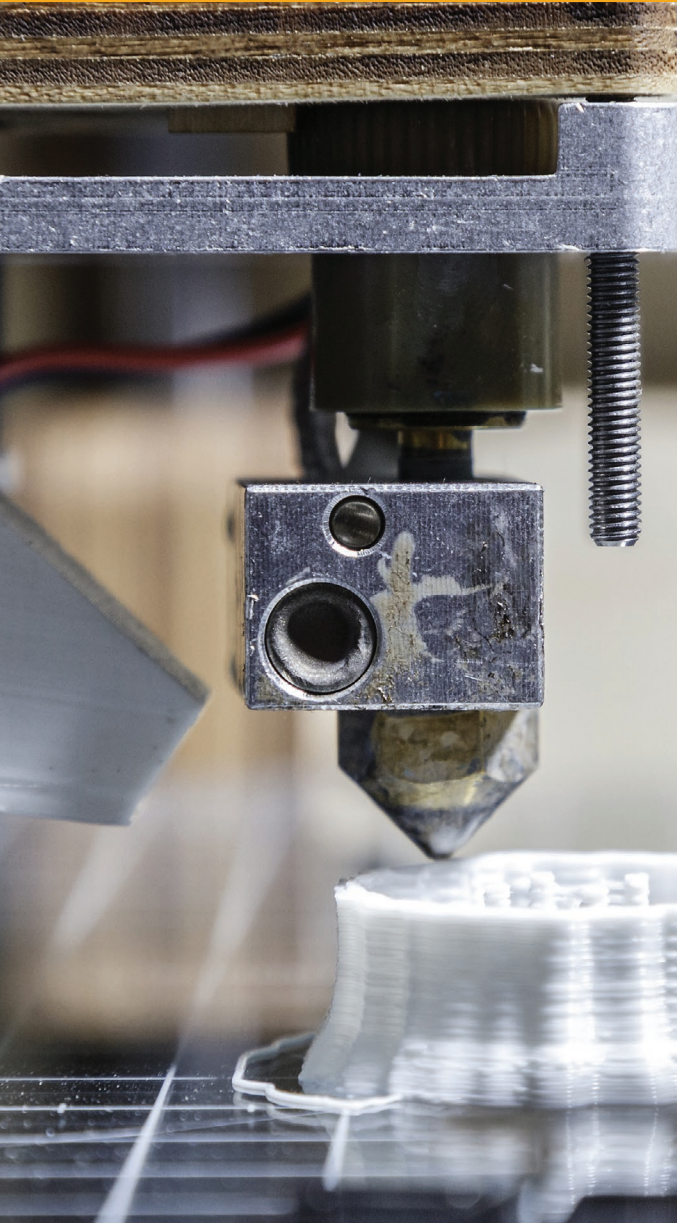


3D PRINTING—A FAST MOVING MARKET



Developments in 3D Printing

A Sector by Sector Overview

Overview

This report explores recent developments across a number of sectors as it relates to 3D printing and its impact on each sector. We've limited our scan to the last three months to demonstrate the pace and scope of activity in the market.



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General

Twenty-five percent of world trade could be wiped out by 2060 as result of 3D printing technology: ING -

According to estimates provided by a report from ING, progress in 3D printing technology will see one-quarter of world trade wiped out by 2060, with carmakers among the most affected. The report describes 3D printing technology as still in its infancy but said that once high-speed mass production becomes economically viable, 3D printing would lead to “less trade growth because 3D printers use far less labor, reducing the need to import intermediate and final goods from low wage countries.” If investment in the technology were to double every five years, that impact could be seen as early as 2040, the report suggests.

HP, Deloitte partner to make push into 3D printing sector

HP and Deloitte are partnering to work with companies interested in using HP’s 3D printers for manufacturing. HP began selling its first 3D printers in December 2016 and it hopes the partnership with Deloitte will give it more credibility in the sector. Deloitte’s interest in 3D printing has grown as improvements in the technology have progressed over the past few years. Deloitte chose to partner with HP rather than more established 3D printing companies because of the PC giant’s size and its global brand recognition.

Siemens develops AM software module for HP Multi Jet Fusion 3D printer

HP is integrating its Multi Jet Fusion 3D printer with Siemens’ Additive Manufacturing (AM) software module, in an effort to accelerate 3D printing for industrial production. Siemens created the NX AM for the HP Multi Jet Fusion as an extension to its design-to-production solution for additive manufacturing. The new module will allow customers to combine design, optimization, simulation, preparation of print jobs and inspection processes for Multi Jet Fusion 3D printed parts in a managed environment.

BASF to establish 3D printing solutions company

BASF is planning to form a new company, BASF 3D Printing Solutions, focused on additive manufacturing. The company was expected to launch on Sept. 1 and will be a wholly-owned subsidiary of BASF. BASF 3D Printing Solutions will focus on establishing and expanding materials, system solutions, components and services. The company will be headquartered at the BASF’s InnovationLab site in Heidelberg, Germany.

Thyssenkrupp opens 3D printing center in Germany

As part of its efforts to make strides into the sector, Thyssenkrupp opened a 3D printing center in western Germany. The company has invested more than \$1 million in the site, which operates two 3D printers, one for plastic and one for metal components. CEO Heinrich Hiesinger estimates the overall market for such components was as high as \$23.8 billion in annual sales and said the company wanted to access it via industries such as aviation, automotive and energy.

