Desktop Metal

CASE STUDY

Additive Manufacturing of Feeding and Assembly Components

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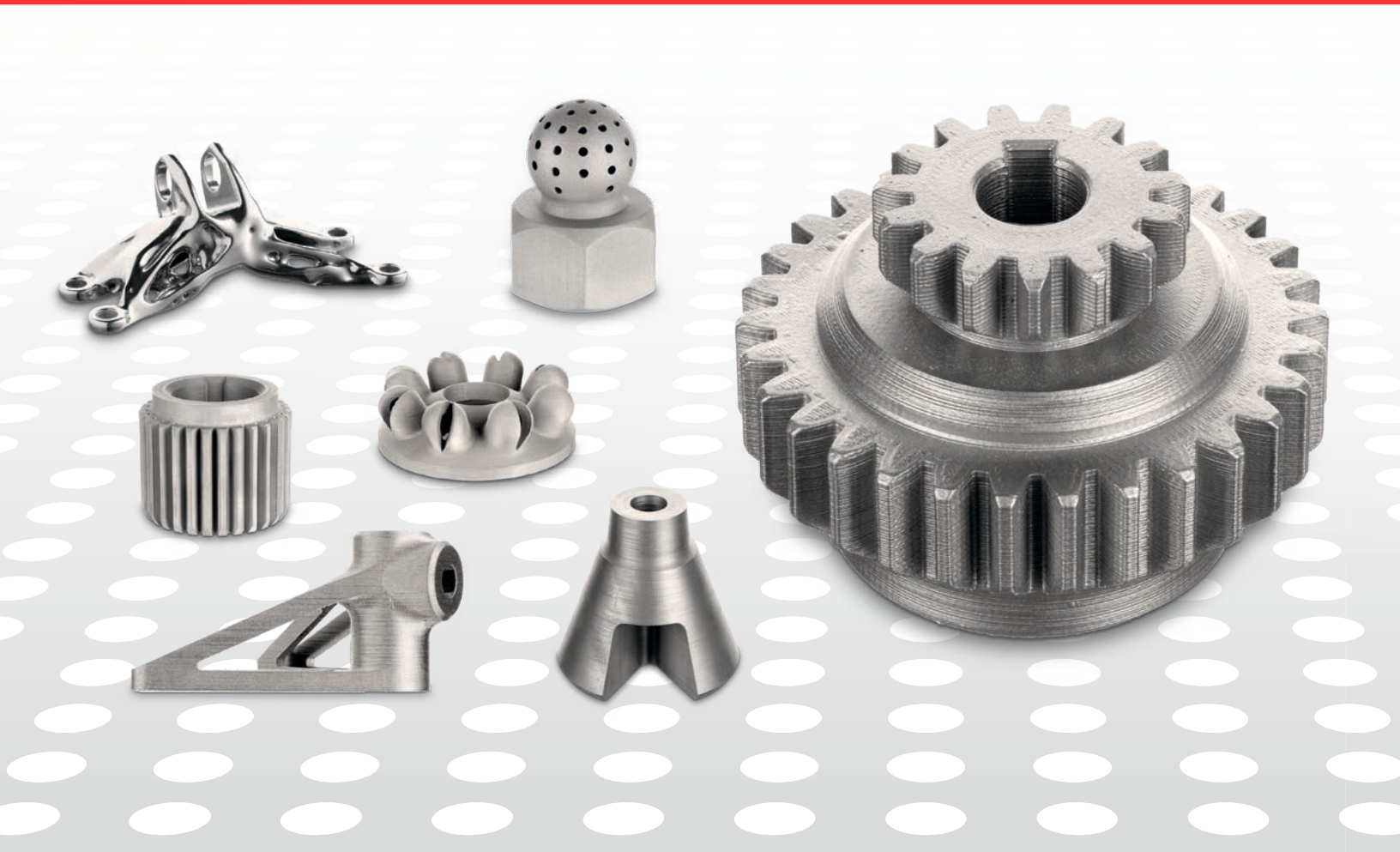
IFC Intelligent Feeding Components combines multi jet fusion and metal binder jetting



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The production of feeding and assembly components at IFC using the Desktop Metal Shop System™, the high-speed and high-resolution binder jetting system

IFC 3D SOLUTIONS

IFC
INTELLIGENT
FEEDING COMPONENTS

Customer
IFC Intelligent Feeding Components GmbH

Location
Oedheim, Germany

Industry
Feeding components manufacturing
3D printing consulting & services

Example of applications
Mechanical barrier, drive pinion gear, switch cam

Machine
Desktop Metal Shop System™

Materials
17-4 PH Stainless steel
AISI 316L Stainless steel

Websites
www.ifc-online.com
www.ifc-3d.com/en

Creative forge in feeding and assembly technology

IFC Intelligent Feeding Components is a German manufacturing company in the field of mechanical engineering as well as in feeding and assembly technology. Founded in 2001, the company produces a broad portfolio of products ranging from simple conveyor belts to a complete, robot-based feeding system. Numerous industries such as automotive, electronics, metal and plastics processing, as well as medical, pharmaceutical, and cosmetics have benefited from the company's creativity and innovation in fabricating feeding and assembly components.

