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AM is helping to produce lighter helicopters and make engines more efficient

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Messe Frankfurt Group

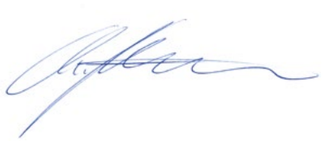
Cover: Emil Wörgötter

If leading market analyses are to be believed, our industry has experienced more than 15 years of uninterrupted growth, including in the last 24 months. Talk to major manufacturers and users, however, and the picture is less euphoric and more mixed. This is also illustrated by the latest VDMA survey in fall (see page 08).

So where does the truth lie? It's hard to say, because the diversity that makes the AM world so fascinating for many also makes it difficult to understand and comprehend. Not only are there manufacturers, designers, service providers, and quality experts, but there are also users from a wide range of industries – from dentists to architects, jewelry designers, and rocket engineers to oil rig managers. And each of these sectors is developing at a different pace, with growth rates often varying greatly in these sectors as well as in the different regions. These different people and industries do however have an opportunity to come together within our AM world to exchange views of processes, share experiences, and much more besides.

We support and encourage this cross-sectoral dialog every year at Formnext, which last year welcomed a record 38,282 visitors from such varied sectors as mechanical and plant engineering, automation, scientific institutions, automotive, and medical and dental technology. The big increase in total visitor numbers was not the result of a boom in one sector, but can rather be attributed to the growing popularity of AM across diverse industries. For us as organizers, the success is the result of a wide range of activities and projects. We work hard throughout the year, publishing media such as the Formnext Magazine, AM4U newsletter and various white papers, and offering other formats such as Formnext TV and webinars. We also organize seminars and workshops and often partner with other trade shows and conferences as an AM ambassador. The goal is always the same: To bring Additive Manufacturing and its business cases to new people and business owners.

In line with our ongoing mission to highlight promising user industries, we are this year focusing on automotive & transportation, construction & architecture, orthopedics and energy, and oil & gas. The sectors and target groups are therefore extremely diverse, all with different interests, challenges, and requirements. Just as the industry is constantly developing new applications, we are preparing for this by keeping abreast of the latest initiatives, trends, and target groups to ensure that Formnext in November is as up to date and varied as possible.



Sincerely, Christoph Stüker
Vice President Formnext

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TEN YEARS OF FORMNEXT: AM HAS ARRIVED

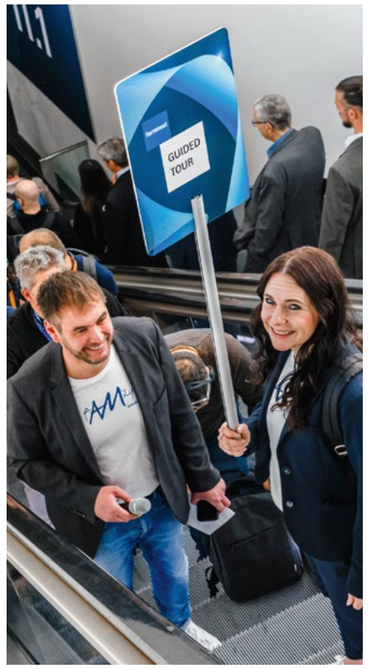
Formnext 2025 demonstrated the evolution of the Additive Manufacturing sector to impressive effect. With record visitor numbers, Frankfurt once again became the international meeting place for Additive Manufacturing and other future-oriented production technologies.

On its 10th anniversary, Formnext welcomed 38,282 specialists and executives (47% from outside Germany), a further significant increase from the previous year. With a total of 804 exhibitors (61% from outside Germany), Formnext turned in a very good result in these economically challenging times.

Sascha F. Wenzler, Vice President Formnext at event organizer Mesago Messe Frankfurt GmbH: »The last ten years have seen tremendous technological progress in the industry. Additive Manufacturing is no longer a vision of the future, but a reality in many industries. With progress, however, come new challenges. And this is exactly where Formnext comes in: It showcases solutions for the ongoing industrialization of AM, greater supply chain flexibility, and the technology's increased accessibility to SMEs.«

EXCITING PROGRAM FOR THE YEAR AHEAD

Formnext 2026 is kicking off the new year with numerous exciting innovations. The world's leading trade show for Additive Manufacturing and industrial 3D Printing is stepping up its involvement in key AM user industries. At the same time, the UK, as the partner country for Formnext 2026, will be showcasing its innovative potential in the field of industrial 3D Printing. In addition, Formnext is optimizing its hall structure and will use three levels instead of four in 2026, despite providing the same floor area.