New Valence Robotics increases focus on 3D printing for incubator spaces

Provider of Built to Share 3D printing solutions New Valence Robotics (NVBOTS) will expand its focus on enabling 3D printing capability to incubator spaces. The NVPro allows users to quickly submit print jobs and track progress of submitted jobs from any internet-enabled device. This capability makes the NVPro ideal for an environment for incubator spaces.

Youngstown's America Makes celebrates fifth anniversary

Youngstown-based America Makes celebrated five years in business on Aug. 16. The company is a public-private partnership that started with 14 companies and has now grown to 185.

Print the Future nears end of first funding round, hopes to launch world's first 3D-printing chain

Vancouver-based Print the Future is looking to launch the world's first 3D printing chain. The company uses a model in which a pool of global designers produce digital plans for products that would be printed at a local store. The company is near to closing its first round of funding and is hoping to secure \$25 million before it lists on Nasdaq, which it plans to do before the end of 2017. The company also plans on opening a new store every quarter in 2018, beginning with one in New York City.

RAND report finds CAD designs for firearms easy to acquire on dark-web

A report conducted by the RAND Corporation revealed how easy it is for individuals to download designs for CAD files from the black-market for 3D-printed guns. According to the report, which looked at 811 weapons listings on the dark-web, digital products including explosives manuals and CAD files were the second highest listed items with 222 listings. The researchers noted that these digital products can pose "additional challenges" for law enforcement agencies. While the average firearm on the dark-web sells for just under \$1,200, the cost for the CAD designs to print a weapon averaged only \$12 and some of those items included files to print multiple types of firearms. The results suggest that such designs could eventually surpass today's online market for conventional firearms, as they are safer to transmit with an unlimited inventory.

Research suggests using noises made by 3D printers as a way to prevent device hacks

Researchers from Rutgers and Georgia Tech offered three suggestions to prevent hackers from sabotaging 3D printer outputs. The first method involves feeding the noises made by a 3D printer during a job into an algorithm, which can be used as a reference point for subsequent print jobs. Any significant variation from the original sound could indicate tampering. The second method involves fitting the print head with a sensor that records its movement and if these differ from the reference motion path, the job is flagged. The final method impregnates the extrusion material with nanoparticles, providing it with a specific spectroscopic signature. If other materials are used instead, or air gaps left in the print, the signature will be altered and the object will be flagged.

McKinsey: Additive manufacturing market could reach as high as \$250B by 2025

McKinsey released its outlook on the additive manufacturing market, highlighting opportunities, as well as challenges faced by the industry going forward. While many analyst reports expect the direct market for AM will grow to at least \$20 billion by 2020, McKinsey believes the overall economic impact from the industry could be even higher. According to McKinsey, the AM market could reach anywhere between \$100 billion to \$250 billion, assuming the technology's adoption continues across industries at its current pace. Most of the sector's potential stems from the aerospace and defense, automotive, medical and consumer goods industries. Despite the positive outlook, the industry still faces some challenges including a lack of design knowledge, high production costs, limited production scale and limited cybersecurity and IP protection.

**Patent & Copyright****Number of 3D printing related patents has surged since 2014**

According to data released by 3D Print, the number of 3D printing-related patents has grown rapidly since 1995. The sharpest surge in patent applications began in 2014, due primarily to the expiration of Material Extrusion and Vat Photopolymerization patents issued in the 80s and early 90s. This surge in applications was followed by an increase in issued patents starting in 2015. The following year, the number of issued patents and published applications exceed those of 2015. The continued increase in published patents should result in a substantial increase in the amount of issued patents in 2017 and beyond.

Study: 3D printing is not a disruptive force on patent law

Researchers examined whether the emergence of 3D printing technology has disrupted patent law. The study looks at the question from two angles – patentability and infringement – through the lens of applicable U.S. and European law. They determined that, in general, 3D printing does not disrupt patentability theory. However, the technology may challenge the type/token dichotomy on which patent ontology is based. They also found 3D printing also doesn't impact infringement theory. They concluded that the emergence of 3D printing may lead to broader and more dispersed scale of infringement and does call into question the capability of existing enforcement tools.

3D printing both a threat and opportunity for IP owners

Jia Li, innovation intelligence consultant with CPA Global, believes 3D printing can be both a threat and a revenue opportunity for IP owners. According to Li, the key to moving forward successfully with the technology will be to examine the opportunity to lead businesses into a new age of technology. Companies also have the chance to learn from mistakes of the past and apply alternate means of creating new revenue streams to help develop the future of 3D printing and IP.



Education

ARC completes first Metal 3D Printing School

ARC Group Worldwide successfully completed its inaugural Metal 3D Printing School at its 3D Material Technologies division. Attendees, which included individuals from various aerospace/defense, power generation, and electronic manufacturers, participated in two days of in-depth instruction followed by hands-on curriculum on how to use metal additive manufacturing in prototyping and production. The next 3D printing school is scheduled to take place between Sept. 20 and 22.

Sci Chic CEO discuss early experiences with 3D technology in college

In this interview, founder and CEO of Sci Chic, Erin Winick, discusses how access to 3D technology during college is what drew her to the industry. Her first experience with 3D technology was in her CAD class during her freshman year, where she learned how to use SolidWorks. She also talks about how this early experience led her to start Sci Chic, whose goal is to show that science and engineering can be creative and fashionable, as well as engage young girls with STEM using 3D-printed fashion.

CECIMO releases overview of AM-related policies

In an effort to monitor the interests of its members, the European Association of the Machine Tool Industries released an overview of relevant AM policies, which it believes deserves “priority attention of EU authorities.” The European Additive Manufacturing Strategy is a compilation of input from a number of experts and offers advice on how to “speed up the AM intake” to stakeholders and policymakers.