Due to several disadvantages in the conventional manufacturing of a few products, including reproducibility issues, long lead times, and high costs, the company decided to enter the world of additive manufacturing by founding an in-house 3D printing center that provides various designs, printing, and consulting services. After experimenting with several additive manufacturing technologies, IFC concluded that the Metal Binder Jetting (MBJ) technology used in the Desktop Metal Shop System™ enabled the company to not only solve the problems caused by traditional manufacturing, but also to grow its business.

Issues with conventional manufacturing

One of IFC's main products is a bowl feeder that is frequently used in automation technology where bulk materials must be automatically separated and fed in the correct position.

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Conventionally-made bowl feeder – welded, bent, and ground in stainless steel

Conventionally manufactured bowl feeders require extensive manual handwork that includes welding, flexing, bending, and forging. It is laborious and an individual single-unit production, resulting in inconsistent product quality and a major reproducibility issue.

The result of the conventionally produced bowl feeder was often inaccurate as well. Problems often occurred, for example, a collision and the whole area of the bowl feeder turning bigger than planned.

IFC also faced several challenges with the conventional production of drive pinion gears and switch cams. For instance, the lead times of the drive pinion gears were very long, often causing delays in delivery to customers. The high costs of using a conventional milling machine to produce the switch cams were a major issue as well, especially in small-scale productions.

To achieve the company's vision and mission of providing future- and demand-oriented feeding and assembly systems, the company urgently needed a sustainable solution. IFC's co-founder and managing director, Andreas Schirmer, was on the lookout for new technologies and found an ideal solution in additive manufacturing (AM).

Experiments with several AM technologies

The company gained its first AM experience with fused deposition modeling (FDM), a manufacturing process in which a component is built up layer-by-layer using molten plastic. It quickly became clear that this process did not come close to meeting either the IFC's or its customers' requirements in terms of dimensional accuracy, delivery times, and product pricing. Through some small-scale trials, the need for a larger investment in a different 3D printing technology to meet the customers' demands became clear. However, the high initial costs of purchasing another 3D printer turned out to be a challenge for a small and medium-sized company like IFC.

Realizing how important it was to build AM know-how within the company and to smartly finance the big investment in several AM technologies, IFC made a bold step in 2019: Establishing an in-house and modern AM center, IFC 3D Solutions, that offers the following services:

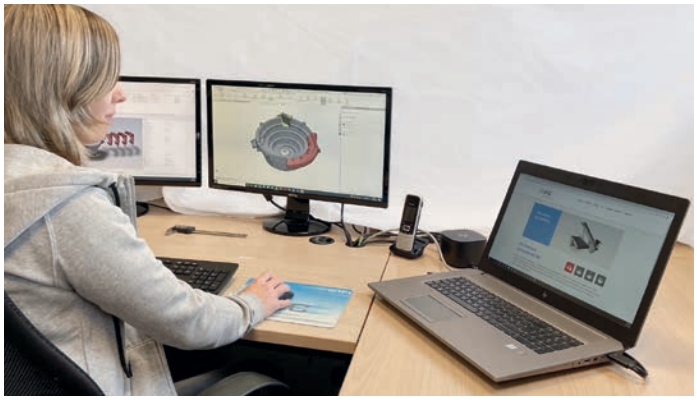
- Print-optimized design and production strategy
- 3D printed elements
- Design and engineering

and demonstrates the possibilities and numerous advantages of the new technologies to interested parties.

"All the issues we used to face with traditional and polymer-based manufacturing can be solved by the Shop System. The binder jetting technology in the Shop System produces high-resolution parts with incredibly fine details. The binder jetting process is predestined for fast and cost-effective production of even small batches."

Andreas Schirmer, Co-Founder and Managing Director, IFC Intelligent Feeding Components GmbH

IFC has been printing simple functional parts, prototypes, and small batch sizes with a Multi Jet Fusion (MJF) polymer 3D printer. The component quality made with this technology, in terms of its mechanical properties, is quite good and on a comparable level with the conventionally manufactured bowl feeders. However, IFC was not entirely satisfied with some aspects. The components easily wore out and were not hard enough, so IFC concluded that the parts required metal 3D printing.



