indigenous cryogenic rocket engine that runs on propellants, like Liquid Natural gas and Liquid Oxygen. The announcement coincided with the birth centenary of Indian rocket scientist Satish Dhawan. Considered the father of the Indian Space Research Program, Dhawan steered the nascent space program through the 1970s and laid the foundations for robust space research in the country. To honor the renowned engineer, Skyroot Aerospace named their 3D printed engine after him.

SUTD develops bioinspired composite for 3D printing on Mars

A study by a team of scientists at the Singapore University of Technology and Design (SUTD) proposed using an organic biopolymer and working with simple chemistry to produce a material that could be used to 3D print objects on Mars. The result, a bioinspired regolith composite called *Martian biolith* that can be made with minimal energy and no need for transporting specialized equipment or dedicated feedstock. The researchers used chitosan derived from shrimp, which they dissolved in a low concentration of acetic acid, a byproduct in both aerobic and anaerobic fermentation. They combined the chitosan with a mineral designed to mimic the properties of Martian soil to create the final biolith solution.

Boom Supersonic release XB-1 aircraft with VELO3D additive manufactured engine parts

Aerospace firm Boom Supersonic released its XB-1 aircraft, featuring numerous additive manufactured parts created by 3D printer producer VELO3D. Boom's supersonic jet, which was unveiled at the firm's hangar in Centennial, CO, included 21 mostly engine-related 3D printed components. The parts produced under the collaboration reportedly mark a "turning point" in both the viability of supersonic travel, and the aerospace capabilities of 3D printed parts.

Desktop Metal receives \$2.4M to develop 3D printing process for U.S. Army

Desktop Metal will be developing an additive manufacturing process capable of mass-producing Cobalt-free hard metal parts for the U.S. Army. The company received a multimillion-dollar grant from the DOD to carry out the project which is expected to improve sustainability and provide an environmentally-friendly method to mass-produce metals, alloys, cermets and composite parts with superior properties for commercial and DOD applications. Global mass production and turnkey AM solutions provider, Desktop Metals announced in October 2020 that it was awarded Phase I of a three-year \$2.45 million project to fund the development.

ICON chosen by NASA to develop Project Olympus moon base 3D printing tech

Project Olympus, a NASA-funded initiative aimed at developing a method for robotic building on the moon, is driven by construction 3D printing firm ICON. Adding to its \$44 million raised from investors so far is the recent Small Business Innovation Research government contract from NASA to 3D print habitats on the moon using local materials and creating no waste. With its partners, architecture firm BIG and space startup SEArch+ (Space Exploration Architecture), ICON will be working with NASA's Marshall Space Flight Center in Huntsville, AL, to explore additive construction of a simulant of moon soil. The sustainability practices achieved in 3D printing on the moon with zero waste could reportedly be extrapolated to construction on Earth.

Army dissects Black Hawk Helo, scans parts for 3D printing

Wichita State University in Kansas is taking an Army Black Hawk helicopter apart piece by piece, scanning each component to create a detailed three-dimensional model that could be used for 3D printing, the head of Aviation & Missile Command reported.

U.S. Army and researchers 3D print microfluidic channels on curved surface in open lab

A University of Minnesota research team, with the U.S. Army Combat Capabilities Development Command Soldier Center, determined how to 3D print fluidic microscale channels that could be used to help automate the fabrication of sensors, diagnostics and assays for medical testing without a cleanroom. The team used a custom 3D printer to print microfluidic channels directly on a surface, in a single step, in an open lab, not in a cleanroom setting. They used a series of valves to control, pump and re-direct fluid flow through the tiny channels. All devices used in the research act as a proof of concept for their hypothesis. The traditional way to make microfluidic devices is through a complex photolithography technique, which requires several steps and takes place in a cleanroom with a controlled environment. A silicone liquid is sent flowing over a patterned surface, then cured so the patterns will form channels in the solidified silicone.

6K awarded \$1M Phase Two program to reclaim defense scrap for aerospace grade powders

Advanced materials specialist 6K was awarded a Phase Two Small Business Innovation Research program from the U.S. Defense Logistics Agency to commercialize a domestic closed-loop supply chain producing high-performance metal powders from scrap sources. Continuing from the success of Phase One, the program will utilize 6K's proprietary microwave plasma platform, UniMelt, to source and reclaim nickel superalloy scrap components and convert them into aerospace-grade powders. These powders will then be used to 3D print real-world parts to demonstrate functionality in test beds or systems.

