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VORSPRUNG DURCH KNOW-HOW

ADDITIVE MANUFACTURING

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Focus topic: Automation

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Automation makes 3D Printing predictable » 26

CR-3D and automation.eXpress, with their modular SmartFAB Matrix production cell, enable automated parts production around the clock with minimal staffing requirements.



The Next Benchmark for Depowdering » 60

At Formnext, Solukon is unveiling the new SFM-AT850, the next generation of its automated debinding systems for complex metal components.

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IN PARTNERSHIP WITH CR-3D

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Photo: automation.eXpress

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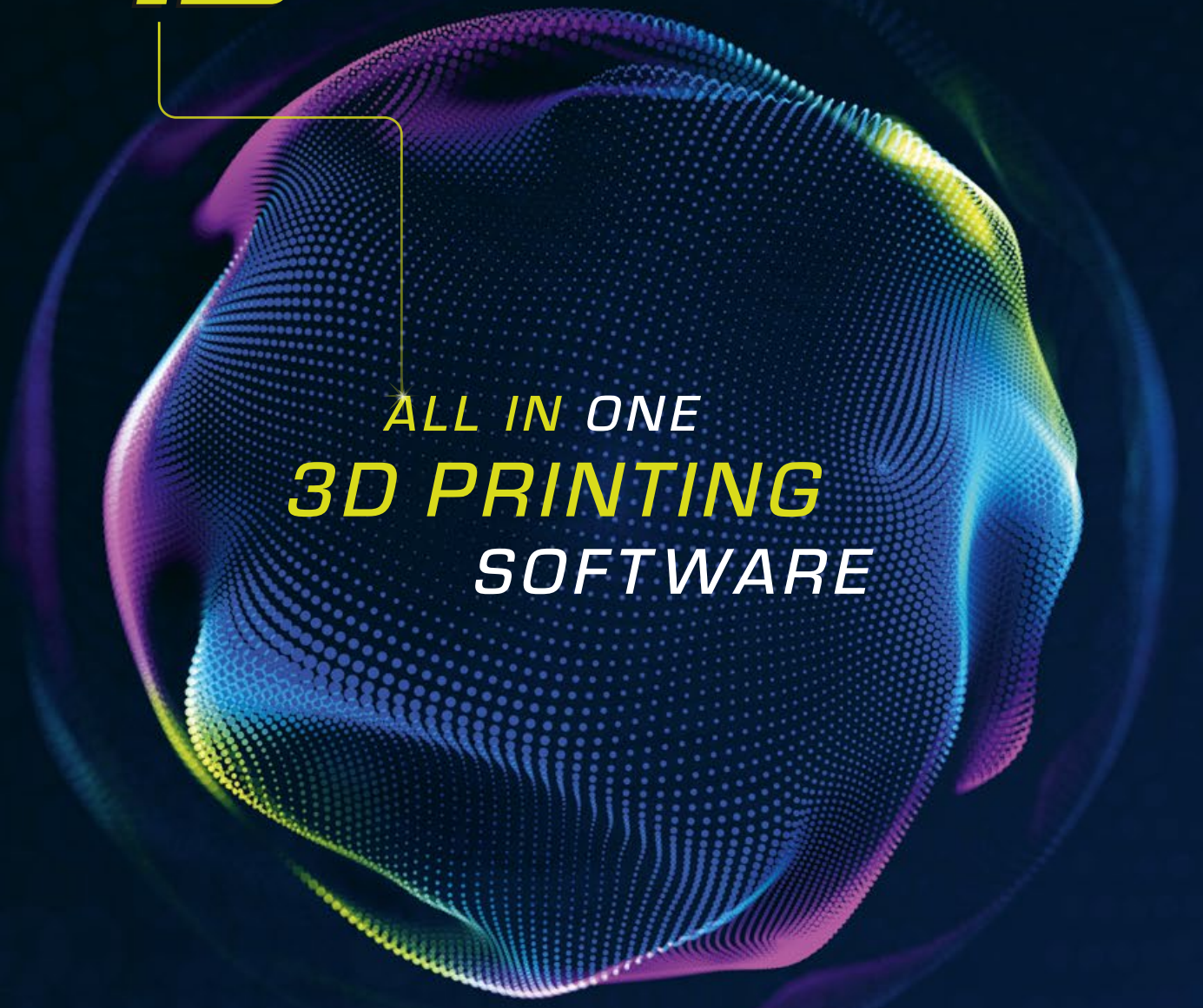
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Automation As a Driver for Scalability



Georg Schöpf
Editor in chief ADDITIVE MANUFACTURING
georg.schoepf@x-technik.com

Machinery, materials, scalability. This is a rough summary of the sequence of developments in additive manufacturing over recent years. The period between 2010 and 2021 was characterised by some groundbreaking developments in the field of manufacturing systems. New technologies emerged, whilst some have since faded into obscurity. Machines have reached a level of technological sophistication that meets the industry's requirements, even though the industry was initially unable to define precise specifications. Through dialogue and collaboration, criteria were established that have driven the industrial adoption of additive technologies.

Between 2022 and 2024, the focus of development shifted to materials. Entire material systems have emerged, and the industry has realised that it makes more sense to evaluate and certify materials that are suited to the technological requirements of Additive Manufacturing and perform well in that context, rather than insisting on long-established materials and alloys which, when used in the additive process, only yield satisfactory results with great difficulty. Standards and guidelines have been established to support reproducibility, technical maturity and process reliability.

Since 2025, we have been witnessing the next leap forward in development. Much of the industry has recognised that Additive Manufacturing must be viewed as a complementary set of processes and that it offers clear economic advantages in many areas. Much to the chagrin of some machine manufacturers and service providers, this realisation has not yet spread across the entire manufacturing sector, but it has at least reached the point where the technology's maturity is no longer in doubt. This developmental step is driven by the industry's demand for the ability to scale system environments, whether through larger machines or by linking them together in conjunction with downstream processes. Increasingly, solutions are emerging that link multiple manufacturing systems with one another and with post-processing systems. Robotics and transfer systems are gaining in importance, and machine manufacturers are being called upon to create interfaces that reduce manual intervention and minimise set-up times.

There is a clear demand to minimise downtime, increase productivity and eliminate sources of error. This also involves simplifying processes and designing overall systems in such a way that operating the machines no longer requires specialist expertise in 3D printing. Formnext, which will once again serve as the industry's meeting place from 17 to 20 November, will showcase how manufacturers of AM solutions are responding to these requirements. The defence sector will also be featured at the event through the Formnext Defence Summit, which is being held in cooperation with the AM Defence Network.



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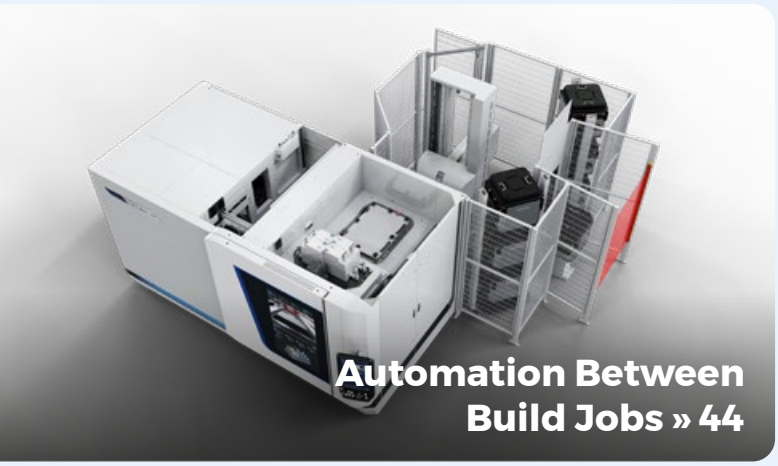
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AMDefNet's launch presentation at AM Village in Albacete in March this year.

INFO

Additive Manufacturing Goes Strategic

Resilient supply chains, decentralised manufacturing and the availability of spare parts in the field make Additive Manufacturing a strategically important technology for security and defence. The Additive Manufacturing Defence Network e.V. – AMDefNet – sees itself as a 'bridge-builder between two worlds' – the AM industry and users in the defence and security sectors – so that a third party, the European armed forces and security forces, can benefit from it.

Additive Manufacturing can really demonstrate its strengths precisely where traditional supply chains reach their limits. For example, manufacturing spare parts on demand and close to the point of use – 'in-time' – increases the operational readiness of weapon systems and equipment and reduces the strategic importance of traditional logistical supply routes. Additive Manufacturing has the potential to create a win-win situation for all parties involved. However, technology alone is not enough to achieve this. Suitable processes are needed for the provision and certification of components, secure data handling and, above all, a shared understanding of requirements and possibilities.

AM Defence Network – an AM Alliance for Europe

This is precisely where the Additive Manufacturing Defence Network comes in. AMDefNet sees itself as a link between industry, research, public authorities and security and operational organisations. The aim is to promote communication across organisational and national boundaries in order to achieve a common understanding of the potential of Additive Manufacturing technologies. In doing so, AMDefNet aims to make a valuable contribution towards a European strategy for Additive Manufacturing that also takes the defence and security sector into account.

The fledgling network made its first official appearance in 2026 at the European Defence Agency's AM Village in Albacete (Spain). Since then, its volunteer members have been working to develop concrete collaborations from their contacts, highlight requirements, exchange experiences and jointly advance topics such as mobile and decentralised manufacturing, spare parts supply, qualification and standardisation, training, and the secure handling of digital manufacturing data. At Formnext, AMDefNet will have its own



The Additive Manufacturing Defence Network is all about bringing the right people together.

stand for the first time, providing a point of contact for all those who wish to help shape Additive Manufacturing in the defence and security sector through membership of AMDefNet e.V.

Source of information and low-threshold access options

Anyone wishing to do business in the defence sector faces specific challenges. Procurement regulations in this sector vary from country to country. The eligibility criteria often differ considerably, and the required documentation is difficult to access. With a network of AM:Bassadors covering the various EU Member States and a direct line to Brussels, AMDefNet offers a working-level point of access free from cumbersome bureaucracy.

Another important step will take place right at the start of the trade fair: on 17 November, the Formnext Defence Summit will be held for the first time, conceived and organised by Formnext in collaboration with AMDefNet. Representatives from the military, politics, industry and research will discuss topics including supply chain management, procurement, logistics, training, standardisation, digitalisation and data management. Because one thing is clear: the potential of Additive Manufacturing for defence and security is very real. The task now is to work together to create the conditions necessary for this to develop into a robust industrial base capable of offering targeted products and solutions. It is already possible to get involved with AMDefNet, either as an individual or through a supporting membership for companies.

» www.amdefnet.eu
formnext Hall 11.0, Booth F18

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The Next Generation of Industrial Manufacturing Returns to Frankfurt

The current debate on industrial development in Europe and around the world is often dominated by economic challenges. At the same time, numerous examples demonstrate how the use of Additive Manufacturing in industrial applications enables successful and scalable business models, thereby opening up new growth markets. From 17 to 20 November 2026, Formnext will bring together the relevant technologies and experts in one place, offering insights into specific applications across the entire value chain, as well as numerous practical examples and business cases from a variety of sectors.

The current market environment highlights the importance of resilient supply chains, flexible production processes and technological innovation. Additive Manufacturing provides concrete solutions in this regard and helps companies to respond more quickly to change, develop new applications and strengthen their competitiveness in the long term. Significant growth momentum is currently being observed, particularly in the aerospace, defence, energy, medical and semiconductor sectors.

Four days of technical dialogue

Against the backdrop of a dynamic phase of industrialisation in the AM sector, Formnext will once again confirm its role as the central platform for the manufacturing technologies of the future in 2026: with around 800 exhibitors expected, all relevant companies from across the entire AM ecosystem will be represented. Throughout the four days of the exhibition, the focus will be on face-to-face meetings, professional dialogue and concrete inspiration for applications within the sector. "The current market phase in particular highlights just how important exchange, guidance and access to innovation are," explains Sascha F. Wenzler, Vice President of Formnext at the organiser, Mesago Messe Frankfurt GmbH. "Formnext brings together the key players and creates the framework in which new ideas for the industrial application of Additive Manufacturing can emerge."



Formnext brings the international AM community together and showcases the latest developments in Additive Manufacturing. (Images: Formnext/Mesago Messe Frankfurt GmbH, Photo: Marc Jacquemin)

Discussions with the Formnext Exhibitor Advisory Board show that the mood in many areas is significantly more positive than in previous years. More and more companies are reporting successful industrial solutions, new projects and a growing market. Highlighting precisely these developments and encouraging discussion about them is one of Formnext's most important tasks. In this context, the organiser is specifically addressing the current changes in the AM sector and has further optimised the hall layout for the upcoming edition. To minimise walking distances, improve wayfinding and, at the same time, ensure a consistently high-quality visitor experience throughout, Halls 11.0, 12.0 and 12.1 will be used instead of four hall levels, without significantly reducing the total exhibition space.

A diverse supporting programme offering fresh inspiration

The supporting programme for Formnext 2026 once again offers a wide range of topics, as well as numerous opportunities for in-depth professional development and networking. "Although Additive Manufacturing is already an integral part of production in many industries, the technologies remain complex and require the development of expertise and, above all, the identification of relevant business models and potential," explains Christoph Stüker, Vice President of Formnext. "This is precisely where we come in, with a variety of formats designed to facilitate this collaboration – including across different sectors."
The lecture programme, which is freely accessible



Impression of **Formnext 2025.**

to trade fair visitors, addresses both cross-sector topics and specific application examples on the Industry & Application Stage, thereby offering relevant insights for users, technology providers and decision-makers from various industries. The programme is complemented by the Technology Stage, where exhibitors present their technological innovations and solutions. Among other things, the Formnext Defence Summit sets new thematic priorities by highlighting the latest developments and requirements in the security and defence sectors. In addition, a special exhibition is dedicated to the important topic of post-processing and illustrates key stages of the industrial value chain.

Tried-and-tested highlights remain a key feature

The Formnext Awards will once again recognise outstanding innovations and developments, whilst the Discover3DPrinting seminars offer a practical introduction to Additive Manufacturing, particularly for newcomers. The programme is complemented by initiatives such as the Start-up Area and the Pitchnext event, which are specifically designed to foster dialogue with investors and partners. In addition, numerous other programme items offer a wide range of insights into applications, technologies and industry trends:

» Special exhibition by the VDMA's Additive Manufacturing Working Group on Additive Manufacturing in mechanical engineering
» BE-AM special exhibition and BE-AM symposium on Additive Manufacturing in the construction industry
» Special exhibition and guided tours on the topic of post-processing
» Career@Formnext with a job board, personalised career advice, photo shoots and networking opportunities
» Partner country: the United Kingdom, which, with its strong manufacturing sector and leading role in Additive Manufacturing, brings a robust ecosystem of technologies and industrial applications to the event
» AM Innovation and Standards Summit, organised by ASTM International, taking place the day before the exhibition

Visitors can get their tickets via the online shop.

» Formnext 2026
17. – 20. November 2026 in Frankfurt a. Main
formnext.mesago.com

» www.mesago.com



Once again this year, the exhibitors are demonstrating what Additive Manufacturing is capable of.



The combination of the EOS P3 Next, the D1 unpacking station and the F1 powder preparation system from Rösler AM Solutions, **together with the EOS Multibox, forms the heart of the PA2200 production process.**

Next-Generation Additive Polymer Manufacturing

With the EOS P3 Next, as well as automated unpacking and powder preparation, W-3D is expanding its polymer production to include an end-to-end SLS process chain. Eighteen in-house colours, consistent surface treatment and the appointment of Leon Weiskircher also mark the transition to the next stage of development. By Georg Schöpf, x-technik

Anyone walking through the production facilities at W-3D in Sohland an der Spree will see a company that does not limit itself to a single process. For Bernd Weiskircher, what matters is not which logo appears on a machine, but whether printing, powder handling, unpacking, blasting, smoothing and colouring combine to form a robust production workflow. It is precisely from this perspective that the company's latest investment should be understood. With an EOS P3 Next, a D1 de-packing station and an F1 sieving and mixing station from AM Solutions, W-3D has expanded its plastics production – which had previously been heavily reliant on HP Multi Jet Fusion – to include an automated SLS line. The three components form a coordinated process chain. It is designed to deliver consistent quality, reduce manual labour and, above all, be scalable.

Shortcut

Objective: To reduce downtime in SLS production.

Material: PA2200.

Solution: D1 unpacking station and F1 powder preparation from Rösler AM Solutions on the EOS P3 Next

Benefits: Freeing up resources by reducing manual intervention to 15 minutes per day.

The investment thus strikes at the heart of what is currently driving Additive Manufacturing. For years, the focus has been primarily on build speed, materials and potential applications. In industrial production, however, cost-effectiveness

is not determined by the printer alone. It arises from the interplay of all process steps and, in most cases, precisely where people have hitherto been moving containers, sifting powder, refilling material or exposing components by hand. In the past, W-3D has maintained its capacity through a high level of personal commitment. Now, growth should no longer depend on whether someone is standing by the machine at the right time, whether at night or at the weekend.



Thanks to the clever interlinking of the individual components via the mobile site containers, **the time required by staff is reduced to 15 minutes a day.**

Automation starts after printing

The P3 Next processes parts on the W-3D EOS PA 2200. Once the build job is complete, the interchangeable frame is removed from the printer and cooled in a controlled manner. The D1 then takes over the automatic unpacking process. According to Weiskircher, this process takes around 30 minutes when the build chamber is fully filled to a height of 600 millimetres. The components remain in the container whilst the unsolidified powder is extracted and conveyed into a collection container. This transforms a physically demanding and dust-intensive work step into an enclosed, defined process.

The F1 stage for powder preparation follows on from the unpacking process. It takes the used powder, sieve it and, at W-3D, automatically mixes it with fresh powder in a 50:50 ratio. The prepared material is then fed into the EOS system's Multibox. If the P3 Next signals a requirement, the necessary quantity of powder is automatically replenished. The operator does not need to transfer »



The F1 powder processing system from Rösler AM Solutions takes in used powder, sieve it and automatically mixes it with fresh powder in a 50:50 ratio.



AM Solutions' D1 unpacking station ensures gentle powder removal and directs almost all of the residual powder to be recycled.



Thies' dyeing systems deliver perfect dyeing results reliably and quickly – a hallmark of W-3D's quality.

material by hand or prepare the mixture separately for the next build job. This leaves just a few clearly defined tasks: briefly vacuuming the D1 platform, feeding the unpacked parts into the blasting machine and cleaning the laser glass at regular intervals.

"The employee spends about 15 minutes a day working with the EOS system. The laser glass is cleaned once a week. Apart from that, you hardly have to do anything else with the printer," says Weiskircher, describing the effort involved. That is precisely where the key lies. A print job takes around 18 hours, but the staff time required is reduced to a small fraction of that period. Furthermore, the peripheral equipment is not designed solely for the machine currently installed. According to W-3D, a combination of D1 and F1 units can supply up to four P3 systems. "However, this only works with the complete automation process," emphasises Weiskircher. Only when the printer, material cycle and post-processing are planned together does a high-performance machine become a scalable production system.



"With our automated SLS production line, we are taking the mass production of polyamide parts in vibrant colours to the next level.

Bernd Weiskircher, CEO, W-3D GmbH

Automation in MJF too

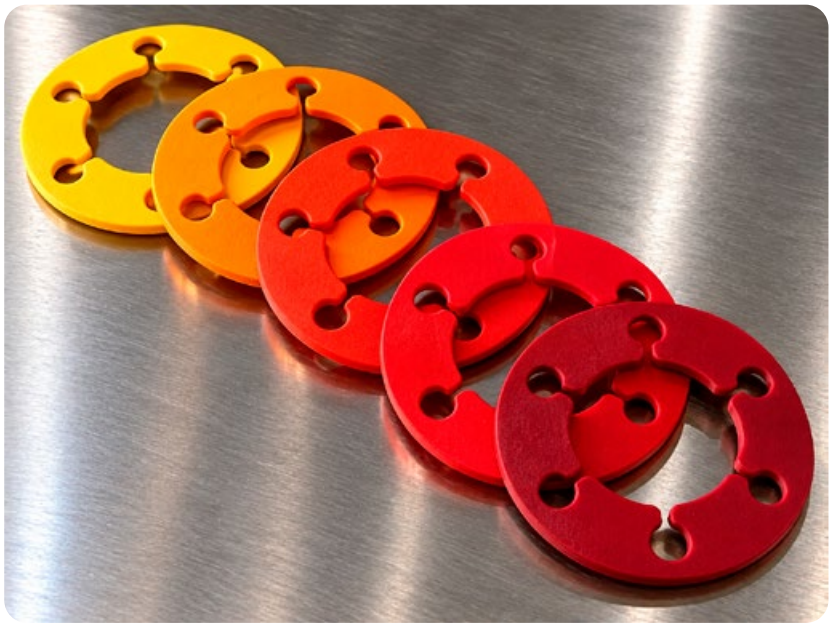
W-3D did not wait for the EOS system to embark on this path. The three HP Jet Fusion 5620 Pro machines are also automated and integrated, along with several build units, into a workflow that provides additional capacity at weekends. An employee cleans the systems on Saturday, loads them with six build units, thereby enabling six additional build volumes by Sunday. According to Weiskircher, this takes five to six hours. "All 5620 Pro units are equipped with automation," he clarifies. Depending on workload, W-3D runs a total of 30 to 40 build jobs per week.

W-3D does not pit MJF against SLS, nor does it declare one process the overall winner. The HP systems remain a key pillar for productive PA12 manufacturing, whilst the P3 Next opens up additional possibilities in terms of material, surface finish and colour effects. What both areas have in common is that nominal print performance alone is not what counts. It is only through short set-up times, the availability of interchangeable containers, automated material handling and coordinated post-processing that they are transformed into usable capacity. Automation does not replace process knowledge. It relieves staff of repetitive manual tasks and frees up time for build volume preparation, quality control and the fine-tuning of demanding applications.

When colour penetrates the surface

A direct colouring comparison illustrates just how different the post-printing processes can be. W-3D treated white MJF components from HP and SLS components made from EOS PA 2200 together in the same colouring bath. The dye concentration, temperature and exposure time were identical. Nevertheless, the SLS part displayed a rich red after just the first pass, whilst the MJF part remained significantly lighter and appeared more pink. "Everything that is side by side in this comparison was produced in a single dyeing process. The difference is enormous, particularly with red," says Weiskircher.