Arts & Entertainment

Chinese company uses 3D printing to replicate ancient works of art

China’s Xian Chizi Digital Technology is using 3D printing technology to replicate ancient art objects. Over the past 10 years, the company has developed its own 3D design technology using a stereolithography machine to print digital replicas of historical artifacts. Designing the items can take between one and three months, while printing can take several weeks, depending on the complexity of the object. In addition, Xian Chizi also makes 3D printed molds for sculptors who use them as models for their own work.

Hong Kong students set record for largest display of 3D printed sculpture

A group of secondary school students in Hong Kong have set a Guinness World Record for the largest 3D-printed sculpture with a giant model of the city’s harbor front. The model measures 35 square-meters and comprises 1,214 3D printed items. The students used CAD software and advanced 3D printing technology to design and replicate 20 landmark buildings on the north and south sides of Victoria Harbor.

Italian opera hires WASP to create 3D printed backdrops

WASP has been enlisted by the Teatro dell 'Opera di Roma in Italy to assist in the creation of one of its largest set designs. The company was tasked with the creation of two stage-sized facades of historical buildings complete with windows and terraces. The sets also needed to be modular in design to facilitate transportation, storage and assembly. The backdrops were first modeled with CAD software and then printed over the course of three months using a bank of five DeltaWASP 3MT printers. A total of 223 panels were printed to make the two sets.

**Printing Techniques and Capabilities****Obsidian looks to use Apple's ARKit technology to develop affordable 3D printer**

Apple's ARKit technology is set to make a significant impact on the 3D printing industry. The technology allows 3D designers to develop designs in a 3D space using gestures and a pen. The designs could then be printed through a 3D printer. Recently funded as a Kickstart project, Obsidian hopes to use the technology to build a 3D printing system that costs less than \$100 and utilizes a more user-friendly interface. If Obsidian is successful, it could be an indication that the 3D printing industry is set to enter the mainstream.

MIT researchers develops software allowing anyone to design working 3D printed robots

MIT researchers developed a system that allows users to quickly design and 3D print robots. The system, called Interactive Robogami, lets non-expert users design and build their own custom walking and driving robots. Interactive Robogami is an end-to-end system, which takes care of generating 3D-print files, software and the electronics wiring, providing the user with a complete plan of fabrication.

Researchers use novel hybrid nanoparticles to develop method of 3D printing in water

Hebrew University of Jerusalem researchers have developed a type of photoinitiator for photopolymerization-based 3D printing in water. These nanoparticles can be used to create bio-friendly 3D printed structures and advance the development of biomedical accessories, as well as drive progress in more traditional industries, such as plastics. To achieve this, researchers used semiconductor-metal hybrid nanoparticles as the photoinitiators. The hybrid nanoparticles present tunable properties, a wide excitation window in the UV and visible range, as well as high light sensitivity by a photocatalytic mechanism that increases printing efficiency while reducing the amount of materials needed. In addition, the process can also be used in advanced polymerization modalities, including two-photon polymerization printers.

Proto Labs adds HP's Multi Jet Fusion to list of available 3D printing service offerings

Digital manufacturing company Proto Labs expanded its 3D printing service offerings to include HP's Multi Jet Fusion technology. The addition brings the total AM manufacturing process offered by the company to five.

XYZprinting launches full-color, filament 3D printer

XYZprinting launched the da Vinci Color 3D printer, a used filament fabrication system, which is capable of 3D printing plastic in full CMYK color. The printer features auto-calibration and a 5-inch color LCD screen. Ink is available through the company's CMYK ink cartridges, which generally run for around \$65. If the device performs as advertised, it could provide a boost to the consumer 3D printing industry.

Stratasys hopes aviation industry will embrace its H2000 printer

With the release of its H2000 printer, Stratasys hopes the aviation industry will embrace additively manufactured parts as a better solution to manufacturing. The H2000 is different than other 3D printers because it lays up printing material horizontally rather than vertically. The H2000 is also not restricted by a build envelope, which allows parts created on the device to be as long as a customer desires. Input from OEMs, including Boeing and Ford, was taken into account during the system's development. Both companies are currently investigating applications for the H2000 system for parts such as aircraft panels and interior closet doors.

Markforged printers create carbon fiber-infused objects stronger than steel

Boston-based 3D printer manufacturer Markforged revealed two new models, the X3 and the X5. Both models use a standard filament printing system to create carbon fiber-infused objects that are stronger than steel objects. Auto-leveling and scanning systems are features included in both printers, which ensure that each printed object is the same as the next. The printers also use Markforged's thermoplastic fiber filament, with the X5 having the ability to add a "strand of continuous fiberglass" which can create objects "19X stronger and 10X stiffer than traditional plastics." The X3 will sell for \$36,990, while the X5 will cost \$49,900.

Brown University team develops method for 3D-printing biomaterials

Researchers from Brown University have developed a technique for creating 3D-printed biomaterials that can degrade on demand. The method can be used to produce microfluidic devices or cell cultures that can change during experiments. The approach utilizes "stereolithographic printing of hydrogels using noncovalent (ionic) crosslinking," which enables reversible patterning with controlled degradation. Using sodium alginate and different combinations of ionic salts, scientists were able to create structures with varying stiffness, which could be dissolved at varying rates. The alginate's biocompatibility holds promise for future application including the creation of scaffold for artificial tissue and organs.