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IFC's employee analyzing the CAD data of the bowl feeder

After comparing several technical solutions, it was quickly clear to the IFC team that Selective Laser Melting (SLM), also known as Powder Bed Fusion (PBF), would only add more steps in production such as support removal and machining after print, which they wanted to avoid. Besides, the technology is unsuitable for serial production because the laser-based technology needs to trace out designs resulting in build times too slow for serial production. IFC also concluded that the PBF process would be too expensive for the company.

Schirmer and his team believed that the next logical step to conquer their manufacturing challenges was to invest in a metal 3D printing technology that is renowned for its huge potential, **Metal Binder Jetting (MBJ)**. In 2021, they decided to start their metal 3D printing journey with a **Desktop Metal Shop System**, the world's first metal binder jetting system designed to print up to hundreds or thousands of high-quality metal parts per day.

The ideal solution: Metal binder jetting

The installation of the Desktop Metal Shop System and all its components (drying oven, powder station, furnace, and Live Sinter™ software) took place in April 2022. Since then, IFC has been conducting numerous experiments with the metal 3D printer to discover all the possibilities and advantages that this cutting-edge technology enables.

Schirmer noted: “All the equipment that we needed to start 3D printing was already included in the purchase package. We can print metal parts anytime at our convenience. Another advantage is we can print the parts in multiple layers on top of each other. This way we make a much more effective use of the build space and produce many parts at once.”

Using stainless steel EN 1.4542/17-4 PH, IFC has been 3D printing metal parts with the Shop System partly for its production needs (ca. 30 %) and mostly for its 3D printing services (ca. 70 %). The production of simpler, less-wear-exposed parts remains the task of the MJF polymer 3D printer.

IFC leverages binder jetting technology to improve its flagship product, the polymer-printed bowl feeder. As specific areas of the bowl feeder are subject to wear, IFC created a mechanical barrier, a special metal element printed on the Shop System, to protect these areas from being worn out.

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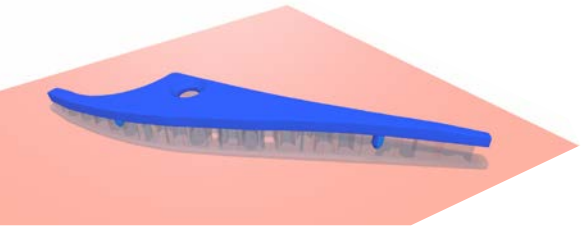
IFC’s mechanical barrier is a special metal element printed on the Desktop Metal Shop System to protect specific areas of the bowl feeder from being worn out

The mechanical barrier has a unique, organic shape which makes it economically impossible to produce with the traditional milling technique. With the Shop System, this mechanical barrier can be easily produced within one week at the price of € 60 per piece.

Within a short time since integrating the Shop System into its productions, IFC has seen a positive impact on many aspects. “All the issues we used to face with traditional and polymer-based additive manufacturing can be solved by the Shop System. The binder jetting technology in the Shop System produces high-resolution parts with incredibly fine details. The binder jetting process is predestined for fast and cost-effective production of even small batches,” said Schirmer.

Software-aided sintering

IFC has also benefited from Desktop Metal's Live Sinter™, a first-of-its-kind software application designed to make sintering more understandable and repeatable. The company leverages the innovative software to prepare filigree parts and organic shapes like the mechanical barrier. Based on their organic shape, these parts need digital file preparation, simulation, and 3D-scan-based quality control. There is no conventional route to iterate parts shaped like these in an economically substantial way. All these steps are integrated with the software and enable quick iteration of part designs within days. "With Live Sinter, we can simulate the sintering process and easily make appropriate corrections on the components. The software is very intelligent. We always get optimal results with it," shared Schirmer.



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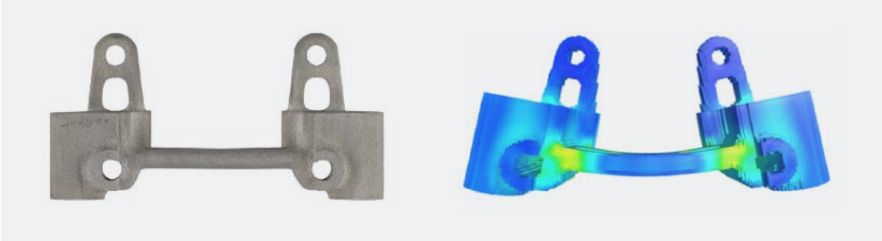
Live Sinter™ simulation of the sintering process of the IFC mechanical barrier



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Live Sinter™ pre-deforms parts to compensate for part deformation during sintering.