The cause lies not only in the externally visible roughness, but also in the structure of the near-surface zone. Weiskircher estimates the density of the MJF component at around 1.03 grams per cubic centimetre, and that of the SLS component at around 0.93 grams per cubic centimetre. The lower density of the SLS part is accompanied by a more open pore structure. The dye therefore does not simply deposit as a thin layer on the outermost surface. It can



Vibrant colours in 18 exclusive W-3D shades. Perfect dosage ensures consistently accurate colour results.

penetrate further into the near-surface structure of the component via the accessible pores. As the penetration depth increases, the coloured volume grows; the colour appears richer and is less affected by any minimal wear or stress on the outermost layer at a particular point.

In a denser MJF component, there are fewer open pathways for the dye to penetrate the material. Under identical conditions, less dye penetrates, or it penetrates to a shallower depth. The result is a lighter shade. Red, in particular, makes the difference immediately apparent, as a rich shade quickly turns to pink if the amount of dye absorbed is insufficient. This observation is therefore more than just a visual demonstration effect. It shows that printing processes, component density, porosity and the dyeing process must be considered as an integrated system.

The dye penetration depth must not be confused with complete dye penetration. The decisive factor is the zone close to the surface that is accessible to the dye during the dyeing process. How deep the dye actually penetrates depends not only on the open porosity but also on the dye, temperature, time and pre-treatment. The comparison in W-3D initially demonstrates the difference in dye uptake under identical process conditions; an exact penetration depth in micrometres was not measured. Nevertheless, the effect is relevant in practice. The greater the dyed volume beneath the surface, the slower the light-coloured base material reappears when subjected to light mechanical stress. Particularly in the case of grips, housings or components that are subsequently assembled and cleaned, the penetration depth thus influences not only the visual saturation immediately after dyeing, but also the durability of the appearance.

This does not imply a blanket dismissal of MJF. MJF components can also be coloured to a high standard; however, the process must be adapted to their structure and the desired result. For applications where vibrant colours are required after just one colouring pass, PA 2200 from the SLS process at W-3D offers a clear advantage. Added to this is chemical smoothing. The treated SLS components come close to injection-moulded parts in both appearance and feel. The porosity initially aids absorption; the surface is then »



Chemical smoothing gives PA2200 parts a surface finish equivalent to that of injection-moulded parts.



Production on the HP Jet Fusion 5620 Pro is also automated, with a total of 30 to 40 build jobs per week.

compacted and smoothed. The sequence of post-processing steps is therefore also crucial.

18 colours from our own laboratory

In parallel with the new SLS technology, W-3D has further industrialised its colouring process. The company now has 18 proprietary colour formulations, which are developed and produced in its in-house colour laboratory. Whilst the raw materials are sourced externally, the formulation and mixing are carried out by W-3D. This means the company is not restricted to a selection of off-the-shelf standard colours and can tailor colour shades to the material, pre-treatment and desired effect.



Automated manufacturing requires consistent workflows. At W-3D, nothing is left to chance.

This independence does not involve mixing by eye. The ingredients are measured out to the nearest milligram. Even slight deviations can become apparent, particularly if an order needs to be topped up later or a colour shade has to be reproduced over a longer period. Even air movements in the laboratory can affect the precision balance. “We mix to the nearest milligram. We paid around 1,000 euros for the small balance, and even the windows have to stay closed whilst weighing,” explains Weiskircher. The effort is not an end in itself. A customer will not accept it if the first delivery is a deep red and the next, for an identical order, turns out lighter.

At Formnext, W-3D plans to showcase the 18 colour shades using a printed colour chart. This demonstrates not only variety, but also that colouring is understood as a controlled manufacturing step. “We now have 18 proprietary dyes that we mix and produce in our colour laboratory,” explains Weiskircher. For housings, control components and other visible functional parts, this reproducibility is crucial. In these cases, it is not enough for a component to fit geometrically. Haptics, uniformity, colour penetration depth and

colour depth all play a part in determining whether it is perceived as a finished industrial product.

This quality strategy is continued in the blasting process. W-3D uses separate AM-Solutions S1 systems for different material and colour groups. Two systems are designated for grey parts, one for white PA-2200 components and one for TPU. This ensures that the white line remains free of other materials. For TPU, W-3D has further developed the process using heavier glass beads and optimised compressed air. "When we chemically smooth TPU, it becomes so black that we no longer need to colour it at all," explains Weiskircher. Here, too, the machine is merely the starting point; the market-ready result is only achieved through the optimised process. W-3D is also expanding its portfolio in the field of chemical smoothing. With a Lux Pro 700 from LuxYours, the company will set new standards in smoothing in future.



At W-3D, the focus is on the next generation, including in terms of staffing. Leon Weiskircher is being gradually introduced to the role of deputy managing director.

Preparing for the next phase of expansion

This latest investment also paves the way for the planned move to new premises. There, W-3D intends to further expand its automated series production. Ongoing operations with the P3 Next, D1 and F1 are providing practical insights for this: How should the machines be positioned in relation to one another? What distances does a build cell cover? Where do buffer times arise? Which tasks can be combined? The current setup serves as both a production facility and a learning platform for a larger production line.

The new site is not just intended to offer more space. Plans also include a high-capacity power supply, photovoltaic systems, battery storage and a 100-kilowatt emergency generator, as well as structural, technical and digital security measures. Weiskircher sets out the requirements in broad terms: "It's about production security, building security, site security and data security." This is only logical for demanding industrial and security contracts. An automated powder circulation system is of little use if the infrastructure comes to a standstill; a secure building is not enough if every additional printer causes staff requirements to skyrocket.

Next Generation gets a new face

At W-3D, the title "Next Generation" describes more than just the new generation of machines. Leon Weiskircher has also been working at the company since September. The 23-year-old son of Bernd Weiskircher is joining as a technical assistant and is set to be gradually introduced to the role of deputy managing director. "Next Generation Junior" is how Bernd Weiskircher succinctly describes this second phase of development.

This marks the start of a transition in personnel, running in parallel with the technical expansion. Leon Weiskircher is set to familiarise himself with the processes from the ground up and take on responsibility wherever it arises in day-to-day operations. The relocation, the expansion of production capacity and the increased automation provide a challenging learning environment for this. The operational and technical knowledge, which has so far been largely concentrated in Bernd Weiskircher, is to be more broadly embedded within the company.

At Formnext, W-3D is thus showcasing two forms of 'Next Generation'. One is in production and combines SLS printing with automated unpacking and powder processing. The other is settling into the company and is set to take on more responsibility in future. Both aim for the same outcome: W-3D is preparing to handle more series production orders using stable processes, without losing the flexibility of a specialised manufacturing service provider. Automation is not an end in itself here. It creates the conditions necessary for growth to remain manageable in day-to-day operations. Bernd Weiskircher is certain that the Formnext booth will also embody the 'Next Generation' concept.

» www.bw-3d.de
formnext Hall 12.1, Booth C49



VIDEO

The split-tube housing of a magnetic coupling is double-walled, extremely light and, in this form, can only be manufactured using Additive Manufacturing.

Experience Put Into Practice

Impellers for offshore pumps, heavy-duty heat exchangers and valve bodies made from nickel-based alloys: in Pegnitz, KSB has been integrating Additive Manufacturing into its industrial process chain for years. This expertise, which has grown over time, is now also available to external customers. The key lies in the ability to consider the material, the component, testing and operation as a single, integrated whole.

By Georg Schöpf, x-technik

Anyone visiting KSB's Additive Manufacturing facility in Pegnitz is also visiting a site with a long-standing tradition of foundry work. The local foundry became part of Armaturen- und Maschinenfabrik AG JA Hilpert in 1889; the business has been part of KSB since 1934. Today, more than 1,600 people work in Pegnitz. Among other things, the site produces industrial and building services pumps, mechanical seals and bespoke valves for the energy market. The foundry, KSB's only one in Europe, processes around 80 materials. The group, headquartered in Frankenthal, employed 16,838 staff worldwide at the end of 2025 and generated a turnover of approximately 3 billion euros. Its markets range from water and building services to chemicals, energy and mining. This integration explains why metal 3D printing has developed differently at KSB compared to many pure manufacturing service providers. In pumps and valves, flowing media, pressure, temperature, corrosion and long service life determine the component design. The design of an impeller is therefore only the beginning. The material must be suitable for the application, the manufacturing process must be reproducible, and the finished part must meet the required certification criteria. "Whatever comes off the production line must meet certain quality standards," says Stephan Braun, Business Development Additive Manufacturing at KSB, describing the starting point. He moved to Pegnitz in 2014 to help set up the AM division.



"We want to supply spare parts quickly whilst also manufacturing components for external customers in series production. To do this, we need available capacity and long-term partnerships.

Stephan Braun, Business Development Additive Manufacturing, KSB SE & Co. KGaA

From pilot projects to production

KSB has been involved in projects relating to metal Additive Manufacturing since the early 2000s. In 2014, the company acquired its first in-house laser powder bed systems at its Pegnitz site, initially an Mlab and an M2 from Concept Laser. A year later, it moved into plastic extrusion. However, the initial focus was not on producing as many printed geometries as possible, but on mastering the process. KSB began with the stainless and acid-resistant grades 1.4404 and 316L. This enabled the company to address a wide range of its own applications. Braun describes it, in essence, as a material that meets numerous requirements without the need to

set up a new material process for every spare part. This included material testing, a failure mode and effects analysis, and approvals for regulated applications. In 2018, KSB set up its own production department. Consequently, larger production volumes, the subsequent steps leading to the finished component and the resource requirements were systematically assessed. The comparison with casting was not limited to the price of a raw part. Tooling costs, material usage, machining, lead times and testing costs were also factored into the calculation. For small batch sizes or expensive alloys, the cost-benefit ratio can shift considerably.

The portfolio was deliberately expanded to cater for specific applications. Following 316L, KSB qualified several nickel-based alloys, including Noribeam® Alloy 625, 718, 59 and 22. These open up applications in high-temperature environments and in corrosive media. For the chemical industry, for example, the company manufactures valve bodies from highly corrosion-resistant alloys in series production. The key, explains Braun, is not to stock every conceivable metal as a standard powder. "Fewer materials, but ones that can then substitute for many others" – for him, this represented a viable path to industrial application right from the start. In addition to the standard materials, the team has investigated numerous other metals. Specialised partners are responsible for powder production. The accredited materials laboratory on site significantly shortens the time between pressure testing, inspection and process adjustment.

Quality requires more than just a test certificate

For KSB, qualification is not merely an afterthought or a selling point. The company manufactures components for systems in which a failure can have far more serious consequences than simply a machine shutdown. According to KSB, in 2019 the site became the first manufacturer to receive TÜV Süd certification for additively manufactured pressure-bearing components in accordance with the European Pressure Equipment Directive. This was followed in February 2024 by DNV certification in the highest category, AMC 3, for the impeller component family in offshore and maritime applications. In 2025, certification in accordance with DIN 2303 for defence applications and qualification under the ASTM AMC-QS programme were added. Which of these certifications are required for a specific part naturally depends on the material, the application and the agreed test plan. An example of the effort involved in such approvals is provided by the impellers for a pump on the



Cover for mechanical seal with integrated cooling made from Noribeam® Alloy 718 with FDM retaining clips.

Norwegian Snorre platform. Cast duplex impellers were replaced with additively manufactured parts made from Alloy 625 to improve corrosion resistance in seawater applications. According to KSB, an initial batch of 14 replacement impellers was delivered within nine weeks. The construction of a single impeller measuring around 409 millimetres took approximately 76 hours. This figure refers to the printing process alone, excluding cutting, post-processing and testing. This illustrates what industrial Additive Manufacturing is all about: the process can speed up the procurement of a difficult-to-source spare part, but its reliability stems from the entire process chain.

Capacity for a wide range of tasks

In Pegnitz, there are now three EOS M 290 machines in various configurations and two EOS M »



In its LPBF production process, KSB relies on **three EOS M 290 machines (one of which is a bespoke AMCM solution) and two EOS M 400-4 machines.**



The layout of the systems supports **semi-automated production, with plans to link the systems together in future.**

400-4 machines. An EOS P 110 complements the production of polymer components. In addition, there are systems and workstations for debinding, sieving, cutting and removing support structures, as well as for surface finishing, heat treatment and measurement. Interchangeable frames facilitate the organisation between the build process and subsequent work steps. For the team, the system is therefore a link in a chain whose cycle time is determined as much by material changes, inspections and reworking as by the actual build time.

The range of parts produced extends from impellers, inducers, shaft sleeves and seal covers to cyclone separators, heatable housings and heat exchangers. In the case of the latter, 3D printing can enable complex internal flow paths and compact designs. In other cases, a near-net-shape blank is produced first, which is then finished by targeted machining. KSB, for example, is showcasing a conventional oil cooler weighing around 6.5 kilograms and an additively manufactured variant weighing just 1.8 kilograms. This demonstrates the potential for design optimisation; cost-effectiveness is determined by function, production volume and the overall manufacturing process.

Another application involves a high-pressure heat exchanger for pre-cooling hydrogen at filling stations. The proposed design combines a compact construction with operating pressures of up to 875 bar, a design rating for 1,050 bar and temperatures down to minus 40 degrees Celsius. Similarly, KSB is working with a customer on components for a test pump in the field of molten salt reactors. At an operating temperature of around 500 degrees Celsius, corrosion resistance and thermal requirements come into play. “In such cases, it is always a joint development project with the end customer. Sometimes a component is already available, which is then revised to suit production; in other cases, we start with the basic requirements and then work with the customer to determine the material and component design,” explains Braun.

Parts On Demand opens the door to external customers

What KSB initially developed for its own pumps and valves is now also offered to external customers under the Parts On Demand brand. The range extends from spare parts and reverse engineering, through the optimisation of an existing design, to the joint development of new components. An order does not necessarily have to relate to KSB products. For manufacturers who only occasionally require highly sophisticated metal parts, access to an existing manufacturing and testing facility may be more attractive than setting up their own AM production. Braun is not relying solely on individual printing jobs, but on long-term collaboration.

In the spare parts business, KSB draws on an infrastructure that extends far beyond Pegnitz. Service teams are deployed worldwide. “The service units have 3D scanners with which existing parts at the customer’s site can be scanned. The scan alone does not yet produce a print-ready file. Wear, target geometry, function and material must be professionally assessed. Particularly for obsolete pumps or parts from manufacturers that are no longer on the market, this approach can restore the supply. At the same time, a higher-grade material can improve service life if it is suited to the specific load conditions,” explains the divisional manager in detail.

The digital warehouse serves as an organisational complement. Customer data can be stored for repeat orders. The ordering process is integrated into the KSB webshop and the SAP processes. The component is assigned a material number, whilst the customer-specific data is accessible only to the relevant Additive team. Implementation is taking place on a pilot basis. This shifts the focus of stock management towards verified data records and available production capacity. It replaces physical stock where lead times, costs and regulatory requirements allow – although a physical spare part may still be necessary for critical components.



WAAM technology is also used for solid components such as pump impellers.

Automation in the right places

With this business model in particular, it is the ability to manage recurring processes that determines whether individual successes can be turned into a functioning service. Multiple LPBF systems, interchangeable frames, depowdering and screening stations, as well as integration into ordering and materials management processes, create the conditions necessary for coordinating construction jobs and follow-up work. However, these do not yet constitute a fully automated production line. Material approval, component inspection, machining rework and the varying geometries still require expert judgement. Today, the benefits of automation lie as much in the standardised transfer of data and orders as in the mechanisation of individual manual tasks. A step outside LPBF production also demonstrates just how practical KSB's approach to automation is. At the Pegnitz foundry, a welding robot scans castings and automatically seals core plugs. For larger additively manufactured blanks, the team is working with Gefertec, amongst others, on wire-based DED processes.

The small printer is part of the picture

Industrialisation in Pegnitz did not begin solely with the Printing Equipment Directive and nickel-based alloys. Plastic printing found its way into the foundry's model-making and toolmaking processes. There, models, jigs and equipment are produced locally, whilst CNC machining remains the better choice for other tasks. Braun recalls a replacement lid for the coffee machine at the site, which the team scanned, reverse-engineered and printed with the KSB logo. In economic terms, an original part would have been cheaper. However, as a practical example, it immediately demonstrated to colleagues what is possible with existing data and an in-house printer.

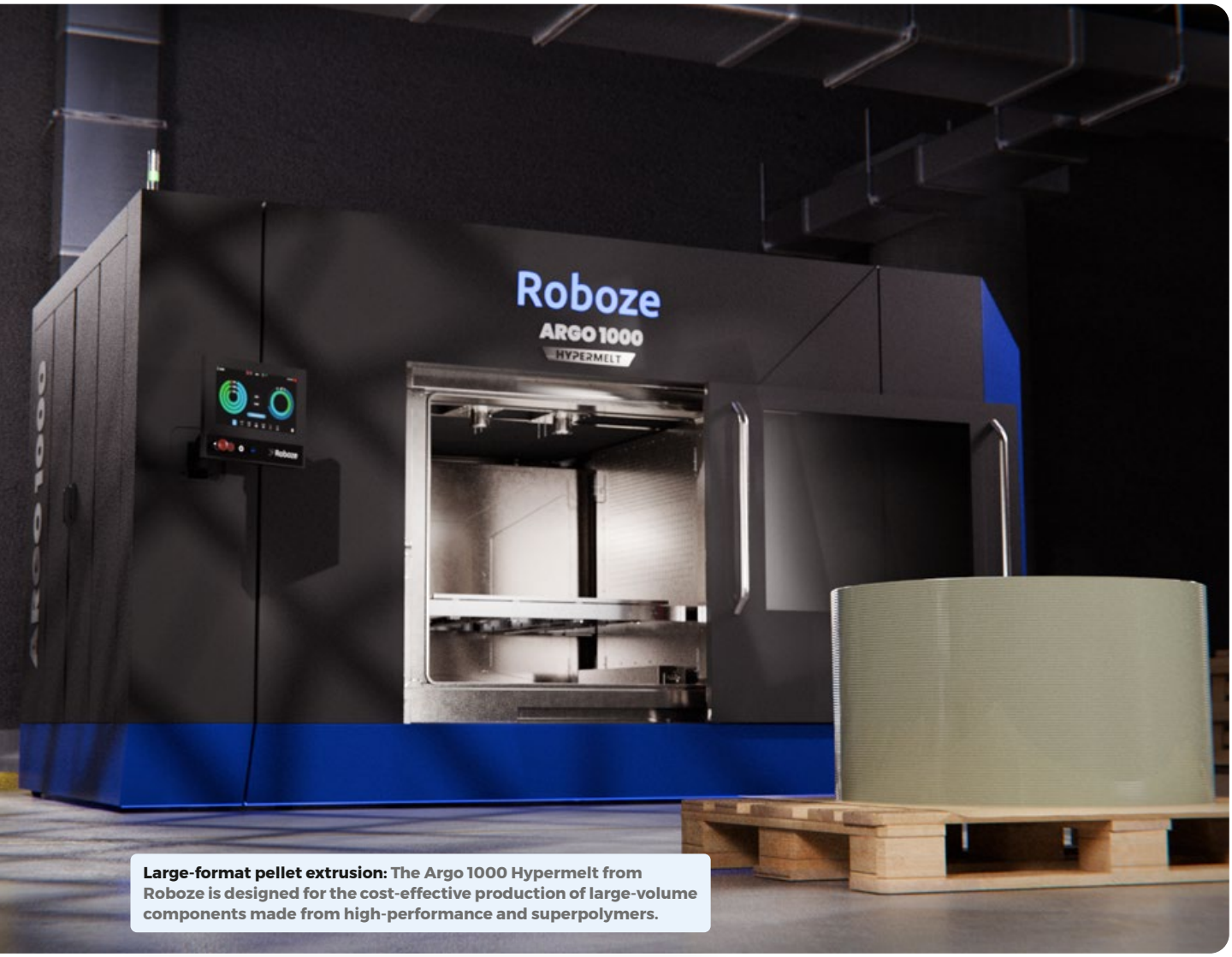
This integration into day-to-day operations is just as important for the Additive Manufacturing sector as the high-profile reference parts. A technology only becomes second nature within the Group when the design, service, materials laboratory, manufacturing and sales departments understand where it delivers benefits and where its limitations lie. For Braun, this leads to a clear strategy: internal spare parts must remain available at short notice; at the same time, external series production and development contracts should ensure continuous capacity utilisation. KSB Additive therefore does not merely sell machine hours: its offering consists of a capability, developed over many years, to take on complex parts from the raw material stage right through to a ready-to-use product – and to apply this capability, depending on the task at hand, either in its own plants or for customers.

» www.ksb.de/pod
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About the company

KSB SE & Co. KGaA, headquartered in Frankenthal, is one of the world's leading manufacturers of pumps and valves. Founded in 1871, the company employed 16,838 staff worldwide at the end of 2025. At its Pegnitz site, where more than 1,600 people work, KSB operates not only its sole European foundry but also its centre for Additive Manufacturing. Under the brand name KSB SupremeServ Parts On Demand, this expertise is also available to external customers. The range of services extends from material development and component optimisation, through reverse engineering, to the manufacture of tested production and spare parts. Facilities available for this purpose include five metal powder bed systems, systems for polymer components and an accredited materials laboratory. Areas of application include pump and valve components, heat exchangers and components for demanding industrial applications.



Large-format pellet extrusion: The Argo 1000 Hypermelt from Roboze is designed for the cost-effective production of large-volume components made from high-performance and superpolymers.

Pellets Instead of Filament

When it comes to large components made from PEEK, PEKK or Ultem™ 9085, filament-based extrusion is increasingly reaching its economic and productivity limits. With the Argo 1000 Hypermelt from Roboze, Bibus Austria, as the Austrian distributor, offers a pellet-based solution that combines high material feed rates with controlled high-temperature processing. This makes superpolymers economically viable for large-format components, moulds and small-batch industrial production in sectors such as aerospace, energy and transport.