Texas A&M researchers use welding techniques to strengthen 3D printed materials

In an effort to strengthen 3D printed parts, researchers from Texas A&M University applied traditional welding concepts to bond the submillimeter layers in a printed part together. The team borrowed concepts commonly used for welding where heat is used to join parts together. Special materials were used to control where the heat hits and bonded the layers together in the small printed parts. The technology is currently patent pending and is being tested for its use in the industrial and consumer industries.

Researchers combine traditional casting with 3D printing to create damage-resistant composite components

Oak Ridge National Laboratory and Rice University researchers combined traditional casting with 3D printing to create damage-tolerant composite components. An aluminum alloy poured over a printed steel lattice showed a greater ability to resist damage than aluminum alone. The process was developed for use in the automotive industry, as well as other applications where thermal and mechanical properties need to be optimized simultaneously.



Materials

Researchers develop self-repairing 3D printer ink-gel

University of Melbourne scientists developed a self-repairing 3D printer ink-gel. The gel is produced using a polymer substance that can be intentionally manipulated over time. The technology could be used to repair cracked cell phones screens, as well as replaceable parts.



Military & Government

U.S. Navy partnership creates 3D-printed submersible

In partnership with researchers from Oak Ridge National Laboratory, the U.S. Navy's Disruptive Technology Lab created the military's first 3D-printed submersible hull. The prototype vessel, called the Optionally Manned Technology Demonstrator, can be used to deploy logistics capabilities and sensors. The 30-foot vessel was created in just four weeks and, by using Big Area Additive Manufacturing techniques, the Navy was able to reduce hull production costs by 90% and shorten production to a matter of days.

U.S. Marines developing 3D-printed unmanned aerial system

The U.S. Marine Corps are currently developing a 3D-printed unmanned aerial system (UAS) for use on the battlefield. The Scout, a fixed-wing UAS constructed almost entirely from 3D-printed materials, is one of just a handful of ideas to come out of the USMC's Logistics Innovation Challenge and enter the prototype stage. While conventional Intelligence Surveillance and Reconnaissance drones can cost hundreds of thousands of dollars to produce and operate, the Scout costs just \$600 to build. The prototype also fits in a standard-issue pack and can be broken down in just over two minutes and assembled within five. Since its body and wings are 3D-printed, these components can be easily and quickly replaced using in-field 3D printers if damaged. After four months of development, Scout has been turned over to drone supplier Mitre for certification testing.

3D printers deployed to Middle East combat zone to assist U.S. Marines

In an effort to speed up supply chains and repair broken gear, the U.S. Marine Corps are deploying several 3D printers. Marine officials have not revealed the exact locations of the printers, not the exact number that have been deployed. However, they have confirmed that several of the devices have been deployed in combat zones with the Marine Corps crisis response task force assigned to the Middle East. In such areas, the printers are used to quickly reproduce vital parts for items such as radios, tools and medical equipment, that would otherwise need to be shipped from the U.S. The Marines are also continuing to experiment with other ways to use the devices to make troops less reliant on supply depots thousands of miles away.



M&As and Investment

Desktop Metal secures \$115M in funding round

Desktop Metal received \$115 million in a recent round of funding from investors including New Enterprise Associates, GV, GE Ventures, Future Fund and Techtronic Industries. While the 3D Printing startup would not comment on its valuation, PitchBook estimates its value to be around \$1.02 billion. The company offers 3D printers that can produce small objects from metal powders, as well as sinters which use microwaves to heat the powders causing them to become dense and usable.

Forecast 3D launches manufacturing center capable of producing 800K parts per week

Forecast 3D opened a 3D manufacturing center, which offers full-run, large-scale production using HP Multi Jet Fusion (MJF) technology. The facility is equipped with 12 HP Jet Fusion 3D 4200 printers and is thought to be the first to offer MJF production at this scale. The facility is capable of producing up to 800,000 end-use production parts in a single week.

Conflux Technologies receives ‘significant’ investment from AM Ventures

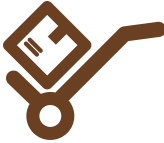
AM Ventures provided Australia’s Conflux Technology with a “significant” investment to advance the applications of metal additive manufacturing. The amount of the investment was not made public but experts believe the investment could lead to some key hires by Conflux in the near future.

SparkMaker Kickstarter campaign raises \$500k for affordable, consumer 3D printer

Hong Kong-based SparkMaker launched a Kickstarter campaign in July, reaching its \$20,000 goal in just 20 minutes. As of Sept. 10, the company had raised a total of just over \$500,000 for its LCD-based SLA 3D printer that prints in high-resolution. The printer is expected to ship on Dec. 17, with a price tag of \$99.

Mothing secures \$24M investment from KaPA Ventures

KaPA Ventures provided 3D-manufacturing startup mything.com with a \$24-million investment. The company uses a platform to connect potential customers with designers and local manufacturer to provide them with custom-made 3D-printed objects. The funds have been put towards prize money for online contests aimed at recruiting talent and jewelry creating designs to sell, as well as monetizing the platform.



Transportation & Logistics

Siemens partners with Dubai to provide rail network with 3D-printed spare parts

Dubai's Roads and Transport Authority (RTA) signed an MOU with the Middle Eastern branch of Siemens to provide the city's driverless transit rail network with 3D-printed spare parts. According to a statement from the RTA, the Siemens partnership "will seek to extend the sources of spare parts for the Dubai metro and increase their availability," which will reduce issues that arise when parts become obsolete.