Schirmer summarized the added value from the DM Shop System and Live Sinter Software: "Using polymer-based additive manufacturing we were able to bring our core product to a new level of cost and time-saving repeatable manufacturability. This was really innovative, but we needed, on top of this, the Desktop Metal Shop System plus the use of the Live Sinter Software to make this additively manufactured product long-lasting and wear-resistant by adding a metal mechanical barrier to specific locations to protect the polymer-based AM-parts against wearing out."

> "With Live Sinter, we can simulate the sintering process and easily make appropriate corrections on the components. The software is very intelligent. We always get optimal results with it."
>
> **Andreas Schirmer, Co-Founder and Managing Director, IFC Intelligent Feeding Components GmbH**

Advantages of additive manufacturing

The advantages of additive manufacturing the bowl feeders with the Shop System's MBJ technology compared to the classic production are summarized below:

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Conventional manufacturing vs additive manufacturing of bowl feeders

Conventional manufacturing of bowl feeders	Additive manufacturing of bowl feeders
– Inaccurate	+ Standardization
– Elaborate, single-unit production	+ Reproducibility
– No reproducibility	+ Digitalization
– Absolut manual handwork (welding, flexing, bending, forging)	+ Flexibility
	+ Short lead time
	– Parts wear out soon (the quality of a polymer-based AM part in specific locations is not satisfying). This can be solved by the
	+ DM Shop System originating metal mechanical barrier

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Sheet metal bowl feeder

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Additively manufactured bowl feeder

Reproducibility is one of the major benefits that IFC has profited from additive manufacturing. IFC can now easily and rapidly print a "base", a standardized basic unit of the bowl feeder. The print quantity ranges from one to a couple of hundred units, making it possible for IFC to stock the parts. The production cost remains low even if only one unit is produced. Thanks to additive manufacturing, IFC can reduce production costs ca. 30 – 40%.

Moreover, the additively manufactured base can be expanded with new or additional feeder elements which can be printed as well such as pneumatic channels, flaps, sensor holders, returns, slots, and tabs.

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Expandable bowl feeder

"The additive manufacturing of the bowl feeders has given us enormous flexibility. The bowl feeder now has a drive and a printed base. The basic unit is the base, which can be extended by various attachments. These add-on parts are all also printed and absolutely reproducible. So, if a customer needs to add new or additional feeding types or parts in the future, it is easy to do as the printed base is expandable or very flexible. The flexibility of additive manufacturing enables us to easily design and construct new attachments at speed," said Schirmer of IFC.

Standardized Basis "Base"	Expandable Base	Digitalization
▪ Cost effective ▪ Quantity of one is producible ▪ Stockable	▪ Expandable with new or additional feeding parts or types	▪ Availability of CAD data ▪ Possibility to replace or duplicate the parts 1:1 within shortest time

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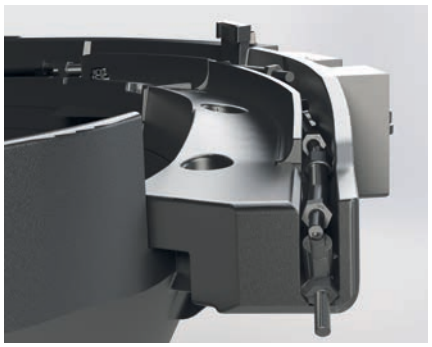
The benefits of AM with MBJ technology in the case of bowl feeders

Shorter lead time

The laborious manual hand work and long manufacturing cycles of eight to ten weeks now belong to the past. With the aid of AM solutions, feeding and assembly components are easily printed based on digital computer-aided design (CAD) data, enabling IFC to replace or duplicate the parts 1:1 within one to two weeks only, thus significantly reducing the lead time.



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Left: Height scraper of 3D printed bowl feeder
Right: Part outlet of 3D printed bowl feeder

> "The flexibility of additive manufacturing enables us to easily design and construct new attachments at speed."
>
> **Andreas Schirmer, Co-Founder and Managing Director, IFC's Intelligent Feeding Components GmbH**

Sustainability

IFC has also set a good example in the area of sustainable manufacturing after integrating the metal binder jet 3D printer into its operations. Around 80 % of the powder used in the metal parts printing processes can be reused again in future production, which also results in cost savings.

Further applications made with Shop System

Apart from leveraging the Shop System to 3D print the mechanical barrier for the bowl feeders, IFC has been producing other metal parts and prototypes for its customers with the printer as well, as shown below.