When considering Additive Manufacturing with high-performance polymers, people usually think first of FFF (Fused Filament Fabrication) or FDM and filament printing. This approach is well established for smaller components. However, as component volume increases, material throughput, production time and material costs become increasingly important. Direct extrusion of plastic granules addresses precisely these factors. Pellets bypass the upstream production of filament and enable larger nozzle diameters as well as significantly higher material throughput rates. Particularly for industrial components larger than 500 mm, this can fundamentally change the cost-effectiveness of Additive Manufacturing.

Why pellets offer advantages for large components

One of the greatest economic advantages of Fused Granulate Fabrication (FGF) lies in the lower material costs. Pellets have been the standard in plastics processing for decades. In the conventional FFF process, the granulate must first be processed into filament and wound onto spools.



Filament or pellets? Particularly when it comes to large components, the direct processing of Ultem 9085 in pellet form offers the advantages of lower material costs and high material throughput, as enabled by the Argo 1000 Hypermelt from Roboze.

In pellet 3D printing, this intermediate step is eliminated: the granulate is fed directly into the machine's screw extruder. This difference is particularly significant for large-format components requiring substantial amounts of material. According to the manufacturer, the Argo 1000 Hypermelt can reduce the cost of large components to as little as one-fifth of the cost of filament-based production. At the same time, direct extrusion allows for larger nozzles and thus a high material deposition rate of up to 2 kg/h. Lower costs per component and shorter production times are therefore »

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The ventilation grille, additively manufactured from Ultem™ 9085 for the rail sector, has no welded seams, thereby reducing manufacturing costs and potential weak points. (Images: Roboze)

among the key advantages of pellet printing in Large Format Additive Manufacturing (LFAM).

The challenge lies in the well-known trade-off: a large nozzle increases production speed but tends to reduce the level of detail. "The decisive factor is not simply the choice between pellets and filament, but how precisely the respective process can be controlled and which method is best suited to the component. With the Argo 1000 Hypermelt, this trade-off can be specifically balanced depending on the application," explains Daniel Kopp, Team Leader for Additive Manufacturing at Bibus Austria. Nozzle diameters ranging from 0.8 to 3 mm are available for this purpose: smaller nozzles enable controlled material deposition for precise geometries, whilst larger nozzles allow for faster production of large-volume components.

Superpolymers make temperature control a key factor

With high-performance polymers such as PEEK, PEKK or Ultem 9085, the extrusion and build chamber temperatures must be precisely controlled. Their excellent mechanical, thermal and chemical properties make these materials ideal for demanding applications, but they require stable process conditions. Roboze has developed Hypermelt technology for this purpose. It combines a specialised high-temperature extruder for pellets with a heated build chamber. The Argo 1000 Hypermelt allows extrusion temperatures of up to 450 °C, whilst the 1 m³ build chamber can be heated to up to 180 °C. These controlled conditions create the ideal environment for the reliable processing of high-performance polymers. The constant build chamber temperature counteracts warping – that is, the distortion or detachment of the part from the build plate. At the same time, it slows down the cooling of the extruded material, which strengthens the bond between the layers and thus increases the part's strength.

Productivity through a continuous supply of material

Another advantage of pellet printing lies in the continuous supply of material. Whilst in filament printing the limited amount of material on the spool may require a change during long print jobs, pellets can be stockpiled in larger quantities and fed continuously. This reduces the risk of material-related printing interruptions – a key factor, particularly for components with printing times of several days. The Argo 1000 is designed for long printing runs and monitors the material level in real time. According to Roboze, printing times of more than 72 hours are possible without refilling. An industrial PLC control system with real-time diagnostics and remote access supports 24/7 operation. The Dual-Print system offers additional productivity: two independently operating extruders enable either the combination of the part material and water-soluble support material, or, in IDEX mode, two parallel printing processes.

Ventilation grilles for the rail sector: one-piece rather than welded

A specific application illustrates just how relevant these properties are in practice: a major European rail transport provider used the Argo 1000 Hypermelt to manufacture ventilation grilles made from Ultem 9085 for an environmental control system. Conventionally, these components require complex welding processes. With Additive Manufacturing, however, the ventilation grille can be produced as a single piece and does not require any potentially critical weld seams. At the same time, the digital warehouse makes

it possible to store component data rather than physical spare parts and to produce components as and when required. This reduces stock levels and shortens response times when spare parts are needed. The key figures also underline the economic potential: the production time, including post-processing, was 18 hours. Compared with the previous solution, service life increased by 150 per cent, maintenance interventions fell by 60 per cent and cost savings amounted to more than 70 per cent. The benefits extend beyond mere printing speed: the key factor is the interplay between the single-piece design, on-demand manufacturing, reduced stock requirements and high-performance materials.

Pellet 3D printing: More than just an alternative to filament

The advantages of pellet printing for large components go beyond mere production costs. "Another crucial factor is how quickly and independently companies can respond to a specific need for parts. Those who can manufacture spare parts, tools, semi-finished products or finished components themselves as and when required reduce their dependence on external suppliers and gain greater control over when and in what quantities production takes place. This flexibility becomes a strategic factor, particularly in the case of supply chains prone to disruption," emphasises Daniel Kopp. Roboze combines this approach with digital warehousing, on-demand manufacturing and the processing of high-performance superpolymers and composite materials. With the Argo 1000 Hypermelt, even complex, large-format components can be manufactured cost-effectively in-house.

Pellet printing thus becomes a tool for shortening supply chains, bringing manufacturing capacity back in-house and making a company's own value creation more flexible. As the Austrian representative of Roboze, Bibus Austria supports companies with, amongst other things, industrial pellet 3D printing. This technology complements a broad 3D printing portfolio, particularly for large-format applications and high-performance materials. The Additive Manufacturing experts provide cross-technology support, ranging from process and material selection to application development and technical implementation.

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The SmartFAB MatriX was developed in collaboration between CR-3D and automation.eXpress: a fully automated production cell with six printing units and 120 plate positions.

Automation Makes 3D Printing Predictable

3D printing can cut costs, but as the demand for parts grows, manual supervision quickly becomes a bottleneck. CR-3D and automation.eXpress know this from their many years of in-house manufacturing. Together, they have developed the SmartFAB MatriX: a modular production cell that automates print jobs and build plate changes. Their approach demonstrates how Additive Manufacturing can scale up economically and reliably supply the assembly line. By Georg Schöpf, x-technik

Adding another printer would have solved the problem for the time being. This had already happened several times at automation eXpress. Demand for parts rose, the existing machines reached their limits, so they were upgraded. Two printers became six, later ten, and eventually a whole printing farm. At some point, the question of the next machine arose. For Managing Director Daniel Schöpf, this marked the point at which he took a closer look. Although the machines could print overnight, once a job was finished, they would wait for someone to change the build plate and start the



”We need our printed parts when they are used in the assembly process. Automation makes it possible to plan this supply and reduces the ongoing administrative workload. Our aim is to have a digital warehouse from which we can manufacture various components as and when required.

Christian Reil, CEO, CR-3D



Completed construction orders are filed away and are ready for further processing. The MatriX itself incorporates around 750 additively manufactured parts.

next job. Additional printers increased the installed capacity, but the hours between the end of one job and the start of the next remained wasted.

In the tranquil town of Cham in Eastern Bavaria, Christian Reil had had a similar experience. Since 2016, his company, CR-3D, has been developing and manufacturing primarily industrial 3D printing systems there, as well as the corresponding filaments produced in-house. The production of the machines alone requires numerous additively manufactured components. At times, around ten printers were in use for this purpose, and one member of staff was constantly busy preparing the jobs and replenishing supplies for the assembly line. Two companies with different areas of expertise were thus faced with the same challenge: how can a manufacturing process, the benefits of which have long been proven, be organised in such a way that it grows in line with demand? This question led to the collaboration between CR-3D and the Tyrolean special-purpose machinery manufacturer automation.eXpress. The result is the SmartFAB MatriX, an automated production cell for filament-based Additive Manufacturing.

Demand stems from in-house assembly

At CR-3D, 3D printing is an integral part of the design philosophy behind its own machines. According to Reil, around 133 of a printer's roughly 500 components are 3D-printed. These include functional components such as brackets, housings and parts of the material feed system. The developers assess, right from the design stage, where Additive Manufacturing can be usefully applied. Given the comparatively small production runs and the variety of machine models, it offers a direct route to the required part. Design changes can be implemented at short notice, without tooling costs or the need for stock. Even a spare part for an older machine can be easily reproduced at any time using the stored data.

However, this production strategy entailed a growing organisational burden. The data was often already available, yet print jobs still had to be put together from scratch time and again. Eight identical parts on a single plate might meet one requirement, whilst the next time four of those and three other components were needed. Before the end of the working day, a job had to be prepared in such a way that it made the best possible use of the night. If an urgent part was added the following morning, the planning process started all over again. "We're not constantly designing new brackets or similar items; essentially, it's always the same parts," says Christian Reil, Managing Director of CR-3D, describing the contradiction between recurring components and recurring preparatory work.

Added to this was the question of which printer was equipped with which material and which nozzle, and whether there was sufficient stock »



The integrated printing units feature a sealed chamber and are therefore capable of processing engineering plastics reliably.

for the next job. It was possible to take holidays into account, but illness was much more difficult to manage. Nevertheless, the assembly department needed its parts by the scheduled deadline. For Reil, therefore, predictability and process reliability were the key requirements for a new solution. As soon as a printed part appears on the bill of materials, its timely availability becomes a prerequisite for the next step in the process.

From trial to firm production decision

At automation.eXpress, the journey began on a much more accessible footing. Founded in 2021, the company, based in Kundl, Tyrol, develops and builds specialised machinery. Daniel Schöpf, Managing Director of automation.eXpress, brings many years of experience in industrial plant engineering to the role; initially, he viewed 3D printing primarily as a means of producing prototypes. A young member of staff suggested purchasing an affordable printer and demonstrated, through initial applications, what could be achieved with it in the workplace. When the need for a second machine arose, concrete comparisons with conventionally manufactured parts were already available. This changed the assessment: what had been an interesting supplementary technology became an opportunity to reduce costs and procurement efforts in mechanical engineering.

Schöpf commissioned a targeted search for further applications. This covered both components that had previously been machined and those purchased from suppliers. A single holder saves only a small amount. However, if the application was repeated many times on a single production line and further suitable parts were added, this resulted in a significant economic benefit. Variants could be designed to fit the installation situation exactly. "This has now become an integral part of our manufacturing process," emphasises Daniel Schöpf. Even at the design stage, a decision is made as to which parts should be 3D-printed and which should be manufactured conventionally. This decision also increases the commitment required for the process. A printed bracket intended for assembly must be ready on schedule. It is no longer sufficient that a component can, in principle, be produced using Additive Manufacturing. The company must also be able to actually call off the required quantity. This is where the gradual addition of further individual printers reached its limits.

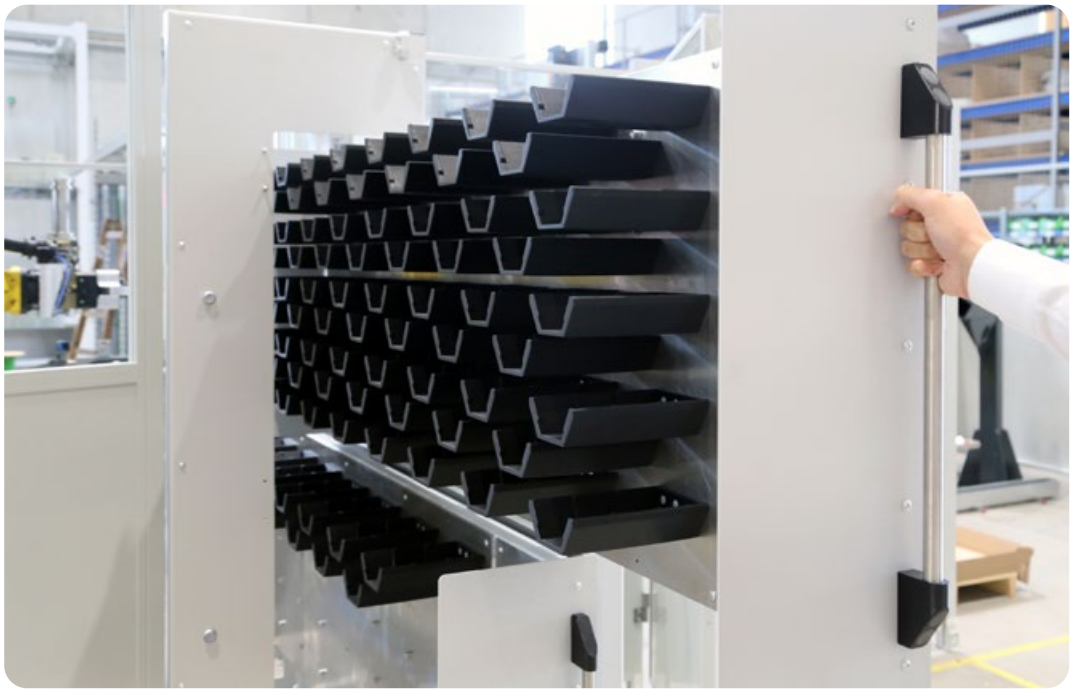
Additional machines offer only limited scalability

Schöpf's calculation was based on this idle time. Assuming an average print job of six hours, he compared the existing working method with an operation in which the next job starts immediately after one has finished, even at night and at weekends. Under the conditions considered, this resulted in a ratio of 6 automated printers



"3D printing has become an integral part of our mechanical engineering operations. As demand for parts grows, we must make the most of the available printing time. In doing so, we take a holistic approach, from raw materials right through to the finished product.

Daniel Schöpf, CEO, automation.eXpress GmbH



automation.eXpress uses the manufacturing cell to produce components for specialised machine construction. **In 2025 alone, this resulted in the production of approximately 45,000 parts.**

to around 18 manually operated ones. The scale of this figure is dependent on the assumptions regarding running times and operation. However, it explains why the automation specialist saw the key to improvement in the transition between jobs. For this to happen, a printing unit does not need to work faster, but rather needs to be in productive operation more frequently.

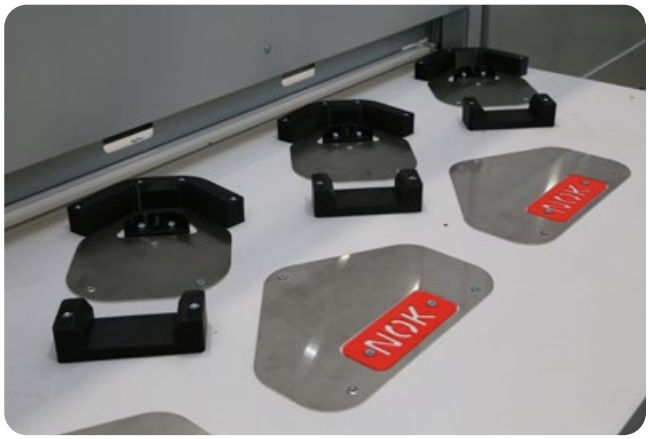
This makes a significant difference in terms of cost-effectiveness. Particularly with short and medium-sized jobs, the downtime until the next operator intervention can consume a great deal of available time. A job that finishes at two o'clock in the morning leaves the rest of the night unused. Having more machines can partially offset this loss, but in turn requires floor space, supervision and investment. Automation, on the other hand, unlocks capacity that has previously remained unused. At automation.eXpress, the labour required for 3D printing was reduced by around 80 per cent. The benefit is therefore not limited to large production runs. Both companies require varying components, often just a few units of a particular variant. In this context, production capability means consistently supplying the right parts in the required quantity and quality. A continuous production process must also be able to handle small batches, rather than deriving its cost-effectiveness solely from the repetition of a single component.

Two areas of expertise combine to form a single system

automation.eXpress initially began by developing its own automation system based on existing printer technology. An initial cell was set up and used for in-house production. However, during integration, the limitations of equipment designed as stand-alone machines became apparent. To achieve an industrial solution capable of long-term development, the company therefore sought a partner who develops their own printing technology and can implement the necessary adaptations immediately. Through social media, they came into contact with Christian Reil, who has been working on the automation of 3D printing since 2017. This brought together two companies that had been working independently towards the same goal. In autumn 2025, the joint development project took shape.

The partners brought a range of expertise to the table. CR-3D was familiar with the Additive Manufacturing process, the materials and the requirements for a reliable printer. automation.eXpress contributed its knowledge of integrated manufacturing, control technology and the implementation of a complete production line. "We told him that we needed a simple way to remove the print bed," explains Daniel Schöpf, referring to one of the many requirements put to Christian Reil. This led to the development of a customised lifting unit. Mechanical and electrical interfaces, as well as the data to be exchanged, were also defined jointly. The printers thus became units that could be integrated into an overall system.

For CR-3D, the modular design of the existing C-Series proved helpful. The systems were adapted to the new requirements. Their overall height »



AX benefits from a high degree of flexibility and **just-in-time parts supply.**



Even brackets that appear unremarkable at first glance offer significant added value in **demand-driven component provision.**

was reduced and certain housing components were omitted; the material supply system could largely be retained. The integration included provision for maintenance access and a safety concept. automation.eXpress successfully implemented the system, including documentation and operating instructions, as a mechanical engineering project.

Automation requires a stable printing process

However, an automatic plate-changing system alone would not have solved the problem. It must be possible to print reliably on every newly loaded plate. Reil points to the advances made in automatic calibration and bed measurement. With the Plus series and its own electronics, CR-3D has developed functions in which the nozzle tip itself is used for measurement. This is the only way to ensure a reliably continuous process.

In their design, the partners focused on small and medium-sized components, which require comparatively frequent job changes. Very large components with long print times are still best produced on separate machines. The MatriX print units can be equipped with C2-IDEX+ technology, featuring two independently moving extruders. Their enclosed build volumes enable the processing of engineering plastics such as TPU, ABS and fibre-reinforced materials. The solution is therefore aimed at functional industrial components with varying material requirements.

In the basic configuration, six printing units operate within the MatriX. Each printer is assigned a material supply unit with space for two 10-kilogramme spools. A shuttle system moves between the printing units and the panel magazine, retrieving finished panels and feeding in new ones. There are 120 magazine slots provided for empty panels. The height of the components is automatically taken into account during placement. Lasers monitor the loading and help to prevent collisions during storage.

The operator is assigned a fixed workstation

The economic benefit also stems from the fact that the remaining manual tasks can be consolidated. When operating individual machines, the operator must repeatedly move to a different printer at the appropriate time. In an automated cell, building panels and material stocks can be made available for a longer period. Reil describes a possible operational scenario in which an employee stocks the system once a day, removes finished panels and then goes on to carry out other tasks. The specific application determines how much time this takes. The organisational benefit lies in being able to schedule this work, rather than having the daily routine depend on the completion times of individual print jobs. “And it is this simplicity and predictability that I want to convey,” Reil summarises.

Expertise in material selection, component design and job preparation remains essential, but does not need to be applied anew at the machine for every repeat order. This is particularly beneficial when Additive Manufacturing is managed alongside other tasks. As soon as it begins to supply the assembly line on a regular basis, it requires an organisational structure that is independent of the constant intervention of a single specialist. This modularity extends to maintenance. Individual components can be removed from the system for maintenance or replacement, whilst the rest continue to operate. If one printer fails, another can take over the job, provided it is ready with the appropriate material and the necessary set-up. This redundancy reduces dependence on a single device. Nevertheless, reserves and potential disruptions must still be taken into account to ensure robust scheduling. Automation creates better conditions for this, but it is no substitute for realistic production planning.

From parts catalogue to digital warehouse

The MatriX Cockpit consolidates orders within a single interface and runs locally on the production line.

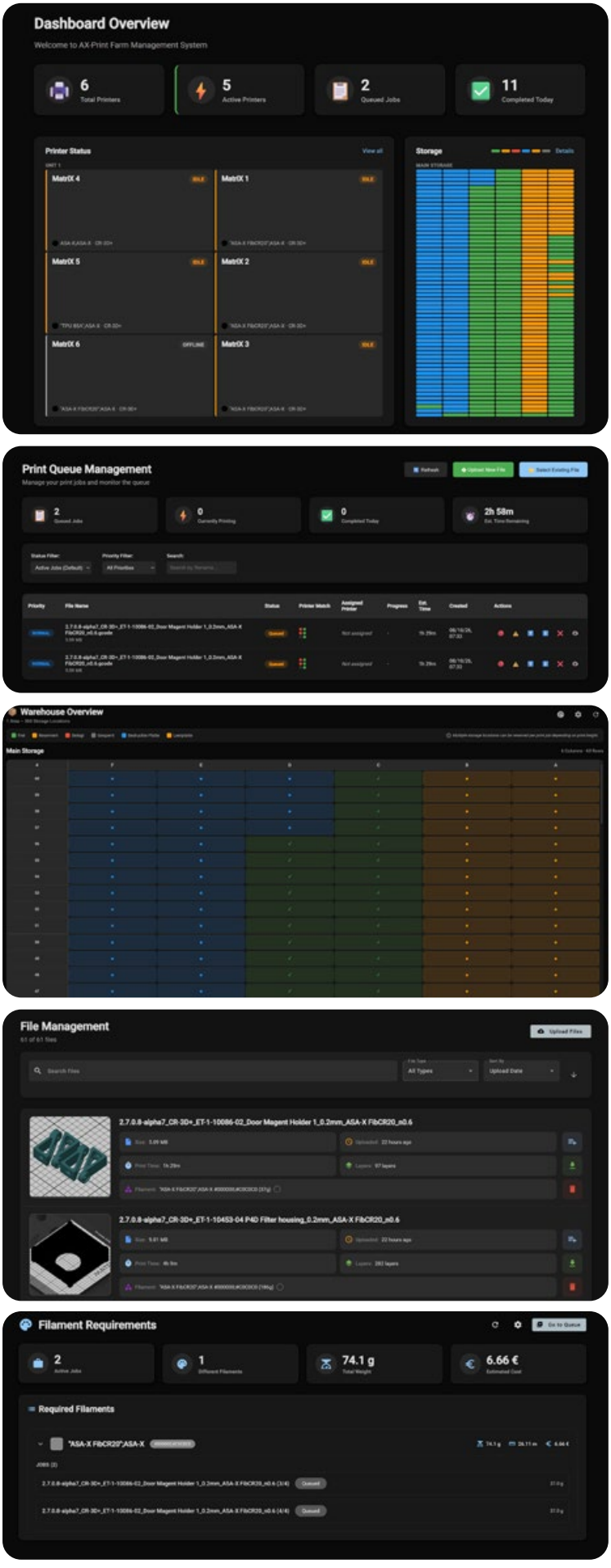
Recurring parts are stored in the system, required quantities are ordered and priorities are assigned. Reil explains: "In machine assembly, not all components are required on the day the order is placed. Some are used early on, others only weeks later. If they are all printed immediately, they end up back in the warehouse for the time being. The alternative is to use the actual assembly date as the starting point for Additive Manufacturing and to make the part available shortly before it is needed. For us, this is the digital warehouse." Reil cites the direct integration of the company's own ERP system as the next step. Parts requirements are to be transferred from the overarching production planning system to the Cockpit. Centralised order management is already in place, but full integration into the operational information flow is part of the ongoing development.