FreeFab's wax 3D printing creates concrete casting molds for London tube line construction

For construction on London's newest underground rail line, Bechtel is using a system designed by FreeFab that uses a specialized wax to print molds to cast concrete. By 3D printing the molds, rather than printing the concrete material itself, the process allows builders to create complex shapes that are both strong and lightweight without dealing with the peeling issues found when printing concrete.



Healthcare and Life Sciences

Disaster Hack using 3D printing to bring inexpensive prostheses to Nepal

Non-profit technology startup Disaster Hack is using 3D printing technology to reduce the cost and time it takes to bring medical equipment to those that need it in Nepal. Company founder Matthew Rockwell first brought a 3D printer to Nepal after a powerful earthquake hit the country in 2015. He has been using the printer to create prosthetic hands for those in need. Using 3D printing, Rockwell is able to create a prosthesis for a fraction of what a traditional one would cost. He hopes to drive the cost down even further by recycling plastic bottle tops to make the wire that feeds the printer. Rockwell has also trained 20 prosthetists at Nepalese hospitals in 3D printing and has signed a deal with Kathmandu's biggest university to set up the country's first biomedical 3D printing lab.

Swiss researchers create soft artificial heart using 3D printing

ETH researchers have created a soft artificial heart using 3D printing. The device was created using a 3D printing method that allowed scientists to make a complex inner structure while still using soft, flexible material as its base. The entire heart is one single part, so there's no concern about how various internal mechanisms interact except at the input and output ports. The heart performed well during tests and was able to push a blood-like fluid along against body-like pressure. However, the heart is just a proof of concept and was not built for actual implantation, so the materials used in creation don't last for more than a few thousand beats.

Doctors in Dubai using 3D-printed models to assist in complicated surgery

Doctors in Dubai used a custom 3D-printed model of a patient's dilated arteries to assist in a surgery to save the life of a 60-year old woman from bleeding in the brain. Surgeons used the model to help understand exactly how to reach the affected arteries safely. Doctors from Dubai have also previously used a 3D-printed model to assist with the removal of a tumor from a patient's kidney.

Designer partners with Sinterit to create 3D-printed exoskeletons for children with SMA

Designer Bartłomiej Gaczorek has partnered with 3D printer manufacturer Sinterit to design custom fitting exoskeletons for children with spinal muscular atrophy (SMA). Gaczorek started the project after receiving a call from a parent asking for his assistance after trying many different 3D designs for their three-year old son, none of which had been sufficient to meet their requirements. He used Autodesk's Fusion 360 to design the exoskeleton and printed it on a Sinterit Lisa desktop SLS 3D printer. The exoskeleton has been used to support the mobility of three children with SMA and Gaczorek hopes that the device will reach more children across the globe.

National University of Singapore opens \$18M biomedical 3D printing center

The National University of Singapore Centre for Additive Manufacturing opened a 3D printing center that will explore tissue regeneration, implants and drug formulations. The center, which cost \$18 million, will also leverage NUS' multi-disciplinary expertise from various faculties and conduct courses for postgraduate students. Co-director Jerry Fuh Ying-Hsi said the center "will play a critical role in supporting Singapore's vision of becoming a leading AM hub."

British student develops 3D-printed extra digit

British product design student Dani Clode has developed the Third Thumb, a controllable prosthetic extra digit. The 3D-printed thumb contains two motors and flexible hinges giving it dynamic motion and range of a real thumb without the use of surgery. The prosthetic was designed to extend a wearer's natural abilities and opens the potential for a new field of elective prosthetics.

Oxford scientists develop method for 3D printing living tissue

Oxford University scientists have developed a way to 3D-print laboratory-grown cells to form living structures. Printing high-resolution living tissues was previously difficult, as cells frequently move within printed structures, leading to collapse. However, the Oxford team devised a method to create tissues in self-contained cells that support the structures, enabling them to maintain their shape. Cells produced using this method improves survival rate of individual cells, allowing the team to improve on current techniques by building each tissue one drop at a time. With further development, researchers say the materials could have a broad impact on global healthcare and could eventually create reproducible human tissue models, which would eliminate the need for animal testing.

Australian man first to have 3D-printed tibia implanted in leg

An Australian man has become the first person to have a 3D-printed tibia transplanted into his leg. The process required five operations over a six-month period, with the final operation taking 14 hours. The 27-year old patient developed spontaneous onset of tibial osteomyelitis, which caused the majority of his tibia to be destroyed. The 3D-printed model, produced in Singapore, was wrapped in biological tissue which then engineers the new bone.

Chinese surgeons replace six vertebrae with 3D-printed titanium replacements

A Chinese hospital completed an operation to remove six vertebrae from a patient's spine and replace them with 3D-printed titanium prosthetics. The patient was diagnosed with chondrosarcoma, a rare form of cancerous tumor that attacks cartilage. Doctors spent three weeks to build the artificial bones using titanium alloy using 3D printing technology. The surgical team also used a 3D printer to create a life-size version of the patient's upper spine.

Quebec to spend \$2.3M to develop, implement medical 3D printing center

The Canadian province of Quebec will provide \$2.3 million for the development and implementation of a medical 3D printing center. The new center will give the province, which has been reliant on foreign products, more autonomy in terms of healthcare. This newfound autonomy will provide financial benefits to Quebec, as well as give it a position at the forefront of technical innovation. The center will reduce intervention time and costs, as well as risk by facilitating the fitting of custom-built prostheses.