Lockheed Martin picks Relativity Space's 3D printing tech for experimental NASA mission

Aerospace and defense contractor Lockheed Martin enlisted the help of California-based rocket-building firm Relativity Space to 3D print projectiles for an upcoming experimental NASA mission. The contract, which was awarded as part of NASA's Tipping Point program for advancing technologies, will see several different cryogenic fluid management systems launched into orbit and tested. Utilizing Relativity's 3D printing technology, Lockheed aims to construct complex rockets to carry the potentially dangerous cargo with reduced lead times, for a launch date in 2023.

VeriTX, Algorand to build a blockchain powered digital marketplace for aerospace AM

VeriTX, a marketplace for digital assets enabling decentralized manufacturing, presented a plan for a digital supply chain for aircraft parts using the Algorand blockchain technology. The VeriTX digital marketplace allows customers such as the DoD and commercial airlines to save significant time and money in manufacturing aircraft parts and to gain valuable economic and logistical data that can be used to maximize efficiency. As the U.S. Army, Navy and Air Force all move toward a digital supply chain, the combined market size for digital aircraft parts is expected to reach \$3.1B by 2025. An Air Force maintenance commander estimated VeriTX would yield a 30% cost savings, 90% reduction in waste and a 25% increase in aircraft performance.

Firefly Aerospace to 3D print large composite structures with Ingersoll Machine Tools' AFP system

Firefly Aerospace aims to use a high-speed, large-scale robotic Automated Fiber Placement (AFP) system from Ingersoll Machine Tools to 3D print composite structures with large dimensions, a task that poses limitations when using metal 3D printing. The aerospace company will install its first AFP Mongoose Hybrid system at its manufacturing and test facility in Texas in May 2021, after which the Alpha rocket airframe will be requalified using AFP manufacturing processes. Once operational, Firefly will be able to produce its all-composite Alpha rocket airframe in two weeks. The company plans to install its second AFP system and automated assembly line at its Florida Space Coast factory and launch site at Cape Canaveral by the beginning of 2022.

Origin, nTopology, Stress Engineering Services create 3D printed clamp component for F-16

3D printing startup Origin collaborated with generative design and topology optimization software provider nTopology and engineering consulting firm Stress Engineering Services to develop a hydraulic tube clamp for the F-16 Fighting Falcon. The clamp component, which is part of the C1375 family of hydroclamps that are used in the U.S. Air Force's F-16 fleet, was designed on the nTopology platform, 3D printed on the Origin One 3D printer and validated by Stress Engineering Services. It was made using Loctite 3955, a flame-retardant, chemically resistant material, and an elastomer IND402 for the tether material, both developed by Origin partner Henkel. The part, with clamp pair and tether 3D printed in a single build, has double the stiffness of a traditional clamp and is 5% lighter. It was awarded the first prize at the Advanced Manufacturing Olympics, organized by the Rapid Sustainment Office of the U.S. Air Force.

Premium Aerotec to use GE Additive's multi-laser system to 3D print Airbus components

Aerospace supplier Premium Aerotec will use GE Additive's Concept Laser M2 system to 3D print titanium components for the Airbus A320 airliner family. The companies, which partnered on the serial production of titanium parts for the aerospace industry for over five years, used two corresponding lasers to produce a part in line with the process qualification requirements. Until recently, only parts built with a single laser on GE Additive's multi-laser system could qualify for aerospace, a limitation that affected the productivity of the machines and the technology.

U.S. Army to use Senvol ML to qualify 3D printed missile part

Senvol, a data merchant for 3D printing, was awarded a contract by the U.S. Army Research Laboratory to implement data-driven machine learning technology that will reduce the cost of material and accelerate part qualification. The plan is to fabricate a missile part and evaluate how close the performance requirements are compared to those predicted by Senvol ML, a machine learning software that helps analyze part properties.

NASA working with AI SpaceFactory to develop material for 3D printing structures for the Moon

Since traditional building materials are too heavy for building structures on the Moon, NASA's Kennedy Space Center and AI SpaceFactory are developing a material for 3D printing using simulated lunar regolith that represents the rock and dust on the lunar surface. Although the goal is to create a printable polymer/regolith composite, AI SpaceFactory noted "the challenge is incorporating as much lunar regolith simulant as possible while maintaining reliable 3D printability and mechanical properties of the composite." The material will be used to 3D print a test structure in a vacuum chamber simulating environmental conditions on the Moon.