The process chain continues beyond the printer

Daniel Schöpf has regarded the automated printing cell from the outset as the basis for further manufacturing steps. "Printing on its own is great, yes, but there are many downstream manufacturing steps missing," he notes. For an industrial order, simply providing a printed plate is not enough. The component must be inspected, marked or placed into a container. Where several manual stations then follow, new handover points and additional effort arise. That is why the concept provides for the integration of additional technologies into the system.

These technology modules are initially to be presented visually at Formnext. They include concepts for measurement, laser marking and packaging. According to Schöpf, an adhesive bonding process could also be an application-specific extension. These extensions are currently under development, with the complete production line being the stated goal. In future, users should be able to implement more advanced requirements for a ready-to-use product within the system. Printing capacity can be expanded by linking several MatriX systems together. The basic concept also takes into account containerisation for transport and potential mobile applications.

» www.cr3d.de
» www.automation.express
formnext Hall 12.1, Booth E131



The MatriX 'Cockpit' is the system's central control interface and can be operated both locally and via a web interface.



Hyundai uses high-speed sintering exactly for the purpose for which the technology was designed: **full-scale, functional components.**

Hyundai Prints Door Panels in One Piece

At the Namyang R&D Centre in South Korea, Hyundai is now producing fully functional, full-scale polymer components – including complete door panels – in a single printing process. This is made possible by two ExOne VX1000 HSS machines: large-format systems for the high-speed sintering of PA12, which are among the largest polymer 3D printers on the market.

Additive Manufacturing is nothing new to Hyundai: the group has been using 3D printing since 1996. At its Namyang site, the newly established Additive Manufacturing Solutions team now brings together a wide range of additive technologies. It supports pre-production with test parts, manufactures small batches and prototypes for research – and steps in when parts with long lead times are urgently needed, parts which would conventionally require a dedicated mould. It is precisely in such cases that every day a component becomes available sooner counts.

Large parts, fewer joints

With its investment in High Speed Sintering, Hyundai is pursuing a clear objective: to manufacture large components quickly and, where possible, in a single piece. After all, assembling a large component from several segments incurs additional assembly costs, and every joint brings its own tolerances, which accumulate across the entire assembly. A component produced in a single print avoids these chain of tolerance errors from the outset.

Furthermore, the printed parts are genuine, functional components, not merely demonstration models. Complete components can thus be validated at their actual size: fit, feel and assembly feasibility are tested on the real component rather than solely on the digital model.

"Hyundai is using High Speed Sintering exactly as we designed it: to produce fully functional, full-scale components. Manufacturing large polymer components with dimensional accuracy and reproducibility, print after print, is one of the most challenging tasks in polymer 3D printing. We have solved this problem – and as a result, Additive Manufacturing is becoming a tool that development teams in the automotive industry can rely on in their day-to-day work," explains Eric Bader, CEO of ExOne Global Holdings.

How High Speed Sintering works

In the HSS process, a print head selectively applies an infrared-absorbing ink to the PA12 powder – precisely where the component is to be formed. A sintering lamp then fuses the printed areas layer by layer, whilst the unprinted powder remains loose.



With a build volume of 1,000 x 550 x 190 mm , the VX1000 HSS is ideal for large-format components.

PA12 is a high-performance thermoplastic that is widely used in industrial Additive Manufacturing.

The final properties of the component depend primarily on uniform, precise temperature control – a particular challenge when working with a large build volume. Even slight temperature variations within the build volume can affect dimensional accuracy and strength. The VX1000 HSS is designed to precisely control the temperature across the entire build volume.

With a build volume of 1,000 x 550 x 190 mm, the system can accommodate even large-format components. A high-performance print head with 8,000 nozzles ensures high print speeds and can even produce an entire door panel in a single print run. For development teams, this has tangible benefits: development cycles are shortened from weeks to days, development costs are reduced, and geometries are created that cannot be produced using conventional methods. The design freedom thus extends far beyond prototyping and toolmaking.

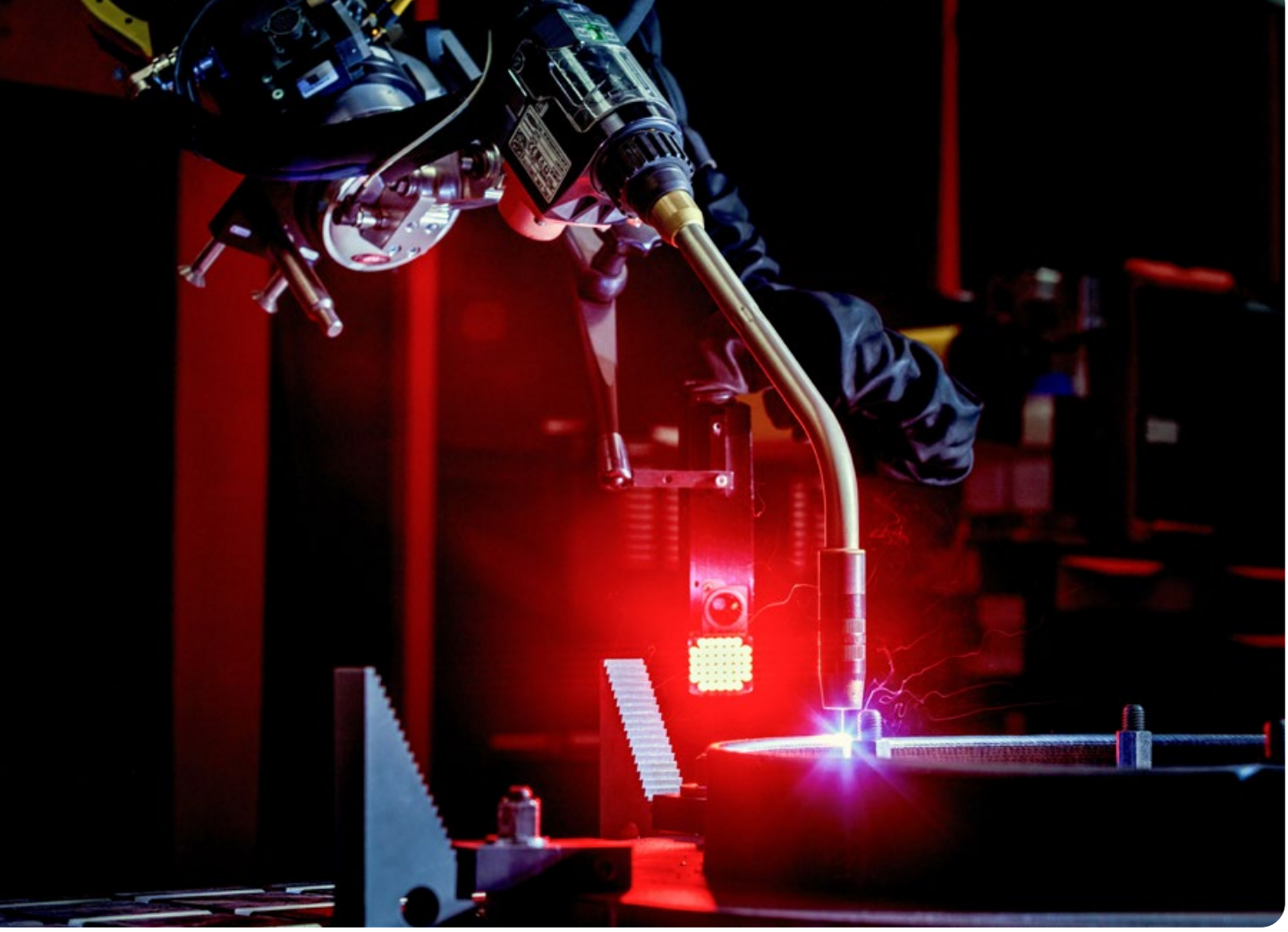
Designed for availability

In day-to-day development work, alongside component quality, the most important factor is that the equipment is available. Both systems are therefore designed to require minimal maintenance: replacing the sintering head or a print module is a routine task. The machines provide process data in real time, enabling operators and manufacturing systems to continuously monitor the printers and integrate them into existing production environments. This means that deviations are detected at an early stage, rather than only once the finished component has been produced. A live video stream also provides insight into the ongoing printing process at any time.

At Hyundai, both VX1000 HSS machines share a unpacking station and a central powder supply system, which can be flexibly integrated into a variety of manufacturing and R&D environments. This is particularly advantageous when both machines are working in parallel on very different jobs. Powder that has not been sintered in a build job can be reprocessed and reused – an important factor in terms of material costs and resource efficiency. "The intelligent powder management system balances out very different build jobs and utilisation rates, and consistently supplies both machines with high-quality powder. This enables the team to work with up to 80 per cent recycled powder without compromising on component quality," explains Alfred Griesser, Deputy Head of Research & Development at ExOne.

Operations are supported by ExOne's global service network, which ensures production reliability throughout the entire lifecycle of the systems. A large build volume, a stable process and high availability thus work in tandem – the prerequisites for daily use in vehicle development. For Hyundai, this means that large polymer components are no longer the exception, but a reliable part of the development process.

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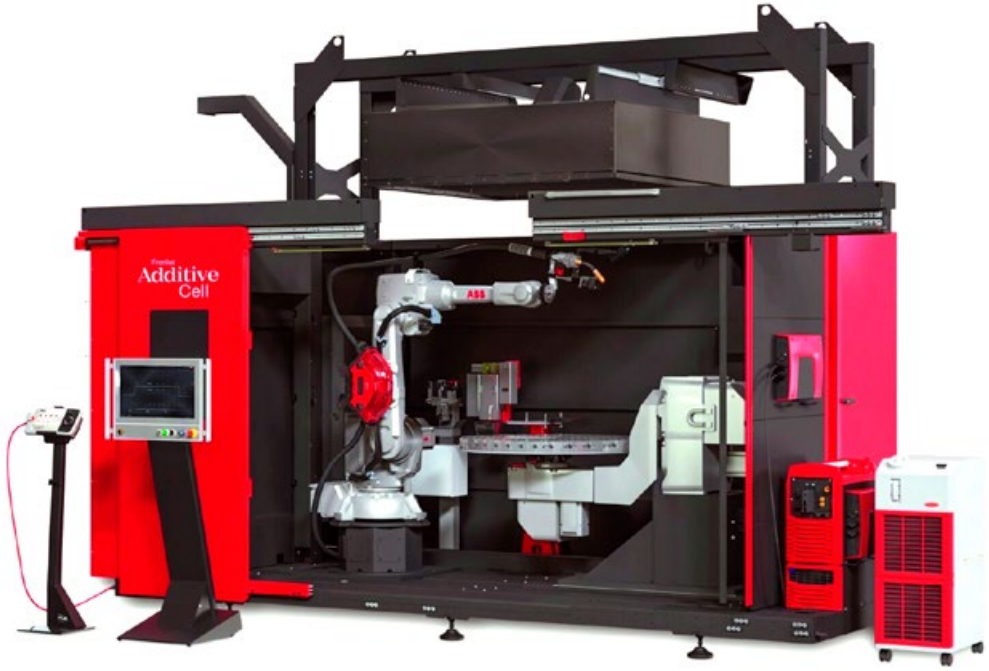
Additive Manufacturing enables **optimised component geometries** and reduces resource consumption.

Additive Manufacturing, Software and Automation Combined

Whether it's a spare part, a prototype or a complex one-off component: Wire Arc Additive Manufacturing (WAAM) is becoming increasingly important in industry. With its new Additive Cell, Fronius combines state-of-the-art CMT welding technology, intelligent process control and user-friendly software into a comprehensive system that makes the production of high-quality metal components easier, faster and more resource-efficient. The technology company is thus underlining its expertise and position as a provider of comprehensive solutions in the field of Additive Manufacturing.

The demands placed on modern manufacturing processes are constantly increasing. Shorter development cycles, maximum material efficiency and the cost-effective production of complex geometries are in greater demand than ever. From the aerospace and oil and gas industries to pressure vessel construction, the rail vehicle and automotive sectors: many industries require bespoke, individual solutions and spare parts that are available at short notice. This is precisely where Additive Manufacturing comes into its own. With metal 3D printing, components are created virtually from scratch. Compared with conventional production processes such as casting, machining or milling, these components keep material and cost expenditure low. "WAAM enables decentralised, location-independent manufacturing without the need for complex production lines. Even complex geometries can be built to the highest quality without wasting valuable material," summarises Manuel Stinglmayr, Business Development at Fronius International GmbH.

A stable welding process that enables uniform layer build-up is crucial for achieving the desired quality in Additive Manufacturing using Directed Energy Deposition-Arc (DED-Arc). The CMT Additive PRO, which is based on the Cold Metal Transfer (CMT) process developed by Fronius, is particularly well suited to this. This comparatively



The Fronius Additive Cell is a perfectly coordinated end-to-end system for additive manufacturing.

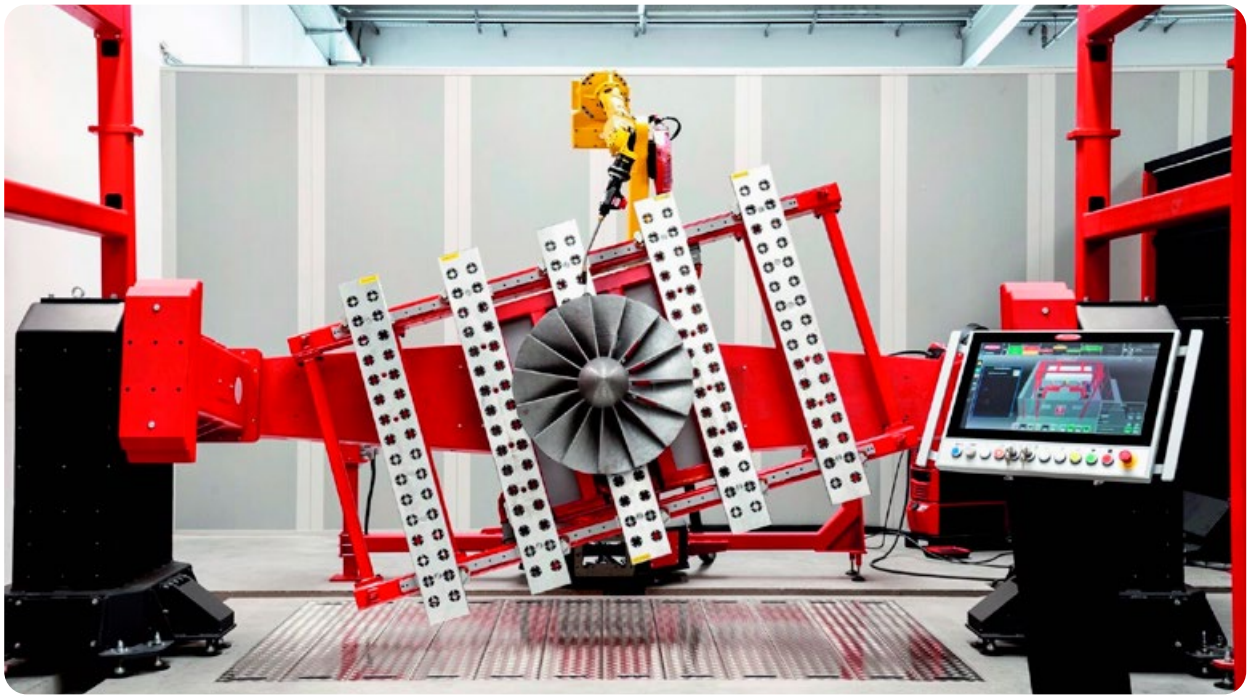
cool short-arc process impresses with its high deposition rate – compared to other additive processes – whilst maintaining low heat input. The CMT Additive PRO characteristic curves are specifically tailored to the requirements of Additive Manufacturing. Features such as a melt rate stabiliser, Pulsed HotStart, CTWD measurement and power correction ensure a stable process. "The CMT Additive PRO functions ensure uniform and, above all, predictable »

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At the Fronius Prototype and Manufacturing Centre, the Fronius team of experts offers a comprehensive range of services of the highest standard for Additive Manufacturing.

layer build-up across the entire component. This significantly reduces scrap and the effort required for any rework," emphasises Manuel Stinglmayr.

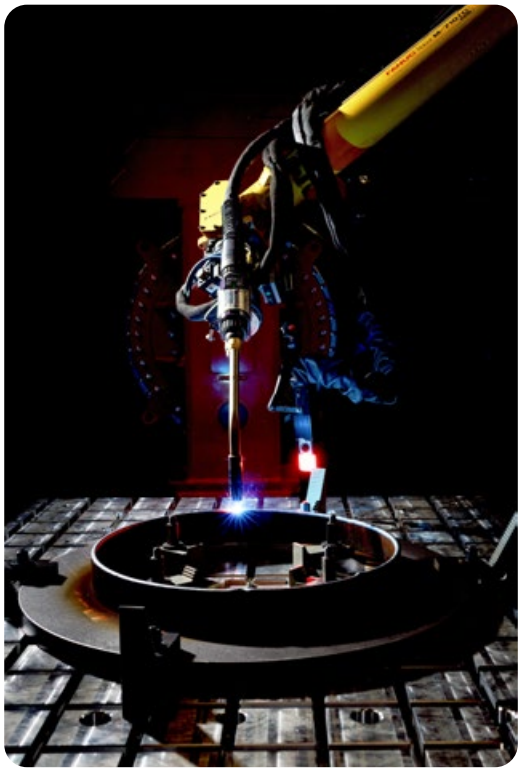
Flexibility for bespoke welding solutions

For many companies, Additive Manufacturing presents numerous challenges. Compared with traditional manufacturing techniques, however, material waste is significantly lower and there is no need for complex moulds or tools, nor for long lead times. With the new Fronius Additive Cell in particular, printing of the first components can begin quickly. The Fronius Additive Cell is a perfectly coordinated complete system developed by Fronius to meet the industry's requirements. Within the welding cell, the CMT Additive PRO, in combination with the Fronius iWave, ensures a precise welding process. The Polaris system control unit manages all processes. "The Additive Cell combines tried-and-tested welding technology, intelligent control and Fronius's many years of welding expertise. All components are perfectly coordinated, resulting in a stable manufacturing process," says Anna Dieplinger, Key Product Manager for Additive Manufacturing, Automation & Digital Solutions at Fronius International GmbH.

The Fronius Additive Cell comprises not only the hardware but also the specially developed Vectris software bundle. Vectris combines the Machine Tool Service KIT (MTSK) and the post-processor within a central platform. Many years of experience and the extensive knowledge of the Fronius team of experts have gone into its development. The result is software specifically tailored to Additive Manufacturing with the Fronius Additive Cell. In addition to an integrated kinematic model, an adapted user interface and validated welding operations for additive processes, it also features geometry-based recognition of different component regions. This enables flexible process parameter input for, for example, outer walls, infills or component joints. Thanks to the FroArc welding command integrated into the post-processor, these so-called 'build styles' are translated directly into code for the welding robot, and the system switches to the correct welding parameters at exactly the desired point without delay. The complete system comprising the Fronius power source and software ensures a simple, stable and reliable welding process.

360° service for Additive Manufacturing

The Fronius Additive Cell and WAAM have a wide range of applications. These range from reverse engineering and the optimisation of existing components to the design of new ones. Whilst reverse engineering is particularly useful for repairs, original parts that are no longer available or missing CAD data, redesigning components allows for optimised component geometries. Both contribute to greater long-term efficiency and cost-effectiveness in manufacturing. To meet these and other requirements, Fronius offers a comprehensive range of services at its prototyping and manufacturing centre – from initial consultation and feasibility studies through to process development and production. Fronius also develops, tests and certifies the optimal welding and pressure parameters for the



The comparatively cool CMT Additive PRO short-arc process impresses with its high deposition rate and low heat input.

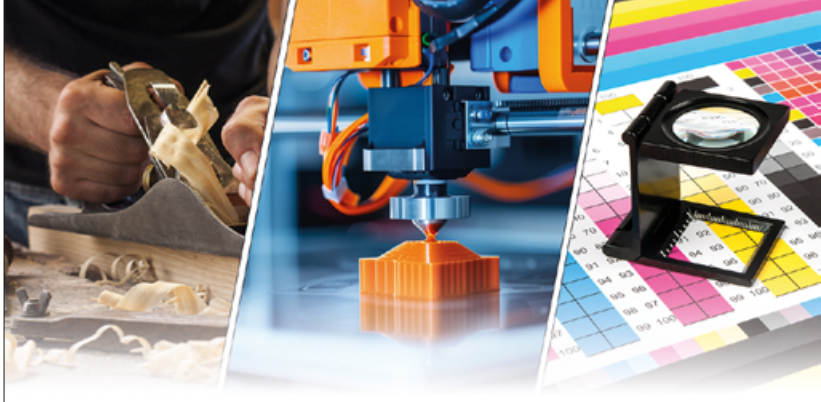
respective target materials. These finalised and validated 'recipes' can be licensed directly for in-house production, enabling production to start immediately. As part of its comprehensive 360° service offering, Fronius can also, on request, take on the complete process engineering for Additive Manufacturing projects. Companies benefit from expert knowledge, state-of-the-art development capabilities and certified solutions, without having to take on any risk themselves.

Technological expertise as a key to success

With decades of experience in welding technology, Fronius has a unique foundation for Additive Manufacturing in the industrial sector. The continuous development of CMT, together with comprehensive application and process expertise, makes Fronius a strong partner for a wide range of Additive Manufacturing applications.