Images: Mesago / Marc Jacquemin

This year, Formnext will increase its focus on specific user industries, such as orthopedics, aircraft construction, automotive, energy, oil and gas, architecture, and construction. »For these important industries, we will work with our exhibitors and stakeholders to further highlight the specific advantages and potential of AM and communicate these to as diverse users as possible,« explains Christoph Stüker, Vice President Formnext at Mesago. This will be reflected, for example, in the supporting program and conference program.

As the hub for Additive Manufacturing, Formnext is a valuable partner and source of information for the industry all year round. To help prepare for the trade show, a range of informative content is provided about all these fields of application. We cover the above focus topics in special features in the Formnext Magazine (see pages 12, 18, and 20), in three white papers, and in our webinar series, the Formnext Technology Talks.

In addition, Formnext will this year be in attendance at a number of leading trade fairs for key application industries, including Aero Friedrichshafen (22–25 April 2026) and Automechanika (8 –12 September 2026, in Frankfurt).

If you don't want to miss anything and would like to stay up to date with all the latest news, sign up for our AM4U newsletter. This gives you free access to white papers as well as invitations to the Technology Talks when the time comes.

+ SIGN UP NOW!
» formnext.com/getindustryinsights

PIONEERING TECHNOLOGIES AND ENTREPRENEURIAL SPIRIT

The 2025 Formnext Awards honored the most outstanding contributions to Additive Manufacturing in six categories. Besides being published online prior to the event, the finalists in each category presented themselves at Formnext to enable attendees to vote for their favorites both on site and digitally. The overall audience vote was then treated like the vote of an additional jury member. The trophies were designed by Sutosuto and produced by FKM Additive Manufacturing, with Renishaw and Fluxo Technologies also sponsoring the awards.

The winner of the the AMbassador Award was Irena Heuzeroth, who has been very involved in the practical study course »Certified Industrial Technician Specializing in Additive Manufacturing«, which is offered jointly by the Würzburg-Schweinfurt Chamber of Industry and Commerce and the SKZ.The Hochschule für Gestaltung Schwäbisch Gmünd won the jury over with its extraordinary AM designs to take home the 2025 Formnext Design Award. The Grabbit products developed by this university are designed to help train the hands – in the case of illness, injury, or age-related weakness, for example.

Laempe Mössner Sinto GmbH has won the (R)Evolution Award. This company has developed a 3D Printing system for the large-scale production of sand cores, which it has successfully put into operation at the BMW Group. The system produces more than 1,100 cores per day, making it one of the fastest binder jetting printers in the world. IAM3DHUB – Project »3DMyMask« is the winner of the 2025 Rookie Award. The project uses AM in combination with 3D face-scanning to produce customized silicone masks that improve the treatment of disorders like respiratory distress.

The Start-up Award supported by Fluxo Technologies was won by Perfi Technologies. With a technique it calls Volumetric Additive Manufacturing (VAM), the company is promising to significantly improve conventional 3D Printing by »printing« every point of an object simultaneously instead of layer by layer. The winner of the Sustainability Award supported by Renishaw 2025 is EOS GmbH Electro Optical Systems. This company has developed a filter system that neutralizes condensate, soot, ultra-fine particles, and other reactive by-products of metal-based AM directly in the production process.

Applications for the Formnext Awards 2026 will be accepted starting in early May 2026.

+ FURTHER INFORMATION:
» formnext.com/awards

THE NEXT GENERATION OF 3D PRINTING

At just 14 years old, Dominik Schkalei was certainly one of the youngest trade visitors at Formnext 2025, and this was already his second visit to the trade fair after his participation in 2024. This time, he spent a total of four days in the exhibition halls, learning about new developments in FDM, filaments, and SLA, among other things. He was also on the lookout for business partners for his self-founded company, Nudaim3D, which specializes in eye-catching 3D-printed advertising material. Dominik is very committed to this: After school, he spends several hours working on 3D Printing. His parents support him with this and discuss business decisions with him. His next goal is to continue growing Nudaim3D.

Images: Mesago/Mathias Kutt, Thomas Masuch

STRONG BUSINESS MOMENTUM IN THE WAKE OF FORMNEXT 2025

Atlix (formerly Trumpf) reported a »highly successful Formnext exhibition and outstanding commercial results in 2025,« confirming the positive response to its new brand identity and corporate image, and expanded product portfolio. »During Formnext, numerous customers and partners visited the Atlix booth and experienced first-hand the company's rebranding, including corporate identity revamp, and the new products presented including new TruPrint 5000.« This strong momentum translated directly into concrete business results, Atlix said. »December 2025 marked the highest monthly order intake of the entire year, representing the strongest order value achieved in 2025.