Royal Australian Navy begins 18-month pilot program with WarpSPEE3D

A world-first trial of Australian metal 3D printing company SPEE3D's large-format metal additive manufacturing technology commenced at HMAS Coonawarra Navy Port in Darwin. As part of an 18-month pilot program, the Royal Australian Navy's Fleet Support Unit installed WarpSPEE3D at the port, becoming the latest of the country's Defence services to have the ability to create their own metal parts with on-demand 3D printing. The Navy will use 3D printing to streamline patrol vessel maintenance, as well as increase the number of parts to which it has access. The pilot program is expected to yield some positive results.

CRP Technology 3D prints Alba Orbital's AlbaPod v2 deployer ahead of largest PocketQube launch to date

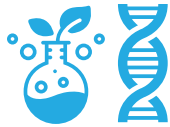
Alba Orbital integrated nine PocketQube satellites into the AlbaPod v2 deployer, which was 3D printed with CRP Technology's Windform XT 2.0 high-performance composite material. The AlbaPod v2 is the world's only space-proven PocketQube deployer. It's set to take off from the Kennedy Space Center in December as part of Alba Orbital's Cluster 3 mission.

Scientists bolster 3D printing of aerospace composites with carbon nanofibers derived from oil waste

Scientists from the Russian National University of Science and Technology MISIS developed a nanocarbon additive for aluminum powder derived from oil waste to improve the 3D printing of aerospace composites. The scientists were able to increase the hardness of 3D printed aluminum parts by 1.5 times and lower their porosity, paving the way for increased safety of aluminum parts produced for applications within the aviation and space industries.

NASA, Johns Hopkins APL mull using metal 3D printing to develop heat shield for interstellar solar-powered rocket

NASA and researchers from the Johns Hopkins University Applied Physics Laboratory (APL) are exploring how metal 3D printing could be utilized for a heat shield for a solar-powered rocket that could bring the exploration of interstellar space a step closer. APL scientist Jason Benkoski said additive manufacturing is a "key component" in developing the heat shield, alongside advances in materials science.



General Life Sciences

Researchers 3D print lifelike aortic valve model with built-in sensors

To allow surgeons prepare to perform procedures, training with 3D printed medical models has been shown to help improve the outcome of the surgery. Researchers from the University of Minnesota (UMN) [studied](#) multimaterial 3D printing to create lifelike, patient-specific models of the aortic valve of the heart. The team made the organ models, with a 3D printing process and specialized inks. The team's goal is to reduce medical complications by providing patient-specific tools to help doctors understand the anatomical structure and mechanical properties of the specific patient's heart. The models can also help patients better understand their anatomy and the procedure. Medtronic and the National Institute of Biomedical Imaging and Bioengineering of the National Institutes of Health, among others, funded the research.

Researchers create bio-ink that delivers oxygen to 3D printed tissue cells

Researchers from UCLA, Kocaeli University in Turkey, the Terasaki Institute for Biomedical Innovation (TIBI) in California, Sharif University of Technology in Iran, Erciyes University in Turkey, Université de Lorraine in France and the University of Iowa are working on an oxygen-releasing [bio-ink](#) that can deliver oxygen to the cells in 3D bioprinted tissues. This allows the cells to survive while they're waiting for blood vessels to finish growing. In order to enhance the physical and chemical properties of their oxygen-generating gelatin methacryloyl bio-ink, the team performed extensive testing, and found that enough oxygen was delivered to the cells to tide the developing tissue structures over until the blood vessels were finished developing. The vessels could take over the delivery of oxygen. However, the bio-ink can still help provide support in order to enhance the growth and regeneration of more new tissue. Additionally, the researchers conducted experiments on tissue constructs that had two types of cells and reported that using the bio-ink resulted in some "positive effects."

Formlabs introduces large format 3D printer for medical and dental

Formlabs announced its latest hardware additions, which will increase the company's line of large-format systems. First, the Form 3BL is a medical and dental system that is optimized for use with biocompatible materials. The dental team at Formlabs validated the Form 3BL, ensuring that it meets all the requirements for producing accurate dental aligners with consistent, repeatable part quality. Formlabs notes this system can fabricate human-scale anatomical models on one build platform. Additionally, Formlabs launched an automated post-processing system, called the Wash L + Cure L, which can be used with large-scale prints. However, the system will not begin shipping until 2021. Formlabs is starting to ship its large-format Form 3L printer to customers. Its LFS technology, which is an advanced form of Formlabs' previous SLA method, uses a flexible tank to reduce the forces of the peel process, in order to create accurate, detailed parts with tear-away supports for a smoother finish. The Form 3L and 3BL have twice the laser power of the Form 3, and five times its build volume.