Drive pinion gears for conveyor belt prototypes

For a customer, IFC had to rapidly produce drive pinion gears for conveyor belt prototypes. The conventional manufacturing of the parts generally took eight to ten weeks and cost € 100 per piece. But 3D printing drastically accelerates the manufacturing cycles to one or two weeks and reduces the production costs. One printed drive pinion gear costs only about € 52 – nearly half of the price of the conventionally produced drive pinion gear.

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Left & middle: Drive pinion gear
Right: Drive pinion gears installed in a conveyor belt prototype

Switch cam for feed rails

Another application which IFC has optimized with the aid of the Shop System is a switch cam that is placed in feed rails to monitor an accumulation course. Conventionally produced with a milling technique, the parts cost about €210 per two pieces. Printing the parts with the Shop System is significantly cheaper than producing them in a classic method. The printed parts cost only around €70 per two pieces, a third of the price of milling.

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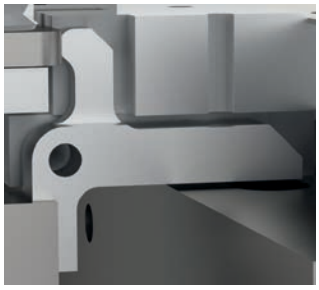
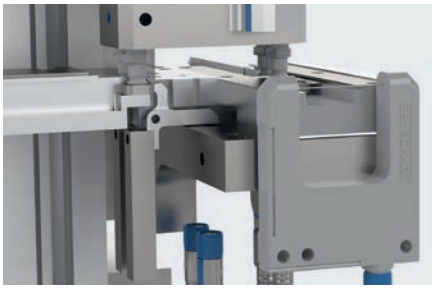
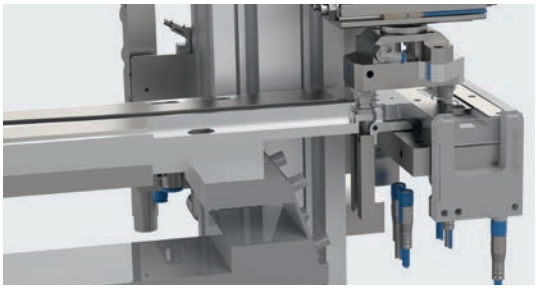
Left: Switch cam
Middle & right: Switch cam in a feed rail







Growing the business with metal 3D printing

With the metal binder jetting Shop System, IFC and its 3D printing center are on the right track to deliver future- and demand-oriented feeding and assembly systems as well as to grow its AM services business. IFC predicts that the 3D printing market globally will grow at about 20 % in the following years. Moreover, there are still few competitors in this market to date as most service providers are still using the SLS and PBF processes, making it realistic for them to aim for a significant increase in revenue from this line of business.

IFC points out that there are many industrial applications that can greatly benefit from the binder jetting technology of the Shop System, including packaging-related applications as well as filigree and freeform parts, which were previously unthinkable or too expensive to produce with the milling technique.

Based on its long-standing expertise and experience in the industrial service, IFC has seen huge potential for its 3D printing center to grow in the area of serial production of metal parts. With the Shop System, IFC can rapidly deliver high-quality and economical 3D-printed metal parts and complex geometries that are either impossible, complicated or very expensive to manufacture using conventional methods.

“Using our long-standing expertise and experience in mechanical engineering, feeding technology, and additive manufacturing, we will continue showing our customers the huge potential and benefits of metal 3D printing for them, particularly with the Shop System. We’ll show them what the system is able to do and what it isn’t. And we are confident that the system can help us grow our business and enhance our reputation as a pioneer in our industries,” argued Schirmer.

IFC 3D SOLUTIONS

IFC
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FEEDING COMPONENTS

About IFC Intelligent Feeding Components

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Desktop Metal

About Desktop Metal Inc.

Desktop Metal (NYSE:DM) is driving Additive Manufacturing 2.0, a new era of on-demand, digital mass production of industrial, medical, and consumer products. Our innovative 3D printers, materials, and software deliver the speed, cost, and part quality required for this transformation. We're the original inventors and world leaders of the 3D printing methods we believe will empower this shift, binder jetting and digital light processing. Today, our systems print metal, polymer, sand and other ceramics, as well as foam and recycled wood. Manufacturers use our technology worldwide to save time and money, reduce waste, increase flexibility, and produce designs that solve the world's toughest problems and enable once-impossible innovations. Learn more about Desktop Metal and our #TeamDM brands at www.desktopmetal.com