3D printing program in Philadelphia helps train new doctors

As part of a project, a pair of doctors is using a laboratory with Ultimaker 3D printers to train new doctors. The JeffDESIGN program enables and empowers students to create their own solutions to healthcare rather than just imagining theoretical ones. By taking advantage of 3D printing technology to better prepare doctors with tangible accurate models, the two doctors wanted to start the first dedicated 3D printing and design program for future doctors within a medical school. The doctors say the program has empowered med students to invent their own solutions to healthcare challenges and helped tighten design cycles. Their products draw from training and experience with actual patients, striving to make a difference in the quality of care for future generations.

3D-printed bandages include wound-healing properties, electronics

Scientists in Finland are developing a flexible 3D-printed bandage that could absorb moisture from a wound to decrease healing time in addition to incorporating electronics to monitor the healing process and transmit the data to clinicians. Researchers say the device is a long way from being available for patients, adding that the materials are also being tested in nonmedical products.

Stryker receive 510(k) clearance for 3D printed Tritanium C Anterior Cervical Cage

Stryker's 3D printed interbody fusion cage Tritanium C Anterior Cervical Cage received 510(k) clearance from the FDA. The Tritanium C is created using a highly porous titanium material designed for bone in-growth and biological fixation. The cage features an open central graft window and lateral windows to reduce the stiffness of the cage and minimize serrations on the superior and inferior surfaces designed for bidirectional fixation and to maximize surface area for endplate contact with the cage. It will be available to surgeons in Q4 2017.

**Manufacturing and Construction****Study: 3D printing could cost toy manufacturers \$135B by 2020**

A [study](#) conducted by Michigan Technical University and MyMiniFactory revealed that 3D printing could have a \$135 billion impact on the toy and game market by 2020. The study investigated the potential costs of printing toys on an open source Lulzbot 3D printer using commercial filament, pellet-extruded filament and post-consumer waste plastic converted to filament using a recyclebot. Compared with commercially available toys, 3D printing using all three materials saved consumers a minimum of 75%, with the recyclebot saving more than 90%. As a result, researchers estimated that consumers could offset \$60 million per year in toy purchases. Researchers concluded that the best way for toy manufacturers to compete is to themselves embrace 3D printing.

Formlabs looks to emulate Amazon Web Services' success to reinvent manufacturing industry with 3D printing

As it continues its efforts to reinvent the manufacturing industry for the modern age, Formlabs named former Autodesk CEO Carl Bass to its board of directors. The company is using the success of Amazon Web Services as an example of what it wants to do for manufacturing. Formlabs sells two models of 3D printer, the Form2 for \$3,499 and the Fuse 1 for \$9,999, which are very accurate compared to other printers in the same price range. The competitive pricing enables any type of organization to manufacture things that they need to stay competitive.

Dutch town to install 3D-printed concrete bicycle bridge

Dutch construction firm BAM is teaming up with the Technical University of Eindhoven to install a 3D printed concrete bicycle bridge in the town of Gemert. The bridge, measuring eight meters long and 3.5 meters wide, is being printed in eight one-meter segments using pre-stressed and reinforced concrete. It will be assembled on-site using a special concrete mortar. The bridge was designed by engineering firm Witteveen+Bos.

Detroit using 3D model to help revitalize downtown core

A 3D-printed model of Detroit’s Little Caesars Arena was instrumental in the building and selling of all of its stadium suites within 40 days of sales being open. The model was designed by Zoyes Creative Group and used a Stratasys Fortus 450mc 3D Printer to create a model of not just the arena but the surrounding downtown district as well. The model features an unparalleled level of detail for 3D models, with each building, street and signpost rendered to exact scale. This allowed developers and potential purchasers to get a sense of the space. The model is even helping developers lease buildings surrounding the arena, which they believe will be vital to transform the city’s downtown core.

Adoption of 3D printing help Jabil bring manufacturing options closer to the customer

Manufacturing company Jabil is adopting 3D printing technologies to allow it to respond to customers quicker and build products in regions closer to where end customers are. In its San Jose facility, the company uses a number of 3D printers, ranging from the size of a microwave to HP printers the size of a small room. “What really excites us about 3D printing is it gives us the ability to free up designers to create the most optimized, intricate designs,” said John Dulchinos, VP of Digital Manufacturing for Jabil. “We now have a way to bring manufacturing options closer to where customers are, and deliver goods that are more targeted and responsive to their needs,” he added.

3D printing technology can make construction industry more sustainable

According to Vincent Hui, the associate chair of Architectural Science at Ryerson University, 3D printing will help the construction industry become more sustainable and cost-efficient. The technology has evolved to the point where it can help construction companies develop building materials that are environmentally-friendly and cost effective. Materials commonly used in construction such as steel, concrete and wood all have an environmental impact, with concrete specifically having a limited potential for reuse. Despite the potential advantages, the technology is not without its limits as some components, such as electrical and plumbing, cannot be made with 3D printing.



Clothing and Wearables

HP enters custom footwear space with launch of FitStation 3D foot scanning platform

HP is moving into the custom footwear sector with the introduction of its 3D scanning solution used to create custom insoles. The FitStation is a hardware and software platform that scans a user’s foot, measures foot pressure and performs a gait analysis, creating a “digital profile” of each foot. The footwear can then be printed using one of HP’s Multi Jet Fusion 3D printers. The FitStation is currently deployed at 4,000 Superfeet retail locations. Safety shoe manufacturer Steitz Secura will also use the platform for its comfort, preventative health and safety program.