3D printing silk to make Scaffolds for regenerative medicine research

3D printed silk, as a biocompatible, natural protein fiber, has many applications in the medical sector. The protein is made of 75% biocompatible fibroin. The Abbott Lab at Carnegie Mellon University (CMU) [works](#) with regenerative medicine and materials science, investigating how tissue development and disease are affected by the 3D microenvironment and studying topics like adipose tissue engineering strategies and non-invasive tissue assessments and silk biomaterials.

Washington State researchers develop cancer fighting soy-based 3D bioprinted scaffolds

Researchers from Washington State University (WSU) [developed](#) a soy-infused 3D printed bone-like scaffold that's capable of combatting cancer cells. They attempted to harness the health benefits of soy products to improve the post-operative care of cancer patients. By integrating soy-based chemical compounds into 3D bioprinted scaffolds, the researchers were able to reduce bone cancer cells in samples, while minimizing harmful inflammation. In future, the 3D printing application could be leveraged as a gentler treatment for the sufferers of osteosarcoma, a type of bone cancer that specifically affects young people.

ACS Custom transforms in-ear device with 3D Systems' Figure 4 direct solution

ACS Custom, a UK-based production house for customized hearing protection, implemented 3D Systems' Figure 4 3D printer to upgrade its production of hearing aids. 3D Systems is a U.S.-based 3D printer manufacturer. It is supporting ACS Custom with its Figure 4 PRO – BLK 10 Plastic materials, Figure 4 Standalone printer, 3D Sprint software and application engineering services. By applying the Figure 4 package, ACS Custom scaled up its production and can prototype about five iterations of a new product a day. There has been a 4X increase in production capacity, so more in-ear devices can be manufactured, and the growth in efficiency doubled to maximize output. As a result, material consumption was reduced by 50%, and labor cost decreased by 80%.

Materialise invests in Ditto's 3D printed eyewear technology platform

Advanced digital fabrication technologies like 3D printing enable the creation of custom eyeglasses and can cost-effectively mass produce glasses. It's possible to be even more customer-focused by using digital manufacturing to create individualized products. 3D printing solutions provider Materialise is hoping to advance by working with Ditto, a California-based developer of virtual eyewear trial and recommendation. Ditto works with eye care professionals, eyewear brands and retailers around the world to develop personalized shopping experiences. Its mission is to make eyewear more personal for the wearer, and more accessible for customers who need it. When pairing augmented reality visualization and AI-based personalization with 3D printing like Ditto does, the manufacturing of eyeglasses can become an end-to-end platform. For its eCommerce, in-store and omnichannel options, Ditto claims to capture a precise map of the customer's face by scanning it.

Orthobroker releases online platform to 3D print orthotic devices

Orthobroker, a Belgian-based orthopedic device specialist, is launching the OrthoSOLID platform in collaboration with Twikit. OrthoSOLID enables the creation of 3D printed made-to-fit products based on measurements or 3D scans. It offers orthotic products, such as orthoses and helmets, to CPO's through an easy-to-use interface. The platform makes the transition towards a digital workflow accessible by translating craftsmanship into a digitized environment, without infringing on the values of the professional. OrthoSOLID is targeting orthopedic technologists and prosthetists who want to make this transition to additive manufacturing simply. It is designed in such that the orthotic specialist does not require preliminary CAD knowledge to work with it. The platform is powered by TwikFit. The cloud-based software solution from Twikit which enables distributed workflows for made-to-fit orthopedic products and wearables. By offering advanced integration possibilities, TwikFit enables the complete flow from 3D-scan to the actual digital manufacturing.