Anyone wishing to see the new Fronius Additive Cell and the full range of 3D solutions for themselves will have the opportunity to do so from 17 to 20 November 2026 at Fromnext in Frankfurt am Main, Stand B59, Hall 12. Fronius experts will be on hand to present the Fronius Additive product and service portfolio and will be happy to discuss your requirements in person.

» www.fronius.com
formnext Hall 12.0, Booth B59



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Titanium Prostheses from Own Production

In the US, over 45,000 people lose a finger every year. Providing them with prosthetic fingers that are both functional and durable is a challenge that pushes traditional manufacturing methods to their limits. Point Designs has dedicated itself to this task. The Colorado-based company develops high-quality, customised prosthetic fingers that restore patients' ability to perform everyday tasks. To achieve this, Point Designs relies on metal 3D printing from One Click Metal, enabling it to take full control of the manufacturing process.

Point Designs was founded in 2016 by researchers at the University of Colorado's Biomechatronics Development Laboratory. The focus was clear: high-quality, bespoke solutions for people who have lost part of their hand. Initially, the company worked with external manufacturing partners. These partners 3D-printed the complex titanium finger components to specification. Whilst this enabled a rapid entry into the market, it created growing problems. As Point Designs' demands grew, so did the frustration over reliance on external suppliers.



The titanium components form the structural and functional framework of Point Designs' finger system.

Outsourcing complex titanium components was expensive, particularly for small production runs or frequent design changes. Long lead times compounded the high manufacturing costs. Reliance on third-party suppliers often led to unpredictable delays and rising storage costs. Another bottleneck was the limited design freedom: rapid iterations and testing of new concepts were virtually impossible without additional delays and costs. Added to this were real risks to intellectual property. Outsourcing the manufacture of sensitive designs meant a lack of control over proprietary technologies and an increased risk of IP leaks.

For a growing company keen to drive forward ambitious product developments, these limitations were becoming increasingly critical. The ability to manufacture fingers quickly, reliably and in-house became a necessity. Point Designs needed a solution that would enable the mass production of highly technical components directly at its own site.

Shortcut

Task: Cost-effective in-house series production of around 1,500 precision titanium components per year for functional finger prostheses.

Material: Titanium.

Solution: Metal 3D printing system from One Click Metal based on Laser Powder Bed Fusion (LPBF) technology.

Benefits: 50 per cent shorter lead times; 74 titanium components in 16 hours; lower manufacturing and logistics costs; greater design flexibility and complete control over manufacturing processes.



The One Click Metal system also enables **cost-effective batch production with minimal material wastage.**

The application: Heavy-duty prosthetic fingers made of titanium

Point Designs' prosthetic fingers are subjected to heavy loads. Not only must they be lightweight and precision-manufactured, but they must also function reliably every day: when gripping, holding and pressing. The titanium components form the structural and functional framework of the finger system. They enable smooth articulation and a robust locking system that withstands the daily demands of medical use.
The requirements are demanding: titanium components must be durable, lightweight and manufactured to extremely high precision. Point Designs required around 1,500 of these components per year in series production.

The solution: in-house metal 3D printing

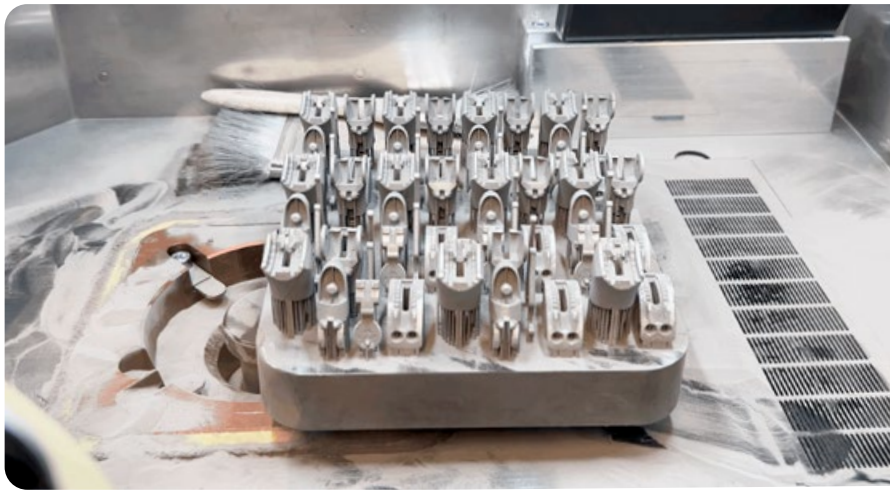
Point Designs opted for a metal Additive Manufacturing system from One Click Metal, based on laser powder bed fusion (LPBF) technology. This investment gave the team the flexibility to manufacture components directly from finalised CAD data, without having to rely on external suppliers. The result: greater control over production, significantly shorter lead times and stronger protection of intellectual property.

Smart manufacturing in real time

A complete build plate containing 74 finger components, comprising 11 assemblies, can be printed in just 16 hours. Thanks to intelligent design and optimised component orientation, support structures are reduced to a minimum, which speeds up post-processing and assembly. The end result is components that are not only lightweight and precisely manufactured, but also mechanically robust enough for everyday use. The combination of titanium and the precision of metal 3D printing enables Point Designs to meet the stringent functional and durability requirements of prosthesis users. »

Technical specifications

- **Component function:** Heavy-duty prosthetic finger
- **Material:** Titanium
- **Technology:** LPBF with a 200 W fibre laser
- **Layer thickness:** 30 µm
- **Build time:** 16 hours per plate
- **Components per plate:** 74 (11 assemblies)
- **Annual volume:** approx. 1,500 components



A complete build plate comprising 74 finger components, which make up 11 assemblies, can be printed in just 16 hours.



The MPrint, the most affordable printer in the One Click Metal range, combines ease of use with powerful printing features.



The MPure ensures the safe and precise unpacking and screening of parts.

The results: Measurable improvements

The switch to in-house production using metal 3D printing has brought significant improvements for Point Designs. Delivery times have been reduced by 50 per cent. Whilst the company was previously dependent on external manufacturing partners and had to contend with delays that were difficult to predict, finger prostheses can now be further developed, printed and assembled within a few days. At the same time, the elimination of external manufacturing fees and logistics costs has led to considerable savings. The One Click Metal system also enables cost-effective batch production with minimal material wastage.

A further advantage lies in the greater design freedom. Additive metal manufacturing enables the production of complex and organic geometries that would be very difficult or impossible to achieve using conventional machining processes. This has enabled Point Designs to optimise the balance between weight, strength and anatomical fit, thereby improving both the functionality and the comfort of the prostheses. Furthermore, in-house manufacturing gives the company complete control over its designs and production processes. This reduces the risk of unintended disclosure of intellectual property and enables shorter innovation cycles and faster design adjustments whilst maintaining confidentiality.

Excellent ROI

The cost-effective One Click Metal system solution, with its compact footprint, is perfectly suited to small and medium-sized enterprises such as Point Designs. As the finger components are small, the build plate is ideally suited to the requirements. The machine requires minimal infrastructure and fits within limited budgets, whilst delivering an excellent return on investment.

Outlook: Bespoke manufacturing is becoming the norm

The case of Point Designs is a prime example of how Additive Manufacturing is transforming medical technology. Particularly when it comes to complex requirements, it enables solutions that cannot be achieved using conventional methods.

In the long term, this could lead to a paradigm shift: away from standardised components and towards individually optimised solutions, supported by Additive Manufacturing. In the field of prosthetics, this means fewer compromises and a better quality of life for patients.

» www.oneclickmetal.com
formnext Hall 12.0, Booth C101

User

Point Designs, a US-based company headquartered in Broomfield, Colorado, develops and manufactures functional finger and thumb prostheses for people who have undergone partial hand amputations. The company, which grew out of the Biomechatronics Development Laboratory at the University of Colorado, utilises Additive Manufacturing, amongst other technologies, to produce robust, customised prosthetic solutions. In addition, Point Designs offers clinical services for the fitting and provision of prostheses.

www.pointdesigns.com



MPA builds up metal layer by layer without melting it. The particles undergo plastic deformation on impact and bond firmly to the workpiece.

Additive Manufacturing and Direct Machining

Building up metal, milling and integrating complex cooling structures: Hermle's MPA process combines Additive Manufacturing with 5-axis machining. Metal particles are not melted, but plastically deformed. This enables the production of large-volume components with low residual stresses in a single clamping operation.

In the MPA process (metal powder deposition), a carrier gas accelerates metal particles to supersonic speeds through a Laval nozzle. Upon impact, the particles undergo plastic deformation and bond with the substrate. The material does not melt. As a result, stresses remain comparatively low even with substantial build-ups.
The deposition unit is integrated into a Hermle 5-axis machining centre. Users deposit material and machine it in a single set-up. The 5-axis kinematics enable Additive Manufacturing on curved free-form surfaces. The large working area is suitable for components measuring up to 600 x 600 millimetres and weighing several hundred kilograms.



Hermle's MPA technology is a kinetic spraying process that compacts metal powder layer by layer into solid bodies.

Integrating targeted cooling into the tool

A key application lies in tool and mould making. MPA enables cooling channels that closely follow the contour, with large diameters, long channel runs and any spatial orientation. To achieve this, pre-milled channels can first be filled with a water-soluble material. Once the surface contour has been prepared, the nozzle applies a steel jacket, and the component is then milled into its final shape following heat treatment. The cooling follows the component's surface and can reduce the cycle time during injection moulding. For customer components, this has resulted in time savings of up to 45 per cent compared with moulds without efficient cooling.

Combining materials, integrating functions

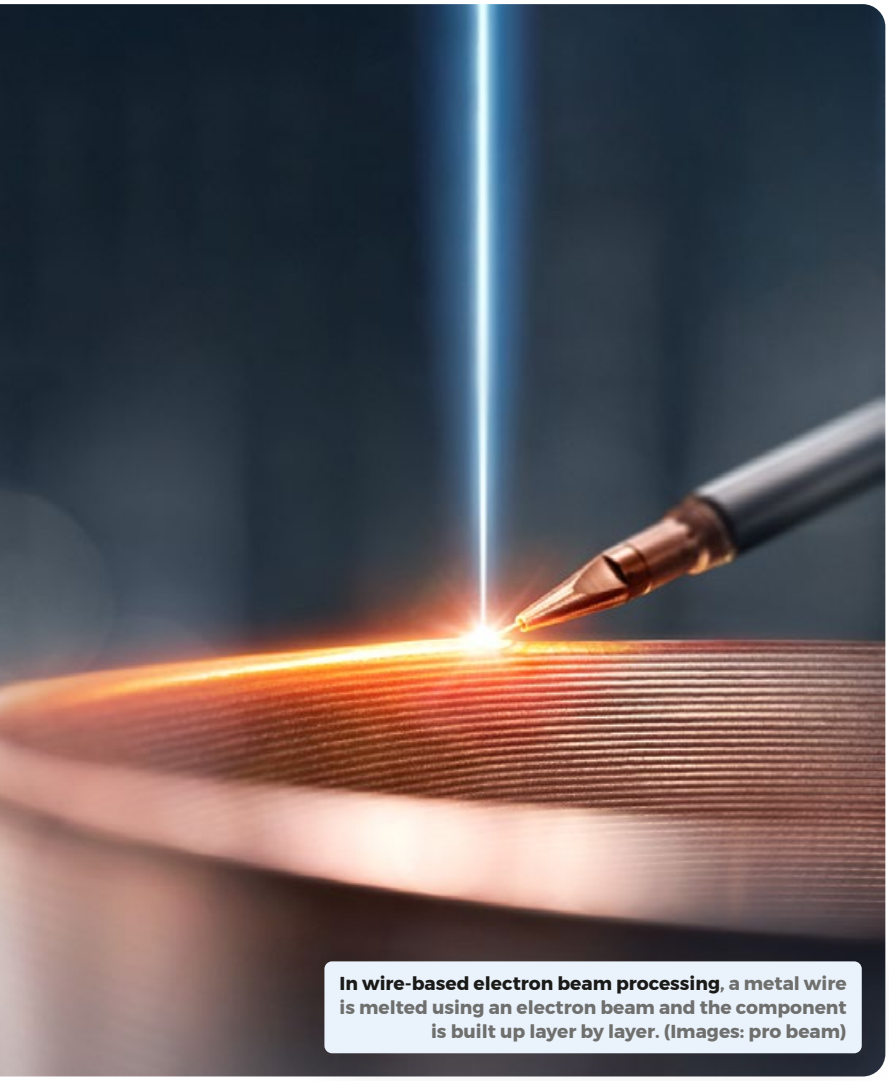
MPA processes, amongst other materials, hot- and cold-work steels, stainless steels, Invar, pure iron, pure copper and bronze. Depending on the physical constraints, different materials can be combined within a single component. The composite material consisting of copper and steel utilises the dimensional stability and durability of the steel, as well as the high thermal conductivity of pure copper. Material gradients, heating elements and thermal sensors are also possible. Hermle provides MPA Studio for process planning. The CAD/CAM software calculates and simulates the tool paths for material deposition and machining. It also supports the adaptation of the component geometry to the planned structure.

» **www.hermle.de**

Printing large components using less energy

High energy consumption, long production times and labour-intensive post-processing: for large metal components, Additive Manufacturing has often not been cost-effective to date. To overcome this obstacle, the wire-based electron beam process WEBAM (Wire Electron Beam Additive Manufacturing) tackles three key areas simultaneously – thereby opening up even challenging materials such as copper for Additive Manufacturing.

13 kilograms of pure copper per hour with WEBAM – deposition rates on this scale are pushing the boundaries of what is economically viable in Additive Manufacturing. Although AM has been regarded as a technology of the future for years, it is not yet widely used for large metal components.



In wire-based electron beam processing, a metal wire is melted using an electron beam and the component is built up layer by layer. (Images: pro beam)

Whether an additively manufactured component is cost-effective is often determined by three factors: energy consumption, build time and post-processing. It is precisely in these areas that the wire-based Additive Manufacturing process WEBAM, utilising an electron beam, comes into its own. The electron beam specialist pro beam is already using the process on an industrial scale for components measuring up to a metre in size.

Energy consumption reduced to a third

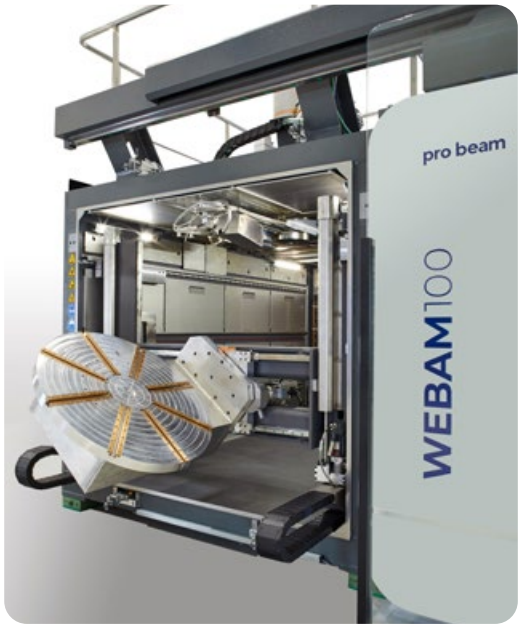
The electron beam generates and transmits its energy without losses due to reflection, scattering or optical components in the beam path. Laser-based processes, by contrast, lose a considerable proportion of the input energy, particularly when dealing with highly reflective metals such as copper. Comparative studies quantify the difference: WEBAM requires only around a third of the energy used by laser-based AM processes. Emissions across the entire process chain are also around three times higher with laser AM. This brings components made of copper and other highly reflective, good thermal conductors within reach – materials that can only be processed to a limited extent using lasers.

High deposition rates, short cycle times

As well as efficiency, speed is key. The electron beam operates at high power and energy density: systems such as the WEBAM 100 achieve up to 9 kW with a build volume of around 2 m^3. This allows wires with a comparatively large diameter of 1.6 mm to be melted at high feed rates. When building cylindrical components, deposition rates of up to 13 kg/h were achieved with pure copper, 11.9 kg/h with Inconel 718 and 6.4 kg/h with Ti-6Al-4V. These figures are significantly higher than those typically seen in Additive Manufacturing and directly reduce lead times.

Two-thirds less machining

Semi-finished products built close to the final contour require significantly less machining than components made from solid material. The effect is even greater when the material is deposited additively not onto a simple geometry such as sheet metal or a bar, but onto a substrate that is already close to the final contour. First, several sheets are joined using electron beam welding to form a substrate with a shape close to the final contour; the additive segments are then



The WEBAM 100 combines a build volume of around 2 m³, a 6-axis kinematic system and up to 9 kW of power for the manufacture of large, complex components.

applied to this. For a component manufactured in this way, the amount of material requiring machining was reduced by two-thirds. For alloys that are difficult to machine, such as titanium or Inconel, this means noticeably less tool wear and lower machining costs.

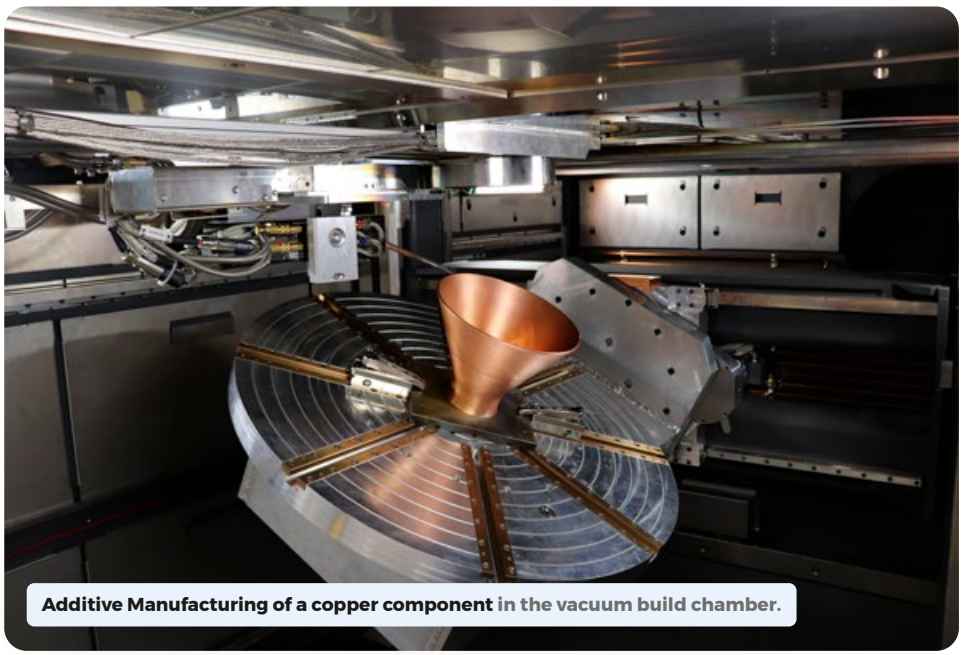
Keeping thermal warping under control

Thin substrates save on material, but are prone to thermal warping during Additive Manufacturing. There are two ways to counteract this: a CNC-controlled flip-frame device flips the component over after each layer without interrupting the vacuum, thereby building up both sides of the substrate plate alternately. With single-sided build-up, on the other hand, the thermal behaviour of the component and substrate can be precisely controlled under vacuum. Relaxation processes within the material relieve residual stresses, resulting in a noticeable reduction in warpage.

Focus on cost-effectiveness

Energy consumption, build time and rework: WEBAM thus addresses precisely those factors that have frequently caused Additive Manufacturing of large metal components to fail in the past. pro beam will showcase the latest developments relating to the process at Formnext 2026.

» www.pro-beam.com
formnext Hall 12.0, Booth C131



Additive Manufacturing of a copper component in the vacuum build chamber.

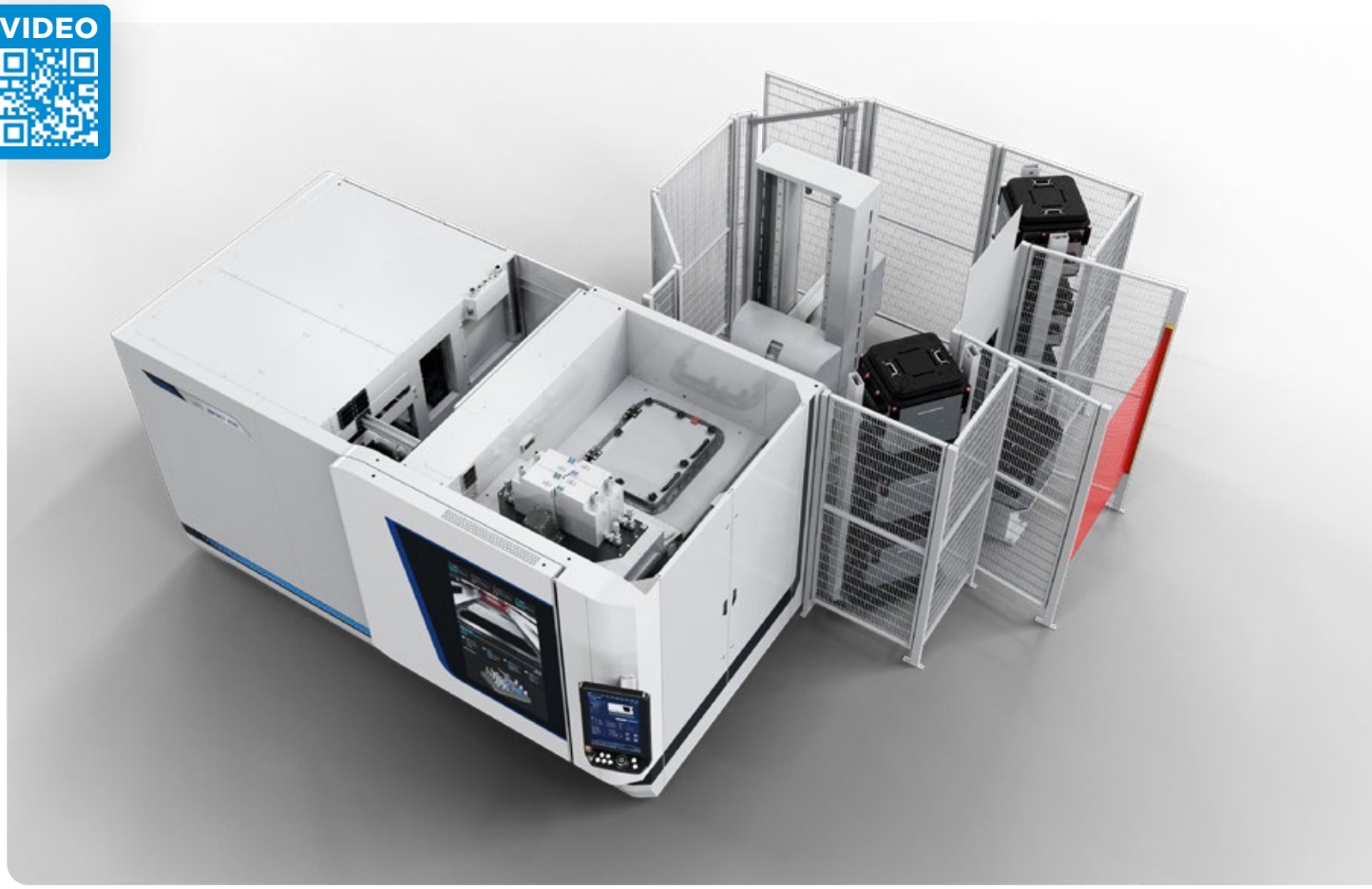


Automation between Build Jobs

Whether an LPBF system operates profitably is often decided between build jobs. With the Impact 4530, Irpd combines metal 3D printing with automated container handling, integrated set-up functions and scalable production logistics. The concept is designed to reduce the need for manual intervention and cut the time until the next build job on the machine to around 15 minutes. By Georg Schöpf, x-technik

High-performance lasers and a stable build process are essential prerequisites for industrial Additive Manufacturing. However, for cost-effective production, it is not enough to consider only the exposure time. After each build job, components and the build plate must be removed from the machine, powder must be handled and the next job prepared. As long as these processes are occupying the system or awaiting an operator, its capacity is not available for the next build job. It is precisely at this transition point that the automation concept of the Irpd Impact 4530 comes into play. Stefan Lang, CEO of Irpd, describes the approach as follows: "Anyone wishing to increase the productivity of Additive Manufacturing must not only optimise the printing process, but also keep an eye on the entire production logistics. Essentially, this also means automating processes." This shifts the focus from the machine to the interplay between the build process, material supply and job changeovers. For the user, what matters is how reliably and promptly the next job can begin,

VIDEO



The Impact 4530 with integrated automation. According to Irpd, the modular design is also intended to serve multiple machines within a shared production cell.