Materialise, Safilo partner to produce 3D printed eyewear sculptures

Additive manufacturing company Materialise is teaming up with Safilo Group on its OXYDO SS 2017 collection, which includes a capsule collection of 3D printed frames. Materialise produces the wearable art pieces that surround each of the frames at its Certified Additive Manufacturing facility. The pieces are manufactured in Polyamide 12 and then subjected to the multi-step Materialise Luxura post-production treatment to enhance their performance and aesthetic.

Harvard researchers develop hybrid 3D printing technique to create low-cost wearable sensors

Researchers at Harvard have developed a hybrid printing technique that integrates soft, electrically conductive inks and matrix materials with rigid electronic components into a single device. The stretchable ink is created with thermoplastic polyurethane (TPU) mixed with silver flakes. The process caused the silver flakes to align themselves along the printing direction so their flat, plate-like sides layer on top of one another, which improves their ability to conduct electricity along printed electrodes. The team also combined printed soft sensors with a digital “pick-and-place process” and placed them onto the substrate surface in a specific, programmable manner. The resulting device, composed of 12 LEDs attached to a flat TPU sheet, was able to be repeatedly bent without a reduction in the intensity of the LEDs’ light or mechanical failure of the device.

Peak launches world’s first 3D printed basketball shoe

Professional sports brand Peak launched the world’s first 3D printed basketball boot, the Dwight Howard III. The boot was created using a 3D lattice structure in the middle of the sole, as well as a TPU structure for the vamp side walls. The company plans to implement 3D printing technology to more of its products in the future.

**Auto Industry****Front end of vintage VW Caddy reproduced using 3D printing**

A group of companies, including csi entwicklungstechnik, Altair, Airbus APWORKS and EOS, teamed up to design and build the front end of a vintage VW Caddy using 3D printing. The project, called 3i-PRINT, took nine months to complete and was launched to demonstrate the potential of additive manufacturing techniques for applications such as automobile manufacture. The vehicle will be on display at Converge 2017 in October, as well as Formnext 2017 in November.

Use of additive manufacturing in automobile manufacturing to increase 10% by 2025, report finds

According to the Global 3D Printing Automotive Market Analysis & Trends - Industry Forecast to 2025 [report](#), the use of 3D printers to create many of the parts used in automobile manufacturing will see a 10% increase by 2025. The report shows that many applications of additive manufacturing such as electron beam melting, fused deposition modeling, laminated object manufacturing, 3D inject printing, stereolithography and selective laser sintering are being used to produce lower cost, personalized cars. Researchers concluded that while the technology is still in its infancy for automobile manufacturing, its application is an important part of the industry's digital transformation.

3D printing is a major aspect of Ford's development process

Additive manufacturing has become a major part of Ford's vehicle development and has evolved from a niche technology at the automaker to becoming fully "entrenched" in the company's development process. Currently, Ford's five 3D prototyping centers produce more than 100,000 parts annually and the company expects 3D printing will be used to construct a least a portion of production parts on vehicles. The automaker has also increased its use of metal materials for 3D printing to create more usable prototypes and "niche applications" beyond simple prototypes.

Mercedes-Benz Trucks creates first 3D printed metallic spare part

Mercedes-Benz Trucks created the first ever metal 3D printed space part, a thermostat cover for trucks and Unimog models. The automaker has already made use of high-quality 3D printed plastic components and with the launch of metallic spare parts has provided it with another production method, useful for the production of smaller batches. "With the introduction of 3D metal printing technology, Mercedes-Benz Trucks is reasserting its pioneering role among global commercial vehicle manufacturers," said Head of Marketing & Operations in Customer Services & Parts Andreas Deuschle.



Aviation and Aerospace

NASA working with North Dakota students to improve 3D printing process in space

A group of North Dakota State University students are collaborating with NASA scientists to develop a better technique for 3D printing in space. The students, ranging from freshmen to graduate students, are trying to develop an algorithm, which they hope will reduce the number of support structures needed to fill an object. Despite weekly conference calls with NASA staff, they are still years away from having a demonstration of the improved 3D printing process ready.

Survey: Aerospace industry set to expand use of 3D printing over next decade

According to a [survey](#) released by ABI Research, 44% of manufacturing companies are utilizing 3D printing in their operations, with most using the devices for prototyping purposes. However, this trend is set to change over the next decade as the FAA and the European Aviation Safety Agency continue to approve 3D printed parts for use in commercial jet engines. ABI believes the U.S. aerospace and defense industries will make up a significant part of additive manufacturing growth over the next ten years, producing products with a value of \$17.8 billion by 2026.

Stratasys to 3D print plastic aircraft parts for Airbus

Airbus will use Stratasys Direct Manufacturing to produce 3D printed plastic parts for use in its A350 XWB aircraft. The partnership allows Airbus to improve its supply chain flexibility and cost-competitiveness, while at the same time reducing material consumption and waste. The parts can be printed as needed and shipped to Airbus, giving the company greater reactivity, faster turnaround times and lower inventory costs. At present, Stratasys will print non-loaded or lightly loaded interior cabin parts, such as covers for cable routing.

Lockheed Martin invests \$1M in additive manufacturing lab at Metropolitan State University of Denver

Lockheed Martin will invest \$1 million in an additive manufacturing lab at Metropolitan State University of Denver. Students will use the lab to create advanced aerospace components. Lockheed Martin is also working to address the skills gap in additive manufacturing by teaming up with the Colorado Space Business Roundtable to offer a two-week course of practical experience for prospective 3D printing engineers.