4-Axis 3D printing enables tubular implants with controllable mechanical properties

Disease and other trauma can cause hollow, tubular human tissues to be negatively affected by long-segmental defects. Autologous grafts can help fix these, but there are limitations, such as not enough tissue availability and additional surgeries, which comes with a potential site morbidity. According to a team of researchers from the University Politehnica of Bucharest (UPB) and Maastricht University, using 3D printing to create a scaffold for tissue regeneration purposes could be a solution. The team wanted to show how extrusion-based AM, with the addition of a synchronized fourth rotational axis, can be used to create complex tubular geometries for tissue regeneration scaffolds. They also studied “the role of geometry in scaffold design,” and how it can influence mechanical properties.

Osaka University scientists develop silk fiber-based bio-ink with improved printability

Researchers from the Japanese Osaka University developed a silk fiber-based bio-ink for fabricating cell-laden structures with improved printability. By removing the sericin protein from virgin silk and grinding it into nanofibers, the scientists integrated the material into cell and polymer-infused bio-inks. The fibers were found to minimize the internal stresses placed on cells during 3D printing, which improved their survivability and allowed them to retain complex shapes. Tteam 3D printed a range of cell-based objects, while keeping more than 85% of its component cells alive. Given that their bio-ink is based on human-compatible silk, the researchers believe that in the future, it could be utilized within biomedical applications.

Canadian researchers 3D print metal caps for tusks of endangered walruses

Using a 3D scanning and printing approach, researchers from the Université de Montréal and École de Technologie Supérieure fabricated metal caps that could fit the tusks of the four endangered walruses at the Aquarium du Québec. These 3D printed “crowns” will prevent the marine mammals from becoming vulnerable to dental abscesses as a result of using their tusks to pull themselves out of the water of their concrete habitat, which isn't well-suited to their dental needs.

Braskem America to make polymer polypropylene 3D printed prosthetic hands via e-NABLE chapter

Braskem America, a producer of thermoplastic polymer polypropylene (PP) in the U.S., can begin 3D printing PP-based e-NABLE Phoenix V3 prosthetic hands after completing the e-NABLE prosthetic device certification process. For nearly nine years, the e-NABLE volunteer community has been matching makers with children and adults in need of low-cost 3D printed prosthetic upper limb devices. The devices made at Braskem America's Pittsburgh Innovation & Technology Center will be provided free to recipients in need in Pennsylvania and globally. The company plans to work towards other certifications in the future, which would enable its newly-established e-NABLE chapter to print more PP-based prosthetic upper limb devices.

Researchers create first-ever living aneurysm with 3D printed blood vessels

A team of researchers from Lawrence Livermore National Laboratory (LLNL), Duke University and Texas A&M [created](#) the first-ever aneurysm capable of living outside the human body by 3D printing blood vessels out of human cerebral cells. The team performed a medical procedure on the aneurysm to observe how it would heal. The findings could be combined with computer modeling methods to develop patient-specific treatments for cerebral emergencies, based on an individual's blood vessel geometry.

U.K. scientists 3D print synthetic tongue with potential tasting capabilities

A team of scientists from the University of Leeds and University of Edinburgh [created](#) a lifelike biomimetic tongue that could be capable of sensing flavors in food by 3D printing papillae like those found in the authentic organ onto a silicone elastomer using a point process-based model. Utilizing their additive dorsum, the team aims to quantify the mechanical interactions between the human tongue and certain foods. Understanding how papillae affect the tongue's texture-sensing capabilities is valuable information that could be used to make foods or medicines more palatable.

Researchers develop 3D printing technique that quickly creates cellular metallic materials

A collaboration led by Cornell University [developed](#) a 3D printing technique that creates cellular metallic materials by bonding together powder particles at supersonic speed. The process, known as "cold spray," results in more porous structures that are 40% stronger than similar materials made with conventional manufacturing processes. The small size and porosity of the structures make them particularly well-suited for building biomedical components, such as artificial knee or hip joints and cranial or facial implants.

Swedish scientists use Biopixlar to generate complex 3D biological tissues

A team of scientists from Fluicell, Celectricon and Karolinska Institutet worked together to [demonstrate](#) how single-cell bioprinting platform Biopixlar can generate complex 3D biological tissues that can be used for drug testing and disease modeling. The team demonstrated how Biopixlar allows researchers to position individual cells in complex patterns, enabling them to create biological tissues with the same high precision as in human tissues. The ability to position cells not only allows researchers to create in vitro biological tissues, but also opens possibilities for applications within personalized medicine and advanced therapies.