Automated container handling links the machine to the production logistics system. Powder and build plates are transported and stored in sealed containers.

and what operator intervention is required to achieve this. Non-productive times thus become a separate focus of system development.

Around 15 minutes until the next exposure starts

According to Irpd, the Impact 4530 was designed from the outset for automated switching between two build jobs and round-the-clock operation. The key performance indicator cited is the time from the end of one build job to the start of laser exposure for the next build job. Irpd puts this defined transition time at 15 minutes. The economic benefit lies in reducing the interruption to productive machine time between consecutive jobs. The extent to which this affects annual output depends on the production programme. Where job changes are frequent, the recurring set-up effort carries greater weight than when there are few, long build jobs. The short transition time only becomes effective if prepared containers are reliably available. Irpd therefore aims to make the start of the subsequent job less dependent on the immediate presence of an operator. »



„Through the automation concept, which has been an integral part of the Impact 4530 from the outset, we are responding to the industry's needs for scalability and integration into the entire process chain.

Stefan Lang, CEO, Irpd AG

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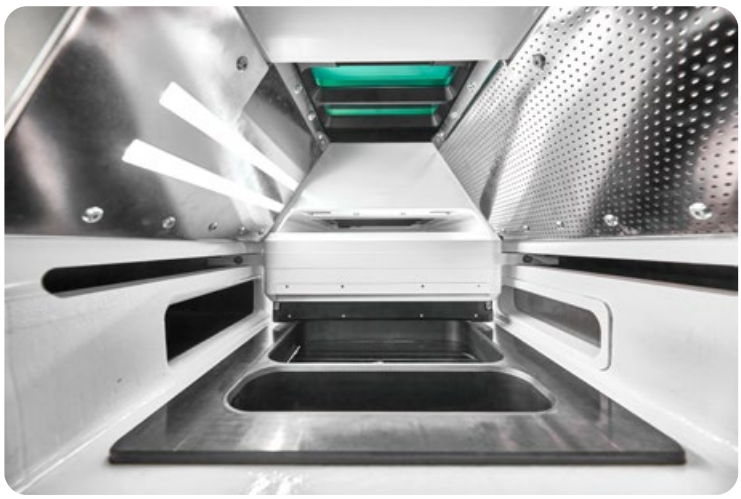


The Impact 4530 with supplementary modules and containers. Under the name Impact Fab, Irpd is pursuing a comprehensive production approach.

Containers link machinery and material flow

At the heart of the system is a modular container and gantry system. Powder and building panels are transported and stored in sealed containers. A robotic system handles container transport automatically. This transforms the manual process of loading and changing containers into a workflow integrated into the production environment. The containers form the link between the construction process and the logistics outside the process chamber. According to Irpd, the concept is designed to supply multiple Impact 4530 machines within a shared production cell. Users can thus further develop the material flow in line with their machine capacity. A prerequisite remains that the required containers are available in good time. A multi-machine solution therefore requires coordinated planning of transport and supply throughout the entire cell.

Non-productive time is to be reduced through automated material flows and fewer manual transport tasks. Recurring handling steps are incorporated into a defined sequence designed to support process reliability. Irpd is thus drawing on the principle of automated machining centres, where productivity is also achieved through the organised supply of the next job to the machine.



A view inside the process chamber of the Impact 4530. The automation concept includes, amongst other things, partial cleaning of the chamber and automatic calibration of the build plate.

Sealed containers for handling metal powder

The sealed containers for powder and building panels are designed to minimise direct contact between the operator and the metal powder, thereby reducing the risk of contamination. Material handling and occupational safety are therefore an integral part of the automation process. Irpd combines this container concept with the requirement to maintain powder quality, traceability and process stability even over extended production periods. This is relevant for applications in medical technology, aerospace and energy technology, where quality assurance extends beyond the actual manufacturing process. The closed-loop logistics system supports this approach; however, industry-specific qualification or approval cannot be derived from this alone.

Automated functions within the machine

Container transport is only one part of the concept. “The automation concept does not end with container transport. We have developed numerous features that help to reduce downtime,” notes Lang. Within the Impact 4530, additional functions handle recurring tasks during the preparation and changeover of build jobs. These include the automatic calibration of the build plate and the automatic start of the job without manual intervention. The automation thus extends to steps that are directly required for the start of the next build process.

The handling of the container lids is also automated. During the manufacturing process, the lids are stored as an integrated part of the system. They are therefore part of the intended machine sequence and do not need to be set aside and

returned manually. A turret magazine is available for several coating lips, enabling a quick changeover in the event of wear or a change of material. This is complemented by automated partial cleaning of the process chamber. The term 'partial cleaning' limits the scope of the function and should not be equated with a complete cleaning of all areas that come into contact with powder. The interaction of these functions is essential. An automatic container changeover alone would be of little use if each job subsequently had to be calibrated or started manually. Similarly, lid handling and cleaning affect the effort required between jobs. The Impact 4530 combines these tasks in such a way as to reduce operator intervention and delays.

Vacuum technology for the process atmosphere

Another key component concerns the inerting of the process chamber. Irpd utilises vacuum technology for this purpose and states that it can thereby establish the required process atmosphere within a short time. Compared with conventional approaches, this is also intended to reduce the consumption of inert gas. The preparation of the atmosphere is thus considered from the perspective of both set-up time and resource usage. Shorter preparation times, shorter intervals between exposure times and reduced inert gas requirements have a direct impact on operating costs. The extent of the savings must be assessed on a case-by-case basis. For recurring manufacturing jobs, these factors add up to significant potential savings. Irpd therefore incorporates the creation of the process atmosphere into the overall concept.

Integration into the subsequent manufacturing process

The production of a precision component is not yet complete once the Additive Manufacturing process has finished. Lang therefore positions the Impact 4530 within the context of a wider process chain. As a company within the United Machining Solutions Group, Irpd emphasises the integration of additive and subtractive technologies. The Group's overall portfolio encompasses milling and grinding, as well as wire EDM and laser machining. Workpiece handling, palletising and production automation using in-house solutions from System 3R are designed to link these machining steps both organisationally and technically.

For users, the challenge lies in planning the interfaces from the metal powder right through to the finished component. Subsequent machining must fit in with the part flow from the LPBF system.



The Impact 4530 with the service doors open on the right-hand side of the machine.

Under the name Impact Fab, Irpd integrates the machine into this more comprehensive production approach. Which stages are combined depends on the component and the manufacturing environment. The group's portfolio does not, however, replace application-specific design.

Practical experience and industrial application

Following a successful twelve-month beta test at Ecoparts in Hinwil, Switzerland (Note: Issue 1/2026 Additive Manufacturing), the Impact 4530 is now available across Europe. Lang highlights the machine design's consistent focus on automation and emphasises the importance of incorporating the industry's needs for cost optimisation and scalability into machine concepts. "The future of Additive Manufacturing will not be determined solely by greater system performance, but is measured to a large extent by the often-overlooked processes between build jobs," Lang summarises.

Accordingly, the Impact 4530 focuses on integrating the build process with production logistics. Enclosed containers, automated set-up functions and the ability to supply multiple systems are designed to turn individual build jobs into a more predictable production workflow. The industrial benefit is measured by how seamlessly these processes fit together – from the provision of material through to the start of the next exposure and on to subsequent machining.

» **www.irpd.ch**

Continuous Carbon Fiber

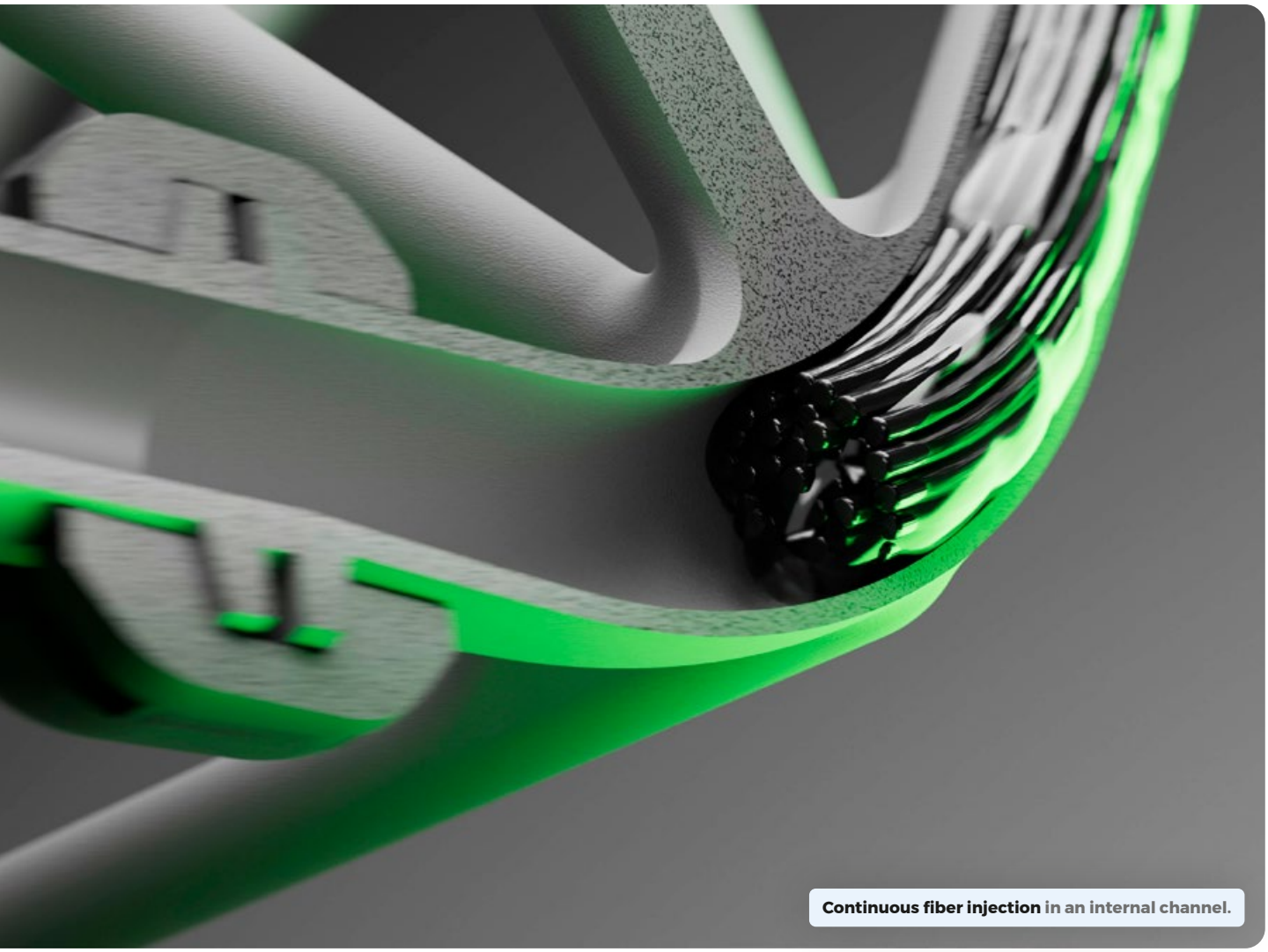
Printed parts are weakest between the layers. Reinforce3D's Delta Factory takes its patented CFIP process, which injects continuous carbon fiber through internal channels, from lab to continuous, large-scale production, with a head over ten times faster and full process data.

Additive manufacturing has an open secret: the datasheet describes the material, not the part. A printed component is built layer by layer, and its strength along the build axis depends on how well each layer bonds to the one below. Designers know it, which is why they derate, over-dimension and keep printed parts away from the main load path. A part that passes inspection on the bench can still fail in the direction nobody tested.

The industry has tried to patch this. Chopped-fiber filaments raise stiffness, but short fibers carry no continuous load path. Continuous fiber deposited during printing does place fiber where it is needed, but only in-plane, at modest fiber volume fraction, at reduced print speed and still separated by layer interfaces. The weak axis remains and so many printed parts stay where failure is cheap: prototypes, jigs and low-stress components.

Fibre where it's needed

Reinforce3D's CFIP, the Continuous Fiber Injection Process, takes a different route. The part is produced first, with internal channels, by additive or conventional manufacturing. Continuous carbon fiber and resin are then injected through those channels. The fiber path no longer depends on build orientation or layer bonding, so print can focus on geometry: complex shapes, integrated channels, lightweight topologies.



Continuous fiber injection in an internal channel.



The new Delta Factory of Reinforce3D will be showcased at Formnext.

CFIP has so far been proven mainly in development and pilot work. The Delta Factory, premiering at Formnext 2026, is a machine built to take it into continuous, large-scale production. It is designed to run inside an industrial plant, shift after shift, at series volumes, and it addresses the variables that decide whether an injected part is good: fiber content, voids and repeatability. The injection head is completely redesigned. It is more than ten times faster than the head of the previous Delta. Integrated electronics and sensors give closed process control, and optional temperature control stabilizes the process and minimizes porosity.

Voids are stress concentrators, so the resin system is built around avoiding them. Resin and hardener are dosed, mixed and degassed automatically, with a digitally configurable mixing ratio and precise control of flow and pressure. An integrated cleaning cycle prepares the next job without manual intervention, which is what keeps a line running.

Higher productivity thanks to larger fibre spools

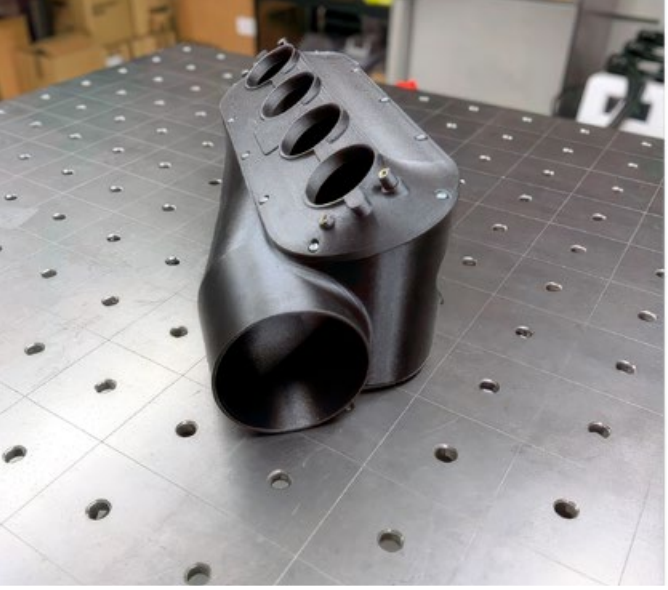
Larger fiber spools mean fewer reloading stops, and clean storage accepts carbon, glass, aramid and other fiber types. A capacitive touch screen guides the operator, monitors parameters in real time and handles recipes, data logging and maintenance, so every part can be traced to its process data.

The target is industries where strength-to-weight and volume meet: aerospace, defense and UAVs, automotive e-mobility, civil engineering and others. All need lightweight structural parts in quantities a lab process cannot supply. The question for industry is no longer whether additive parts can be strong, but whether that strength can be produced repeatably and documented. The Delta Factory is Reinforce3D's answer. It can be seen at Formnext in Frankfurt

» www.reinforce3d.com
formnext Hall 12.0, Booth A121



A hexacopter with **CFIP-reinforced arms.**





High-strength components made from Luvocom 3F PPS CF 50899 BK. (Image: 3D-Druck Matt)

Three Materials, One Manufacturing Concept

Lehvoss aims to simplify industrial FFF printing with three key materials. The concept combines materials, defined filament grades and optimised printing systems with scalable component manufacturing. For automotive users, this paves the way from in-house component development to production. 3D-Druck Matt is a key technology partner in this regard.

Anyone wishing to manufacture a component using Additive Manufacturing is initially faced with a multitude of options. Which material is suitable for the application? On which printer can it be processed reliably? And how can the transition to larger production runs be achieved later on? In the automotive sector in particular, material selection, filament quality, printing parameters and the machine must all work in harmony. With every new material-printer combination, part of the testing and qualification process starts all over again.
This is where Lehvoss's 'Focus Material' programme comes in. Rather than continuing to expand the range, the company focuses on a small number of strategically selected Luvocom 3F materials that cover a broad spectrum of industrial property requirements. At the core of this range are PAHT 9936 BK, PET CF 9780 BK and PPS CF 50899 BK. A system has been developed around these three materials that simplifies the path to producing robust components.

An overview of the process chain

Ultimately, what matters to the user is whether a component can be produced to a consistent standard of quality and in economically viable quantities. That is why the concept extends beyond the compound itself: defined filament grades, optimised printing systems, application-oriented support and access to industrial component manufacturing with large-scale printing capacities form a shared technical foundation. A key element is the qualification printer. This enables companies to produce, test and further develop initial components in-house for their specific applications. The harmonised starting point facilitates a smooth transition to additional printers and larger production capacities in print farms. Qualification and scaling are thus treated as a single unit from the outset.

From in-house printing to external manufacturing

Within the Focus Materials programme, 3D-Druck Matt acts as the link between filament production, the printing process and component manufacturing. Lehvoss contributes its expertise in materials and applications. 3D-Druck Matt supplies the Fokus-material programme with filament, provides detailed printing parameters and – following qualification by the specifier – handles the printing of large quantities on high-speed farm printers. Whilst the programme is already well established in Germany, further international processors are currently being qualified to join the programme. This ensures a uniform quality standard is achieved worldwide.
The intended process is therefore clear: first, the user develops and evaluates their component on a designated qualification printer. Following successful evaluation, they can transfer production to the production systems of 3D-Druck Matt and qualified processors in other countries without having to completely rebuild the process chain – for example, if qualification takes place in Germany but series production begins in the USA. In-house development and external manufacturing interlock as coordinated stages.

Material twins for the transition to injection moulding

The transition to injection moulding is also part of the concept. Whilst 3D printing may be suitable for development, pre-series production, special models or the supply of spare parts, injection moulding remains



The qualification printer combines in-house component development with scalable manufacturing. (Image: Lehvoss/3D-Druck Matt)

an economically viable option for very high production volumes. With what are known as 'material twins', Lehvoss links both processes using materials with very similar or comparable performance profiles. A specific example is Luvocom 3F PPS CF 50899 BK for FFF, which is matched by Luvotech eco PPS GFM BK for injection moulding. The strategic aim is to support a part's geometry throughout its lifecycle, from the prototype stage through various production runs right up to spare parts. The choice of manufacturing option depends on the production volume, requirements and lifecycle phase of the component. The benefits of the focus materials therefore stem from the interplay between the material, filament quality, printer, process expertise and manufacturing partner. For automotive companies in particular, this is intended to reduce the number of open interfaces whilst maintaining flexibility in scaling: from the first component printed in-house, through an external small-batch production run, to the transition to another manufacturing process. Planned user case studies in forthcoming issues will demonstrate how customers are utilising this approach in specific automotive applications and progressing from the requirements specification to a qualified component.