Made In Space develops 3D printer capable of operating in space

Made In Space developed a 3D printer, which was able to produce multiple polymer-alloy objects during a 24-day test inside a thermal vacuum chamber. This marks the first time a 3D printer has created “extended structures” in a space-like environment. The printer is a component of Archinaut, a robotic system also under development by Made In Space, which will feature robotic arms that will work in conjunction with the 3D printer to build and assemble structures in space. The technology will allow for the design and manufacture of larger, more ambitious spacecraft.

HRL Laboratories to 3D print ceramic rocket parts for NASA

HRL Laboratories received a reward from NASA as part of its Space Technology Research, Development, Demonstration, and Infusion program. The award will take advantage of HRL's research into converting preceramic resins into ceramic materials capable of withstanding intense heat to allow for the 3D printing of ceramic rocket engine parts. HRL will work with micro-spacecraft company Vector, who will determine how 3D printed components can be implemented into its own line of launch vehicles and rockets.



Consumer Goods & Retail

Fifth-generation retailer says 3D printing innovations allow merchants to be 'curators of design'

In this interview, fifth-generation retailer Sterling Hawkins of advancingretail.org discusses his appreciation of 3D printing and its potential to innovate the retail sector. Hawkins believes 3D printing will dramatically alter the retail supply chain. He doesn't predict the technology will render retail obsolete; rather, he suggests it will improve a customer's experience by offering customizable product options quickly.

'Dolphin Board of Awesome' first 3D-printed compostable, recyclable surfboard

A global collaboration of scientists, engineers and talented designers say their 3D-printed "Dolphin Board of Awesome" is a significant step towards sustainable surfboard construction. The compostable and recyclable board is made of algae and eco-friendly bio-resins. The material used for the green sections of the board are derived from algae in lakes in the middle of the U.S. where the plant is considered an invasive species. The other section is derived from plastic water bottles.

Paper outlines significant savings in DIY 3D-printed toys over retail equivalent

A [paper](#) by Michigan Technological University researchers shows that DIY 3D-printed toys are anywhere from 40%-90% cheaper than buying similar items at retail. The team identified the 100 most downloaded toy designs from popular 3D-printing site MyMiniFactory.com, describing a wide variety of designs. They found that by using different filament types, 75% to 90% of the retail price could be saved.



Food

3D Systems partners with CSM Bakery Solutions to develop 3D printers to food industry

Bakery ingredients provider CSM Bakery Solutions and 3D Systems Corporation will collaborate on the development, sale and distribution of 3D printers, products and materials for the food industry. As part of the agreement, CSM will have exclusive rights to use 3D Systems' ChefJet Pro 3D printer for high-resolution food products for the professional culinary environment.

Researchers suggest putting vegetables into 3D printer to encourage children to eat them

Researchers from the University of Foggia suggest vegetables be made into shapes using 3D printers to convince children to eat them. For the study, researchers blended banana, white beans, mushrooms and milk together before pouring it into a 3D printer. A computer was used to produce a snack based on the mixture in the shape of an octopus. The team believes the 3D printing of food could become normal in restaurants, schools and homes.

3D printed food could help make food industry more sustainable

With current global agriculture and food production models growing increasingly unsustainable, the 3D printing industry may begin to play a larger role in keeping the world fed. While many high-end commercial kitchens, bakeries and food companies have already begun to implement 3D food printers to their equipment collections, experts from MIT believe the technology can help reduce food-shipping costs, saving distributors time and money through flat-packing. The process involves creating thin strips of edible cellulose in various patterns over a top layer of gelatin. As certain layers absorb more water, different structures curl into different sizes and various shapes including the traditional macaroni or more elaborate designs. The method would allow grocery stores to stock “food cartridges” that could last for years instead of days like most perishable items, which would free up shelf space and reduce transportation and storage requirements.

Researchers experiment with lemon juice gel in 3D printers

Researchers from China have found that lemon juice gel may be a suitable ingredient for 3D printing and could be used as a building block for high-tech recipes. When combined with potato starch, they found that the mixture allowed for “suitable 3D printing of designed object.” The gel behaves similar to the way fudge would, allowing for the same texture. The team also investigated 3D printing nozzles for food, testing them in terms of height, width, rate of extrusion, movement, speed and more. They found the rate of extrusion and speed of the nozzle had an effect on 3D printing, with high extrusion leading to wavy lines and low extrusion leading to discontinuous lines that could cause collapse.

Australian researchers combining personalized nutrition with 3D printing in new study

Researchers with Australia’s Commonwealth Scientific and Industrial Research Organization are studying the personalized fabrication of smart food systems. Personalized nutrition involves creating tailored diets based on data including genetic information, as well as lifestyle and physiological state obtained from real-time sensors. For the three-year study, the team will combine the science of personalized nutrition with intelligent manufacturing such as 3D printing. However, 3D printing technology is still limited when it comes to producing food products and researchers will develop new technologies to bring it to the next level.

University of Washington team develops method to 3D print yeast for fermentation

Alshakim Nelson from the University of Washington discovered a way to ferment yeast using a 3D printer. So far, the process has been used to create ethanol but Nelson plans to expand into other substances such as proteins or drugs. Nelson and his team created a “bioreactor that not only keeps bugs alive and active for months at a time, but can also be made in minutes, using low-cost chemicals and a 3D printer.” The process uses a 3D-printed hydrogel lattice, consisting of 70% water and 30% polymer infused yeast, as well as the unique 3D printer to extrude it. The printer layers the lattice into cubes which are then cured with an ultraviolet light to solidify its shape. The cubes can then be placed in a solution of glucose to ferment.