Researchers 3D bioprint structures to replace damaged knee cartilage

As part of a proof-of-concept study, researchers from the Wake Forest Institute for Regenerative Medicine [examined](#) a method for 3D bioprinting. They used multiple bio-inks to 3D print cartilage and supporting structures that can be used as a replacement of damaged meniscus resulting from sports injuries or age-related wear. The fibrocartilage tissue is 3D printed layer by layer, with the first encouraging the body's cells to repopulate and the second keeping the structure strong and flexible. The 3D printed structure was tested on mice, which began to regenerate their own fibrocartilage 10 weeks after surgery.

3D Systems teams up with VHA to 3D print POC medical devices for veterans

After collaborating to improve the supply chain for face masks and other PPE in the early days of the COVID-19 pandemic, 3D Systems and the Veterans Health Administration (VHA) are expanding their relationship to include an initiative aimed at improving patient care for veterans. Together, they will provide veterans with 3D printed medical devices produced at the point-of-care (POC). The additive manufacturing solutions provider will help the VHA establish FDA-compliant manufacturing facilities in its various hospitals to 3D print POC medical devices. As part of the collaboration, the healthcare AM team at 3D Systems will work with the VA to design medical devices and get them cleared by the FDA.

Russian scientists develop method of 3D printing personalized ceramic bone implants

A team of scientists from the Skolovo Institute of Science and Technology [deployed](#) a simulation-based approach to create flexible, flaw-free 3D models that would provide a basis for ceramic bone implants. The team optimized these designs to feature large pores that could be customized to suit the needs of specific patients and make them easier to fuse with organic tissue.

Clarkson University scientists develop 3D printed wearable biosensors for sun burn protection

Researchers from Clarkson University [developed](#) a bio-ink and deployed it to create skin-compatible 3D printed biosensors. The team's ink design includes titanium nanoparticles that once exposed to UV radiation, initiate a photocatalytic reaction with colored dyes, causing the gel to change color. The scientists have been able to 3D print skin-friendly biosensors that enable users to minimize any damage caused by potential overexposure to the sun's rays.

Harvard scientists develop algae-infused bio-ink to improve the viability of bioprinted tissues

Scientists from Harvard Medical School [developed](#) an algae-based bio-ink that, once 3D printed into soft tissue structures, demonstrates enhanced cell viability. The team formed their bio-ink by combining a photosynthetic algae and human liver cells into a hydrogel matrix, then used it to 3D print hexagonal structures featuring lifelike liver "lobules." Due to the algae's natural oxygen-emitting tendencies, the bioprinted human cells multiplied, showing increased functionality, and producing liver-specific proteins. The researchers believe their bioprinting technique could be applied in areas including drug development, personalized medicine and algae-based snacks.

CTIBiotech unveils 3D printed skin models for commercialization

Cell therapy research startup CTIBiotech unveiled two bioprinted full skin model technologies for skincare applications. The company presented the first bioprinted immune skin model suitable for screening drugs and ingredients for normal and inflamed skin, as well as a 3D printed sebaceous gland model for oil secretion screening and burns research. The technologies are expected to enable researchers to reproducibly create predictive human tissue models in large quantities and advance biomedical research.

Chungbuk scientists 3D print customizable eye implants for dogs

Researchers from Korea's Chungbuk National University [developed](#) low-cost personalized artificial eyes for canines that lost theirs to incurable diseases. Using scanning and modelling techniques, the scientists were able to tailor their implants to individual dogs, before rapidly printing them with an off-the-shelf biocompatible resin. Having tested their prosthetics on two poorly beagles, the team described them as "cosmetically excellent," and hope to see their devices used to treat other companion animals in future.

FC Barcelona joins project to trial regenerative 3D bioprinted ankle implants

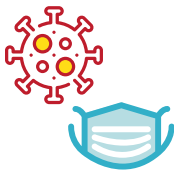
Spanish football club FC Barcelona's R&D lab, Barça Innovation Hub, joined the EU-backed Triankle project to help test its 3D bioprinted cell-restoring ankle implants. The group of 12 companies, including bioprinting firm Cellink, is developing collagen-based cell grafts that could reduce patient recovery times by up to 50%. Barcelona agreed to test the transplants on its amateur squad, with a view to optimizing performance and preparing them for commercial release.

POSTECH scientists 3D print stents to combat radiation-induced esophagitis in cancer patients

Pohang University of Science and Technology researchers developed 3D printed stents that could ease the symptoms of esophagitis in radiotherapy patients. Based on a throat cell-derived bio-ink, the dumbbell-like devices proved capable of reducing the inflammation caused by radioactive cancer therapies. The potential esophagitis cure reportedly could also be loaded with other tissue-specific cells and used to treat local injuries such as wounds or burns.