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Easy front-top loading

Intelligent depowdering with SPR-Pathfinder®

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Option with long swivel arm

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PART

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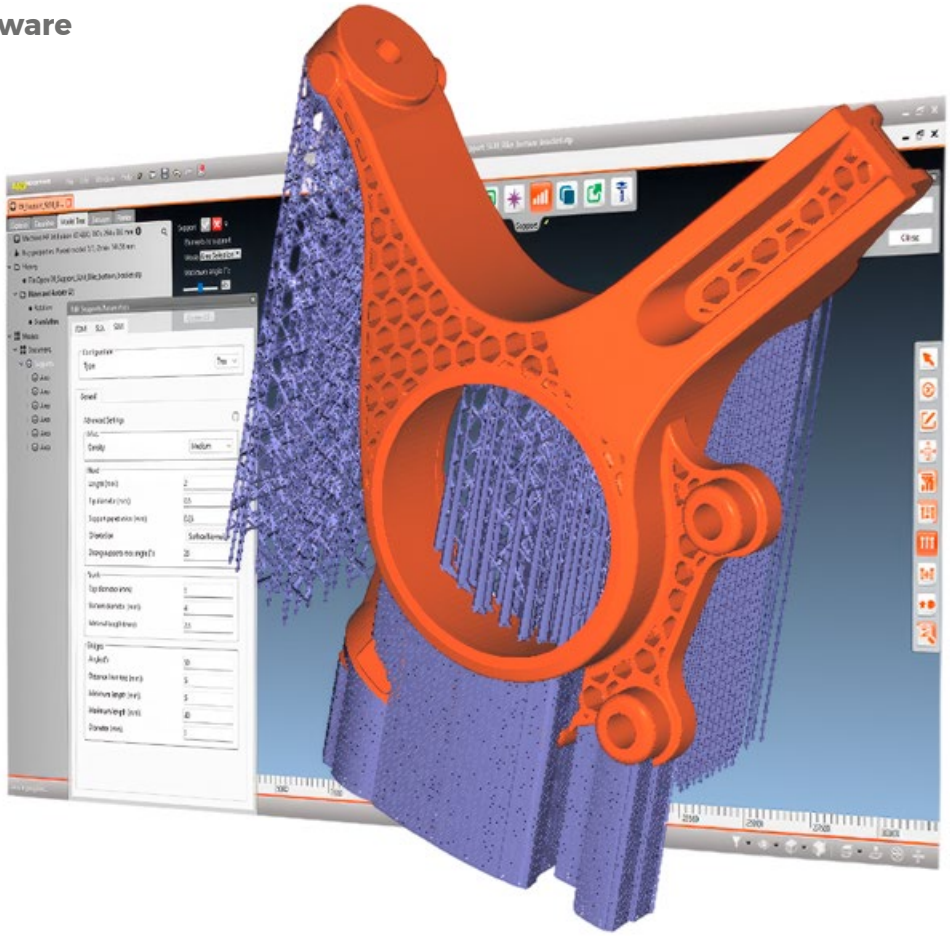
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Simulating SLM components helps with the design of support structures to ensure distortion-free production.

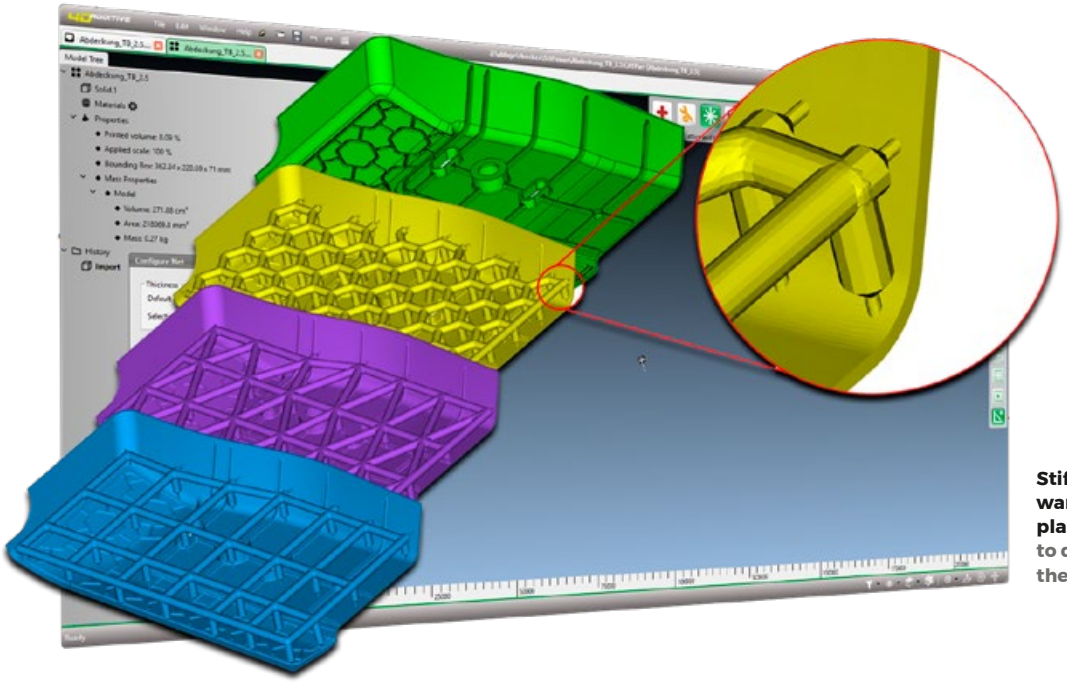
Automation and Simulation for Additive Manufacturing

At Formnext 2026, CoreTechnologie is unveiling a comprehensively revised version of its universal 3D printing software, 4D_Additive 1.8 SP1, which enables end-to-end, automated Additive Manufacturing. In practice, the direct transfer of all production data from MES systems to the 3D printing software significantly reduces set-up time. Among other things, the latest version enables the simulation of SLM components to optimise support structures.

The new 4dam format, new functions for component duplication and the transfer of correct orientation enable a seamless process chain in Additive Manufacturing. MES systems facilitate transparent and straightforward quotation preparation, order management and workflow planning. All component manufacturing information is transferred directly from the MES software to 4D_Additive via the new 4dam file format. This automatically loads the CAD models defined for the orders, aligns them and duplicates the components. Once the desired nesting parameters have been defined, 3D nesting with high packing density and thermal optimisation takes place in 4D_Additive. Information regarding the number and build space position of the manufactured components for a job is returned to the order management system via the 3mf format. This enables a significant increase in efficiency and reduces the error rate to a minimum. By eliminating the 'human factor', errors in day-to-day work are avoided and automated manufacturing processes with high quality standards become possible; in everyday 3D printing practice, this can result in a 40 to 60 per cent reduction in manual labour. The integrated solution enables an automated workflow with an optimal first-time-right rate, reduces scrap to an absolute minimum and enables high throughput for all Additive Manufacturing processes without compromising part quality.

Simulation of component warpage in SLM

With a new function for calculating and visualising warpage in SLM components, 4D_Additive 1.8 SP1 allows the warpage of the component to be displayed with or without support structure, depending on the selected material. The simulation enables the user to directly assess the effects on component deformation both before and after the support structure is generated. The simulation in the 4D_Additive software enables a fast and direct workflow, as the results are available in the same software immediately after the



Stiffeners counteract warping in thin-walled plastic parts. The user is free to determine the position of the stiffening structure.

support structure has been generated, and the simulation of the progressively optimised variants is carried out in a very short time. Furthermore, an analysis function is available to identify solid zones, enabling users to gain valuable insights into the design of the support structure before the first simulation is run.

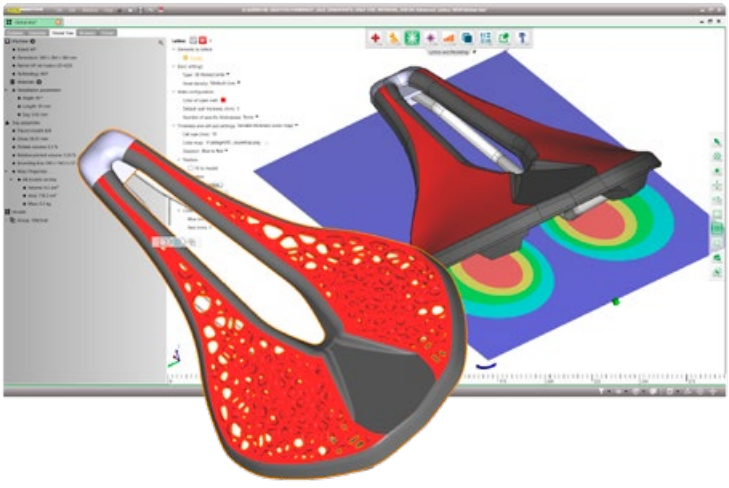
New cutting functions for flexible component division

The extensive expansion of the cutting tools in version 1.8 SP1 now makes it possible to cut complex models flexibly using the current 3D view, as well as multiple defined cutting planes or existing model surfaces. A transparent model display with the cutting tool overlaid makes it easier for the user to position and control the cuts precisely. Adjustable clearance dimensions on both sides of the cut line, rounded cut contours and configurable sawtooth profiles complement the machining options. Defining cuts with pin and overlap joints is also simplified. The aim is to make the preparation of multi-part components for Additive Manufacturing and subsequent assembly more convenient.

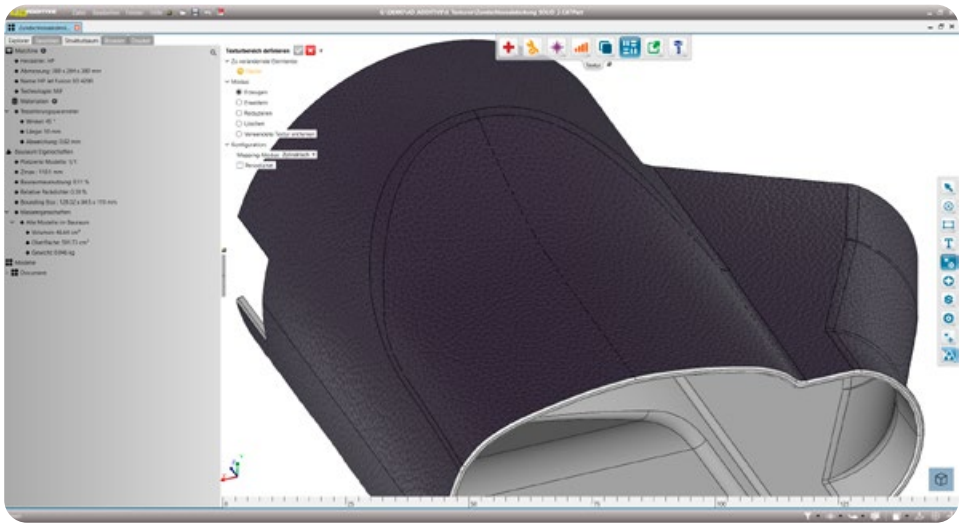
New stiffener function

A new stiffener function for the quick and easy creation of temporary stiffeners enables the targeted stabilisation of large and thin-walled components using individually configurable stiffening structures. This helps to reduce thermally induced deformations in powder-based 3D printing processes. In particular, long, flat and thin-walled component geometries are prone to deformation in powder-based manufacturing processes. The causes of this include internal stresses and thermal gradients resulting from differing heating and cooling rates within the component.

The new function enables the automated generation of temporary stiffening structures based on predefined honeycomb, triangular or quadrilateral patterns. The user can first freely define the position of the stiffening structure within the component and then generate the desired geometry. In addition to selecting the structural pattern, the dimensions of the individual cells can also be defined individually and adapted to the respective component requirements. Furthermore, optional hollow bracing structures help to ensure an optimal, distortion-free printing and cooling process. The bracing structures are connected to the existing CAD geometry via so-called pins. Their geometry, position and orientation can be specifically configured, allowing them to be easily removed after printing. »



Using the lattice library integrated into 4D_Additive, components with specific damping properties can be created quickly and easily.



With 4D_Additive, **VDI surface textures can be generated** directly on the CAD models to eliminate the stair-stepping effects that occur during 3D printing.

Transparent and flexible build job preparation

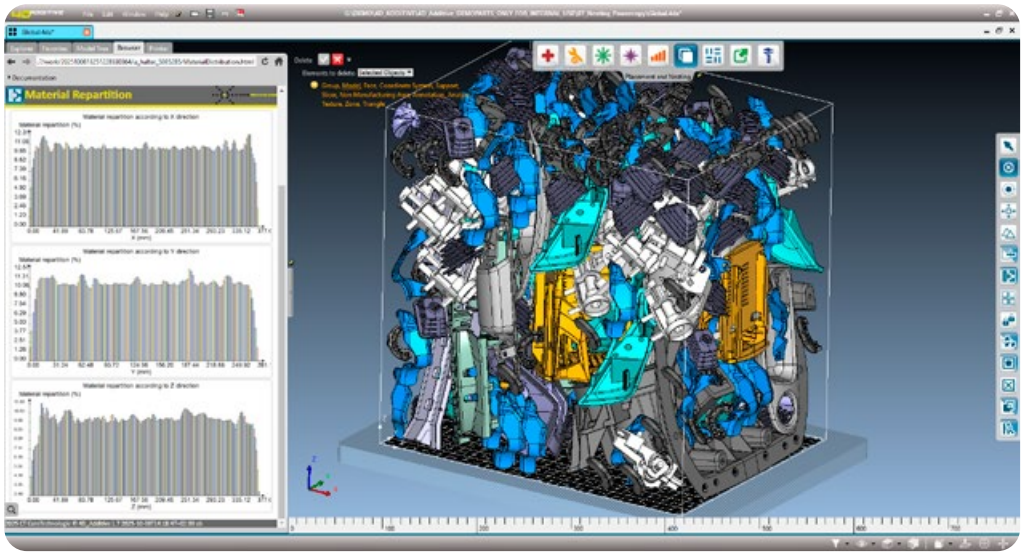
Another highlight of 4D_Additive 1.8 is the new Build History Tree. Modelled on the design tree found in modern CAD systems, it records all the steps involved in build job preparation and component optimisation within a clear, structured layout. In addition to a powerful undo/redo function, it enables comprehensive documentation of the entire preparation process. Users can also access all editing steps directly at any time, check their parameters and adjust them as required. This makes it easier to make changes and significantly reduces the effort involved in revising existing build jobs. Team collaboration also benefits: thanks to the traceable editing history, build jobs prepared by colleagues can be quickly understood, reused and adapted to new requirements.

Universal software for automated Additive Manufacturing

The modular 4D_Additive software suite has been designed as an innovative tool for all printing processes and enables end-to-end build job preparation for SLS, MJF, SLM, SLA and FDM processes within a unified, modern and user-friendly graphical interface. The nesting functions, which are extremely fast thanks to multi-processor processing, also enable high packing densities and a thermally optimised distribution of models within the 3D printer's build volume. The software reads all common CAD formats such as Catia V5/V6, NX, SolidWorks Creo, STEP, JT, as well as STL and 3MF data. Furthermore, all common slicing formats can be processed, and the software also allows STL, OBJ, 3MF and STEP data to be saved.

Clever repair functions enable faulty CAD, STL and scan data to be converted into watertight, printable models in a very short time. Using CAD modelling functions, specific modifications can be made within 4D_Additive. Functions for creating labels and textures, as well as internal and external mesh structures, round off the feature set of this universal 3D printing software.

» www.coretechnologie.com
formnext Hall 12.1, Booth C82



Nesting ensures high packing densities and optimised heat distribution.

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The generously sized machine doors allow for convenient loading and unloading. The inner door of the SFM-AT850 is clad in stainless steel, ensuring that no powder adheres to the inside of the door.

VIDEO

The Next Benchmark for Depowdering

Compact, intelligent and designed for large and heavy components: with the new SFM-AT850 depowdering system, Solukon is expanding its portfolio with a system that will replace the SFM-AT800-S and SFM-AT1000-S models once the current batches have been delivered. This continues a multi-award-winning success story. As the next generation, the SFM-AT850 sets a new benchmark in the automated debinding of complex metal components with an even higher load capacity. Solukon is also simultaneously introducing an 'E' variant featuring ultrasonic excitation. The SFM-AT850 depowdering system will celebrate its world premiere at Formnext 2026.



With an optionally available longer swivel arm, components up to 1,050 mm in height can be depowdered.

With the SFM-AT850, Solukon Maschinenbau presents the next generation of its automated depowdering systems for complex metal components produced using the laser powder bed fusion process. The system combines a wide range of components with a compact design and enables the efficient, reliable and reproducible cleaning of a wide variety of geometries.

Compact depowdering system for components weighing up to 1,000 kg and measuring up to 800 mm in height

The SFM-AT850 can accommodate components weighing up to 1,000 kg (an increase of 700 kg and 100 kg respectively compared with the previous models) and measuring up to 650 x 650 x 800 mm. At the same time, its external dimensions are smaller than those of the SFM-AT800-S.



The SFM-AT850 is controlled via a new, large display in portrait orientation, which can be moved around flexibly.

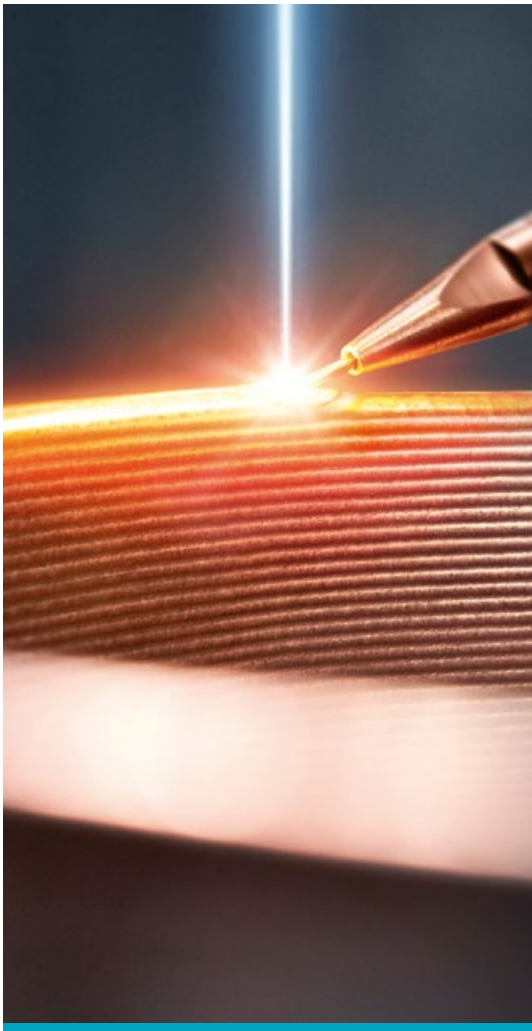
This saves space on the production floor and improves the ratio of footprint to usable chamber volume. Metal 3D printing has undergone dynamic development in recent years, particularly in the large-format component segment. The increasing (series) production of large and heavy components, combined with the dense packing of parts on build plates, places greater demands on post-processing. With the SFM-AT850, Solukon is responding specifically to this development. Its load capacity of up to 1,000 kg and optimised chamber volume make it an ideal complement to large-format flagship printers such as the EOS M4 Onyx and the NXG XII 600 from Nikon SLM Solutions.

Like all Solukon depowdering systems, the SFM-AT850 is also compatible with all metal 3D printers (laser sintering process). A key feature of the SFM-AT850 is the front-roof loading system, which is already available on the SFM-AT1000-S and the SFM-AT1500-S. When the roof is opened, the upper door frame folds upwards as well. This allows even large and heavy components to be fed into the system flexibly at turntable height. There is no need to thread components in from above, which makes loading by crane considerably easier.

SFM-AT850-E variant with ultrasonic agitation for gentle cleaning

Ultrasonic agitation is particularly well suited to extremely delicate lattice structures, such as those found in medical components, or very long internal channels. This very gentle form of agitation has already proven its worth in Solukon's »

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The new SFM-AT850 is making its debut at Formnext in Frankfurt and can be seen in action at the Solukon stand.

smaller SFM-AT350-E system for medium-sized components and is now also available for the new depowdering system in the SFM-AT850-E variant. "Automated ultrasonic depowdering has proven its worth in recent years and established itself as a genuine alternative to pneumatic agitation. With the new SFM-AT850-E, this gentle and silent cleaning method is now also available to our customers for larger components," says Andreas Hartmann, CEO/CTO of Solukon.

Intelligent depowdering with SPR-Pathfinder®

For more than a decade, Solukon technology has been shaping and defining the dust extraction market, and the SFM-AT850 is the latest example of durable, reliable engineering, combined with the highest standard of cleaning quality and intelligent features. Naturally, the latest Solukon system is also compatible with the unique SPR Pathfinder® software. Using the component's CAD file, this software calculates the perfect sequence of movements, which the machine then executes. The advantage is that, right from the design phase, users can use the software to check whether their geometry is suitable for depowdering and receive a precise time estimate for the depowdering process. 'Design for Depowdering' thus becomes a firmly established step in the Additive Manufacturing process.

Optimal usability and ergonomics

The SFM-AT850 utilises the tried-and-tested principle of Smart Powder Recuperation Technology (SPR®): programmable 2-axis rotation and vibration make the powder free-flowing, allowing it to drain out of even the most complex channels. For reactive materials such as aluminium or titanium, the SFM-AT850 can be inerted with a protective gas. A new feature is the addition of two extra compressed air and inert gas connections on the turntable, which can be used, for example, for an additional blow-out solution on the turntable. The powder can either be collected in a container or discharged safely and automatically using the compatible SFM-PCU powder collection station. The SFM-AT850 is controlled via a new, large portrait-format display that can be adjusted flexibly. The glove ports are ergonomically positioned at an ideal height and have been enlarged. The inner door of the SFM-AT850 is clad in stainless steel, ensuring that no powder adheres to the inside of the door.

Comprehensive innovations in machine software

In the field of machine software, too, the SFM-AT850 represents a major step towards greater user-friendliness and improved production planning: for instance, different user levels with varying access rights can be set up on the depowdering system. "In a production environment, for example, it may be sensible to ensure that not every user can make changes to the basic settings of the Solukon system. With different user levels, we can tailor the operation of the Solukon system even more precisely to our customers' needs," says Andreas Hartmann. Furthermore, individual

cleaning programmes – both SPR Pathfinder® programmes and user-defined programmes – can be managed and assigned more easily directly on the machine. For the first time, remote maintenance will also be possible with the SFM-AT850.

Option with long swivel arm for components up to 1,050 mm in height

For particularly tall components, the SFM-AT850 is available with an optional long swivel arm. This allows components with a height of up to 1,050 millimetres to be deburred, making it perfectly suited to components printed on an AMCM M 4K, for example.

Unveiling of the SFM-AT850 at Formnext 2026

Solukon will be unveiling the SFM-AT850 to the public for the first time at Formnext. The system will then be available to order and is expected to be delivered by the end of Q3/2027. The predecessor models, the SFM-AT800-S and SFM-AT1000-S, will be phased out once the current batch has been delivered. The SFM-AT350-E for medium-sized components will also be on display at the booth.