Korean scientists 3D print surgical guides to aid breast tissue retention during cancer surgery

Researchers from the Korea-based Asan Medical Center 3D printed surgical guides that could help cancer patients to retain more of their breasts after surgery. The scientists found during testing that they were not only able to customize their devices to each patient, but they could save tissue from the tumor. In future, the team aims to further develop their technique to enable tailor-made guides for greater adoption within breast cancer procedures.

**COVID-19 Support and Medical PPE****Print Parts delivers over 1M 3D printed nasopharyngeal swabs to support NY COVID-19 testing**

Print Parts Inc., a NY-based AM service, provided over a million nasopharyngeal (NP) swabs for use in NY COVID-19 test kits. To manufacture NP swabs, Print Parts opened a dedicated ISO 13485-compliant medical manufacturing lab in Manhattan, in collaboration with NYC Health + Hospitals, the New York City Economic Development Corporation, Albert Einstein College of Medicine in the Bronx, and Collab, a Brooklyn-based fabrication lab.

Carnegie Mellon University develops 10 sec COVID-19 test with Optomec Aerosol Jet process

A COVID-19 antibody detection device developed by researchers at Carnegie Mellon University, capable of identifying the antibodies within 10 to 15 seconds, is entering a trial stage with COVID-19 patients. The system consists of a low-cost sensor made up of tiny gold electrodes 3D printed using Optomec's Aerosol Jet technology. With the device, clinicians could instantly detect COVID-19 antibodies in patients, which could provide a deeper understanding of how the virus spreads and a better chance of controlling it. Moreover, it is cheap to produce, reportedly costing tens of dollars. The Carnegie Mellon University research team is also working to adapt the device to detect the active virus in patients, which could streamline the testing process. It could also be used to detect other types of virus, including Zika, Ebola and HIV.

U.S. healthcare manufacturer to use electronics 3D printing to produce diagnostic medical device

Optomec, whose Aerosol Jet Printing (AJP) technology is used for prototyping and research in electronics development, will also be employed by an unnamed major U.S. healthcare manufacturer. The company will use it for volume production of a leading diagnostic medical device. The AJP system is part of a \$1-million contract that also includes the delivery of software and production processes. The printer will 3D print multi-layer circuitry onto structural parts, rather than manually incorporate flexible circuits into the devices. In turn, it is believed that costs will be cut, while throughput and flexibility increase.

Xerox's PARC to use AlphaSTAR Simulation to 3D print turbomachinery parts

Palo Alto Research Center, a Xerox-owned R&D subsidiary company, selected AlphaSTAR technology to create a virtual additive manufacturing (AM) approach that will save time and materials for 3D printed parts of turbomachinery applications. AlphaSTAR's AM simulation solution GENOA 3DP will be used as part of one of the projects of the U.S. Department of Energy's Advanced Research Projects Agency-Energy DIFFERENTIATE program, which seeks to reinforce the pace of energy innovation by incorporating AI and machine learning into energy technology developments.

Materialise able to recycle 100% of sintering powder for SLS 3D printing

To help reduce powder waste, Materialise developed the Bluesint solution, in which the company tweaked a dual laser powder bed fusion system to heat recycled powder before building it into new parts. The company claims that, they can achieve a 100% recycling rate. Parts printed with Bluesint PA12 have similar mechanical properties to other powders.



Wearables

Stratasys PolyJet used for direct-to-textile 3D printed clothing

Stratasys is working with fashion designers Julia Koerner and Ganit Goldstein. The collection features 38 different parts, forming a modular design that can be fitted into an entire dress. The designs allow for consumer-specific customizations made possible due to 3D scans which are made of the wearer. The pieces are joined together with 3D printed connectors, which is a first in textile assemblies.

Carbon, CCM Hockey 3D print world's first NHL-certified hockey helmet liner

Carbon and sports goods manufacturer CCM Hockey 3D printed the world's first NHL-certified hockey helmet liner. Produced using Carbon's proprietary Digital Light Synthesis (DLS) resin process, the Super Tacks X with NEST (Next Evolution Sense Technology) features a digitally printed lattice structure on the inner lining. It is intended to deliver better comfort and protection and can be customized to fit the athlete's head using 3D scans.



Food and Agriculture

Researchers develop simple method to 3D print milk products

Singapore University of Technology and Design (SUTD) researchers developed a [method](#) to perform direct ink writing (DIW) 3D printing of milk-based products at room temperature, while maintaining its temperature sensitive nutrients. 3D printing of food was achieved by multiple printing methods, including the selective laser sintering and hot-melt extrusion methods. However, these methods are not always compatible with temperature-sensitive nutrients in certain foods. While the cold-extrusion is an alternative, it often requires rheology modifiers or additives to stabilize printed structures. To tackle these limitations, the team from SUTD's Soft Fluidics Lab changed the rheological properties of the printing ink and demonstrated DIW 3D printing of milk by cold-extrusion with powdered milk.

Swiss scientists use 3D printing to increase the perception of sweetness in low-sugar candy

Swiss-based Bern University of Applied Sciences and ETH Zurich researchers used 3D printing to modulate the perception of sweetness in low-sugar snacks. Leveraging a dual extrusion-based technique, the team were able to fabricate a set of sucrose-based confectionery samples that tasted 30% sweeter than normal, without adding any extra sugars. In the future, the Swiss research team aim to deploy their approach in the creation of solid foods with reduced fat, to combat broader global health concerns such as obesity and diabetes.



Environmental Efforts & Energy

Forest scientists 3D print Lignin for sustainable light construction

A research team from the Chair of Forest Biomaterials at the University of Freiburg [created](#) a wood-based biodegradable synthetic that can be developed into a viscous biopaste for 3D printing complex geometries. The team recognized the potential of lignin as it strengthens the cell walls of plants, resulting in a stable woody structure that is "lignified." This evolutionary trait protects plants from the elements, and from bugs. Known as waste from paper production, it is usually burned as a bioenergy source. The team began exploring better ways to use the raw material, studying previous research regarding the use of lignin for biopaste and the development of biosynthetics.

Oregon scientists use 3D printed nerve tingling device to better understand birdsong

Researchers from the University of Oregon developed a 3D printed device that can record and stimulate the electrical impulses that drive vocalizations within songbirds. The team's microscopic device, featuring a tiny thin-film electrode with a 3D printed housing, functions by decoding and modulating electrical signals sent to either the brain or spinal cord. Leveraging their "nanoclip," the scientists were able to control nerve output within multiple zebra finch test subjects, evoking distinct predetermined vocalizations. The technology behind the device could be deployed within keyhole surgical applications, or even in the creation of bioelectronic medicines for diseases such as diabetes or arthritis.



History, Arts & Entertainment

Historic Environment Scotland 3D prints face of ancient Neolithic dog

Historic Environment Scotland (HES) revealed what dogs from the Stone Age may have looked like after commissioning a reconstruction of a Neolithic canine skull with the help of 3D printing. Housed in a collection of National Museums Scotland, the 4,500-year-old skull was first discovered in Cuween Hill chambered cairn on Orkney, in the Northern Isles of Scotland. After being CT-scanned by staff at Edinburgh University's Royal (Dick) School of Veterinary Studies, HES' Digital Documentation team was able to create a 3D print of the skull which was then passed over to forensic artist Amy Thornton to create a realistic model.

XtreeE to 3D print pedestrian bridge for 2024 Paris Olympic Games

[Plaine Commune Grand Paris](#) awarded a consortium the design-build contract for a 40-meter pedestrian footbridge made from 3D printed structural concrete, in preparation for the 2024 Olympic Games in Paris. According to XtreeE, the project is a world-first; bringing together 3D structural concrete printing and Industry 4.0 to form a new infrastructure typology.

Cobra uses HP Metal Jet to 3D print next gen putter

A first-of-its-kind 3D printed golf putter, the KING Supersport-35 3DP, was commercially launched by Cobra Golf. The company developed the equipment in partnership with HP and Parmatech. The club was optimized for weight distribution and moment-of-inertia to ensure consistency, reliability and accuracy.



Home & Safety

Aectual Studios creates 3D printed fully circular furniture

Aectual designed a selection of 3D printed room dividers and safety screens to offer a solution to the ad-hoc disposable plastic screens that clutter work environments. All products are part of Aectual's circular product line. After use, Aectual takes back the products and recycles them into newly printed furnishings. Customers receive a deposit or reduction on their purchase.