» www.solukon.de
formnext Hall 12.0, Booth D58

About Solukon

Solukon Maschinenbau GmbH is an internationally active, modern, owner-managed company specialising in the development, assembly and sale of cleaning chambers for industrial 3D printing. In 2015, Solukon unveiled the world's first automated depowdering system. Founded by Andreas Hartmann and Dominik Schmid, the Augsburg-based company has extensive experience in the development of AM systems and associated peripheral equipment, and boasts a wide range of industrial powder processing systems in its portfolio. Since 2022, Solukon has also been offering the SPR-Pathfinder®, the world's first and only intelligent software for the automated simulation and (pre-)calculation of depowdering for beam-fused metal parts. Solukon products meet the highest standards of functionality and safety and are approved for the safe and reliable removal of difficult-to-handle and reactive materials such as titanium and aluminium. With its metal depowdering systems, Solukon has established itself as the market leader in the field of industrial powder removal.

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Financing – Personal and Competent

Financing is about more than just numbers. As an owner-managed leasing company, Elbe-Leasing focuses on entrepreneurial thinking, personalised advice and bespoke solutions. It understands markets, identifies opportunities and supports its clients over the long term – with short decision-making processes and a direct line to those in charge.

Every entrepreneur knows that external lenders are essential for the sound development of a business. Whether for working capital, an overdraft facility or investments in commercial property and machinery, etc. Typical financing institutions available include banks, leasing companies and factoring firms. In addition, private equity firms, guarantee banks and development agencies may be utilised, although a principal bank is usually required to handle the transactions. All these organisations are subject to legal requirements to divide the company into a 'Market' (sales) and a 'Back-Office Processing & Control' (controlling) function. This is intended to prevent the



Image: Sutthiphong/stock.adobe.com



„With owner-managed leasing companies, customers benefit from direct access to the decision-makers.

Thomas Grübner, CEO, Elbe-Leasing GmbH

acquisition of poor-quality business, i.e. particularly foreseeable high-risk business. As this did not work well in the past, it led to the so-called financial market crisis in 2008/2009, with far-reaching consequences for the financial sector.

Understanding the market and businesses

The financial market crisis was essentially triggered by banks selling products they did not themselves understand. This created risks that would have caused key market participants to fail. As a result, Commerzbank in Germany was bailed out with €17 billion of public funds – in other words, taxpayers' money – because the Federal Government considered the failure of this bank to pose a greater threat to Germany as a business location. The banking supervisory authorities (e.g. BaFin) were given a political mandate to significantly tighten supervisory rules and control mechanisms. This resulted in a significant increase in the liability of senior management, such as board members and directors.

In short, financial institutions today should genuinely understand the business they conduct and the products they sell. To understand markets and market participants, one must immerse oneself in them. This requires people with intelligence »







and experience – in other words, time. Both cost money. Another consequence of the financial market crisis was a decade of low interest rates, intended to help the economy get back on its feet. For financial institutions, it therefore became increasingly difficult to build up expertise and achieve commercial success. So the decision was taken to shed the excess fat accumulated during the boom years and focus solely on straightforward business. Branches were closed, cash machines were removed, staff numbers were cut and institutions were merged. The result: banks are indeed profitable again, but in many markets they are no longer to be found because they have fundamentally turned their backs on these markets.

More than just numbers

Whilst access to debt capital used to be particularly difficult for entrepreneurs in the entertainment and arms industries, today printing companies, car dealerships and the AM sector – as well as many other sectors and businesses – are also facing increasingly difficult conditions or outright exclusions. As human labour is too costly in these processes, financial institutions are increasingly relying on digital and AI solutions, meaning that data-driven algorithms make the decisions. What counts are equity, profitability and liquidity, etc. Plans, visions, market ideas and market developments no longer play a role. From Elbe-Leasing's perspective, this is not a positive development and is a key reason behind the so-called 'quiet quitting' – that is, the closure of small and medium-sized enterprises.

Owner-managed leasing companies

All these rules now apply to owner-managed leasing companies as well. They are also subject to supervision. They, too, are divided into a front-office and a back-office. However, the company is owner-managed, that is, by one or more natural persons. These individuals have generally set up their business with the intention of making a profit. Their motivation therefore differs enormously from that of a well-paid savings bank executive.

Advantages of an owner-managed leasing company

- Commitment to understanding the market and the property in question
- Understanding of the service provider's role
- Specialisation in specific markets or sectors
- Access to decision-makers





The prospect of finding a sympathetic ear and competent people who contribute ideas and help shape the business is significantly higher simply because of this difference in motivation! At Elbe-Leasing, at any rate, this is certainly the case.

Support

The finance experts from Dresden aim to understand their clients and then provide them with expert support. Not only when initiating a particular investment, but also in the periods in between. They are also happy to offer services that make it easier for their clients to run their businesses – services that clients might not necessarily expect from a leasing company. This is also evident from the fact that owner-managed leasing companies often specialise and have thus built up specific market expertise, enabling them to navigate their respective sectors with confidence. Furthermore, during critical phases in a company's life cycle, such companies are often more approachable – and in a different way – than institutional providers. Clients often find it much easier to gain access to the actual decision-makers, or indeed, such access is possible at all.

» **www.elbe-leasing.de**





The HandyScan 3D MAX series, when used in conjunction with the Mobility Kit, enables wireless measurements, thereby reducing reliance on fixed workstations or complex set-ups and facilitating a more efficient workflow directly at the site of operation.

Next-Generation Mobile Scanning

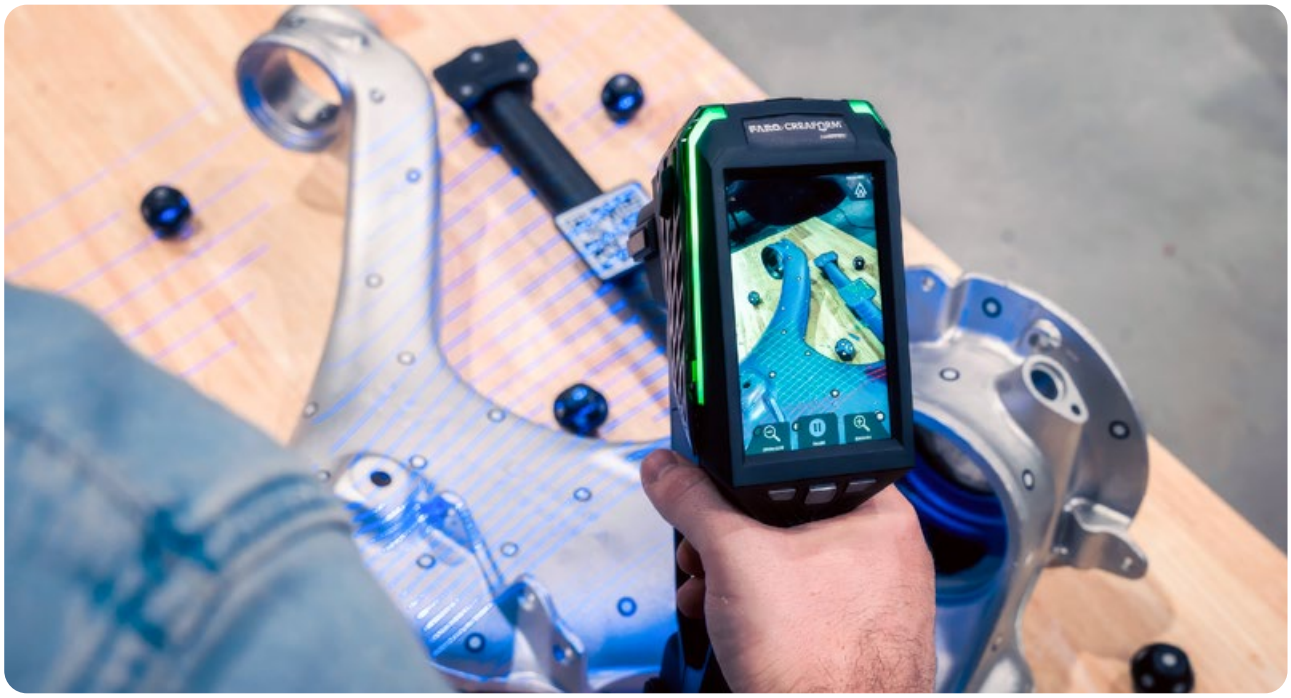
Faro Creaform, a business unit of Ametek, Inc. and a global supplier of 3D scanners and portable CMM solutions, has announced enhancements to its HandyScan 3D product family. The company is launching the HandyScan EVO and the HandyScan EVO Plus to optimise daily inspection workflows through a more intuitive, user-centred platform. At the same time, Faro Creaform is expanding its capabilities for metrology-grade inspection of large parts with the launch of two new models in the HandyScan 3D MAX series, thereby offering manufacturers a more consistent, mobile and efficient way to measure everything from small to large, complex parts.

At the heart of the announcement is the next generation of the HandyScan 3D MAX series, now represented by the HandyScan MAX EVO and the HandyScan MAX EVO Elite. These models have been developed for large and complex parts and extend the tried-and-tested EVO platform, enabling even large parts to be inspected – whilst maintaining the accuracy, robustness and performance required for quality control, quality assurance, reverse engineering and non-destructive testing.

Wireless measurements for a more efficient workflow

When used in conjunction with the Mobility Kit, the HandyScan 3D MAX series enables wireless measurements, reducing reliance on fixed workstations or complex set-ups and facilitating a more efficient workflow directly at the point of use. Thanks to integrated on-screen functions, guided workflows and comprehensive mobility, the process from scan to report is more intuitive with this new generation, whilst maintaining the proven measurement accuracy. The devices have been tested in calibration laboratories accredited to ISO/IEC 17025 and comply with the VDI/VDE 2634 standards.

Thanks to its volumetric accuracy of 0.150 + 0.020 mm/m, the HandyScan MAX EVO is suitable for applications in product development, whilst the HandyScan MAX EVO Elite, with a volumetric accuracy of 0.075 + 0.010 mm/m, is suitable for inspections and non-destructive testing (NDT)



The company is launching the HandyScan EVO and the HandyScan EVO Plus to optimise daily inspection processes through a more intuitive, user-centred platform.

that require a higher level of accuracy. Together, these models offer a scalable approach to mobile, metrology-grade measurement of larger parts, without compromising the ease of use and operational flexibility required on the shop floor. This development is supported by the launch of the HandyScan EVO and the HandyScan EVO Plus, which further underpin Faro Creaform's focus on efficiency, accessibility and user experience through integrated visualisation directly on the scanner and simplified, guided workflows.

Winner of the Red Dot Design Award

Thanks to the EVO platform, the HandyScan 3D product family also excels in the area of design. The HandyScan 3D EVO series was recently awarded the Red Dot Design Award for its ergonomic and user-centred design. This evolving, experience-driven solution is now available for both the EVO and MAX series and offers features such as QR code scanning on the Elite models (EVO Elite and MAX EVO Elite), which enable inspection programmes to be launched more quickly.

"The further development of the HandyScan 3D product family reflects our commitment to making metrology-grade 3D scanners more intuitive, mobile and efficient," said Jérôme-Alexandre Lavoie, Director of Product Management for 3D Scanners at Faro Creaform. "With the new MAX series, manufacturers who need to inspect large and complex parts benefit from the optimised platform environment that characterises the EVO series, without having to compromise on the accuracy required for critical inspection decisions."

All new models are fully integrated into the Creaform Metrology Suite, offering a unified software environment and an unrivalled user experience tailored to the EVO-based architecture. With a unified platform for the entire HandyScan 3D product family, Faro Creaform is further consolidating its leadership position in the field of portable, metrology-grade 3D scanners, offering quality control and manufacturing teams a simpler and more scalable way to reliably measure parts of virtually any size.

» www.creaform3d.com
formnext Hall 12.0, Booth B12



The HandyScan MAX EVO Elite, with a volumetric accuracy of 0.075 + 0.010 mm/m, is suitable for non-destructive testing (NDT).



50 damper mountings for Formula Student racing cars, produced using 3D metal printing, can be removed individually for further process steps thanks to AMF's modular substrate clamping plate. The zero point always moves with them. (Images: AMF)

Zero Point to Go: The Formula 1 of 3D Manufacturing

Anyone who manufactures parts for motor racing using metal 3D printing knows the value of speed. M&H CNC Technik recognises this too, and has accelerated its printing processes to extreme speeds using high-performance machines equipped with an ever-increasing number of lasers. Yet the additional speed gains achieved during and after the process by the modular AMF substrate clamping plate system, in conjunction with zero-point clamping technology, leave even seasoned experts in a state of incredulous amazement. Suddenly, efficiency and cost-effectiveness have reached unprecedented heights, catapulting 3D metal printing from the industrial future into the here and now.

„The segmented AMF substrate clamping plate with defined zero-point interfaces makes our processes fully end-to-end and, above all, even more efficient when transitioning from one post-processing stage to the next following 3D metal printing," reports Patrick Herzig, Managing Director and founder of M&H CNC Technik GmbH in Ilz, near Graz, Austria. Chris Vogel, Head of Key Account Projects International at AMF, elaborates: "Because the finished 3D-printed part carries its defined interface with all other downstream processes, users regularly report time savings of several hours."

From substrate to substance – only faster than ever before

And this is the key point: the 25 segments of the patented AMF substrate clamping plate can be removed individually along with the printed 3D part and clamped into the next process straight away. Whereas in the past a great deal of time was lost unproductively due to cumbersome clamping, alignment, calibration or re-clamping, value creation on the component can

Shortcut

Task: Simplification of follow-up processes for LPBF components.

Solution: Modular AMF substrate clamping plate system.

Benefits: Components can be further processed directly on the substrate clamping plates without the need for re-clamping in subsequent processes.



As the components are removed individually and passed on to the subsequent processes, there are **no interfering contours that could impair 5-axis machining.**

now continue immediately after printing without any loss of time. Philipp Schwemberger, Head of Additive Manufacturing at M&H, sees a further advantage: "As well as saving time, we also benefit during the milling process. As the components are transferred individually to the subsequent processes, there are no interfering contours that could hinder 5-axis machining." M&H Production Manager Roland Mittendrein adds: "Furthermore, we can do without the additional clamping tabs that were previously required for further processing and had to be removed later. This simplifies the design and reduces the effort involved in downstream processes. The key advantage, however, is that each component retains its defined zero point throughout the entire process chain."

You can really sense the passion at M&H, which is hardly surprising. After all, when an owner-managed SME operates in the medical technology, aerospace, defence and motorsport sectors, it promises a high level of expertise and interesting applications – which, unfortunately, cannot be discussed publicly due to confidentiality agreements. However, M&H CNC Technik also supports the Formula Student team at Graz University of Technology. Things are a little less secretive there, but by no means any less demanding. For the students who compete every year on the Hockenheimring circuit in their self-built formula racing cars, it's all about winning. M&H manufactures damper mountings using 3D metal printing, with a focus on lightweight construction, precision and the rapid implementation of new development stages.

Substrate clamping plate: from a utility tool to an efficiency booster

But back to the facts: following metal 3D printing, further manufacturing processes are generally required – such as debinding, machining, cleaning, polishing, measuring and sawing. The patented AMF substrate clamping plate, unveiled as a world first in the summer of 2025, measures 248 x 248 x 23 mm and features 25 zero-point interfaces. »



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1 The printed workpieces are removed individually using the substrate plate segment and positioned in the subsequent machines for the next stages of the process. These machines are fitted with **K5-sized pneumatic zero-point clamping modules from AMF**, which clamp the workpieces with repeatable accuracy to within less than five micrometres (5 µ) and ensure process reliability.

2 Each segment contains K5-sized zero-point clamping bolts. This enables **immediate further processing after 3D printing**, without the need for calibration.

The base plate is made of stainless steel and can accommodate substrate plates made from various materials. An optional adapter plate enables flexible mounting on 3D printing machine tables with different hole patterns. The substrate clamping plate features 25 segments with K5 zero-point clamping bolts, each measuring 49.2 x 49.2 x 20 mm and including an indexing pin, which can be removed individually. The clamping bolts are secured mechanically, centrally, simultaneously and without screws using a T-handle torque tool. "We deliberately opted for the mechanical locking system. Any other solution, such as pneumatics or hydraulics, would have been far too complex and expensive," explains Chris Vogel.

Easy-to-use high-tech instead of time-consuming manual labour

M&H now prints 25 damper connections, each approximately 80 mm high and 40 mm wide, onto it simultaneously. These are then removed individually with the substrate plate segment and gradually positioned in the other machines and systems for the subsequent processes. These are fitted with AMF's K5-sized pneumatic zero-point clamping modules, which clamp the parts with repeatable accuracy and process reliability to within less than five micrometres (5 µ). They hold the parts securely with a force of 13 kN. Pneumatic pressure is only required to open the clamping modules. "It's simple and quick," assures Roland



A workpiece is produced using metal 3D printing on each individual, separately removable segment.

About AMF

Founded in 1890 as Andreas Maier Fellbach (AMF), the company is now a full-service provider in clamping technology and ranks among the world's market leaders. Thanks to its global market presence, the staff are always attentive to customers' problems. Drawing on its strong solution-finding expertise, expert advice, intelligent engineering and the highest manufacturing quality, AMF consistently develops bespoke projects and specialised solutions for customers, as well as standard solutions that prove successful in the market. With more than 5,000 products and numerous patents, the Swabian-based company ranks among the most innovative in its sector. The keys to success at Andreas Maier GmbH & Co. KG are speed, flexibility and 240 highly qualified employees. In 2023, AMF achieved a turnover of 51 million euros.





3 **Milling operations on the 5-axis machine can begin immediately thanks to AMF zero-point clamping technology, without the need to calibrate the component.**

4 **Once machining is complete, the workpiece retains its zero point on the measuring machine and can be clamped in place straight away.**

Mittendrein. “Remove, insert, clamp, done.” Chris Vogel adds: “We’re actually talking about a matter of minutes for all subsequent processes, where previously up to hours were wasted unproductively. You might not believe it, but anyone who’s seen it is immediately convinced.”

For example, milling operations on the DMG 60 evo 5-axis machine can begin immediately without the need to calibrate the component. As only individual parts are fed into the next process at any one time, there are no interfering contours and the five-sided machining runs smoothly. At the end of machining, the part can also be clamped directly onto the measuring machine. Should the measurement result be unsatisfactory, the part is simply re-machined quickly on the relevant machine. If the part meets all tolerance specifications, the final process involves separating the part from the substrate plate segment. Depending on the part and support structures, this is either achieved by sawing or the part can be snapped off directly. Finally, the substrate plate segment is ground down and can then be reused immediately for 3D printing.

Flexible and modular for entirely new 3D printing processes

Another key feature of AMF’s patented substrate plate clamping system is its flexibility. Customers are not restricted to components measuring a maximum of 50 x 50 mm (L x W). “The build platform adapts to the component,” emphasises Chris Vogel. This means that larger components can simply be clamped using larger plate segments, which are »

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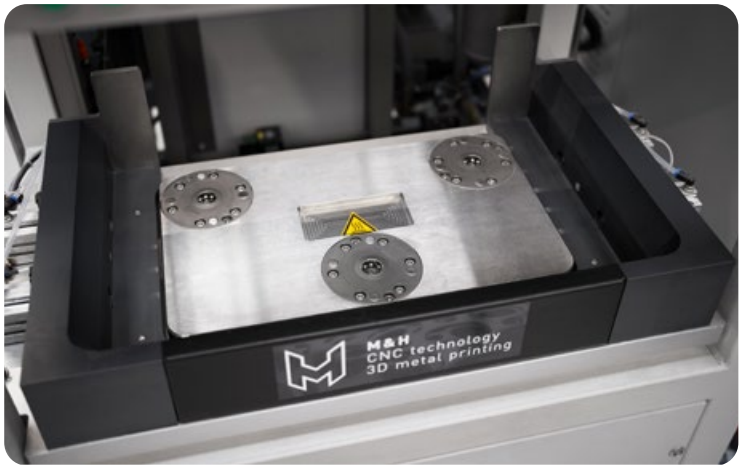


Patrick Herzig (Managing Director and Founder, M&H CNC Technik), Chris Vogel (Head of International Key Account Projects, AMF), Roland Mittendrein (Production Manager, M&H CNC Technik) and Philipp Schwemberger (Head of Additive Manufacturing, M&H CNC Technik) are relying on the AMF substrate clamping plate for more efficient post-processing in metal 3D printing.

designed to accommodate multiple clamping positions, without having to use every clamping bolt receptacle. It is also possible to place individual or several different components on a single clamping plate. "This is, of course, extremely interesting because it means we can print different components simultaneously, either as single pieces or in small batches, particularly during the prototyping phase of a product," says Philipp Schwemberger enthusiastically. "The resulting simplification and increase in efficiency have clearly proved their worth for us," concludes Patrick Herzig.

And, to sum up, Chris Vogel is keen to emphasise that "our patented AMF substrate plate clamping system, combined with the zero-point clamping technology, virtually eliminates set-up times in metal 3D printing and simplifies all processes from start to finish. Mechanical clamping, alignment, calibration or re-clamping – none of this is required." It is clear that this is where the cost-effectiveness of metal 3D printing is determined. With this patented technology, AMF is bringing the process from the industrial future into the here and now. For 3D metal printers with round build plates, a round substrate clamping plate is available, on which individual octagonal segments are mounted. Furthermore, for larger build volumes, several systems can be used side by side, as demonstrated by the example at M&H. In addition, the manufacturer is open to its customers' individual production requirements and also manufactures to order.

» www.amf.de
formnext Hall 12.0, Booth D101



AMF zero-point clamping modules are also fitted to the base plate of the 3D printer. An optional adapter plate allows for flexible mounting on 3D printer tables with different hole patterns.

User

M&H CNC Technik GmbH, based in Ilz, specialises in the Additive Manufacturing of metal components and precision CNC machining. The company supports projects throughout the entire value chain – from technical consultancy and component optimisation, through metal 3D printing, to mechanical finishing, heat treatment and quality assurance. Its range of services includes the processing of high-performance materials such as Inconel 718, titanium, aluminium and other metallic materials, as well as the production of prototypes, individual parts and small batches. The portfolio is complemented by CNC milling and turning, surface finishing, metrology, and documented testing and quality assurance processes. M&H supplies customers in sectors such as aerospace, motorsport, mechanical engineering, energy technology, medical technology, defence and other industrial applications.

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