WHEN SPACE IS RUNNING OUT

The printing process is accompanied by crackling noises as the expanded polystyrene foam swells out of the nozzle and solidifies into a wide sausage shape. This happens so quickly »that we have to shut down the machines from time to time. If we print all day, we end up with so many ship models that there isn't enough space on the stand,« explained Szymon Skorupski, CTO of Fanum, at Formnext 2025. Founded in 2007, the Polish company has its roots in traditional milling but has been active in Additive Manufacturing since 2021. Skorupski sees applications for its large-scale hybrid gantry printer in molds (e.g., for laminating yacht segments), show cars, and swimming and flying drones, among other things. A particular advantage of Fanum's technology is the low material price of the polystyrene used, which costs just 2 to 3 euros per kg.

»MATURATION OF THE INDUSTRY OPENS UP NEW OPPORTUNITIES«

Kai Witter, Chief Customer Officer at Dyemansion, sees many positive aspects to the maturation of the AM industry, which has been accelerated by consolidation within the sector. This stabilizes the industry and opens up new opportunities. »We notice this in our discussions with AM users through requests for specific business cases.« Customers already know in advance that AM is the right technology. »It's then increasingly about specific costs, especially total cost of ownership (TCO), including infrastructure.« And according to Witter, this whole process is opening up new opportunities for many AM players: »The more serious applications there are, the better we can play to our strengths – not only showing that our technology works and what it costs, but also proving it.« Witter was also delighted at visitor response to his company's presence at the trade show: »It's not just well attended. It's been really crowded.«

SOBERING-UP PHASE

Andy Langfeld, Chief Revenue Officer at Stratasys, considers the AM industry to be in a sobering-up phase. »The market is maturing. Our customers come to us with specific application examples, so as a supplier, you have to think in terms of processes, from CAD and design to planning the entire workflow. Ultimately, it's the cost per component that counts. That's the deciding factor. For manufacturing companies, it all comes down to cost and process reliability.«

Images: Thomas Masuch

OPTIMISM HAS DECLINED

Disillusionment is increasingly setting in within the Additive Manufacturing industry. According to the VDMA survey in fall, the number of companies expecting growth in the next two years is falling. The US government's customs policy is also having an impact here. Nevertheless, companies are investing in new technological developments.

»Our member companies continue to demonstrate remarkable stability, but optimism has noticeably declined,« says Dr. Markus Heering, Managing Director of the Additive Manufacturing Working Group within the VDMA that brings together manufacturers and users both from the metal and plastics sectors. The fall 2025 survey conducted by the Working Group shows that the industry is moving sideways in a challenging market environment. While some companies report positive revenues, the proportion has not increased compared to the spring 2025 survey. At the same time, 29 percent of companies reported declining revenues over the past 12 months. In the past six months, this figure was only 20 percent and has not risen.

»We currently see no clear upward trend, but rather a phase of consolidation,« Heering explains. Companies are responding cautiously, focusing more on efficiency and stability rather than growth.

Optimism is no longer at the high level seen in previous surveys. Looking ahead to the next 24 months, only 63 percent of respondents expect growth in the domestic market – 14 percent fewer than in the spring survey. Regarding exports, 51 percent of member companies anticipate an increase over the next 24 months, which is 13 percent less than in the spring.

AM application from the VDMA special show at Formnext 2025: SMS Group gas/air mixer.

Image: Thomas Masuch

»GROWTH IS MORE UNEVEN«

Last year, according to the Wohlers Report 2026 published by Wohlers Associates and powered by ASTM International, global AM sales grew by 10.9 percent to USD 24.2 billion. In the AM process chain, printing services showed the largest increase with a rise of 15.5 percent and now account for a market share of 48 percent – significantly more than system sales and maintenance (26 percent), materials (20 percent), and software (6 percent).

Wohlers Associates attributes the relatively low growth in system sales of only 3.6 percent to the fact that the »maturing industry« is characterized, among other things, by increasing utilization of installed capacity, while value creation is increasingly concentrated on production and service delivery.

The report also highlights sharply diverged regional trends, with companies in the Asia-Pacific region reporting average revenue growth of 19.8%, compared with 12.6% in the Americas and 9.0% in Europe, the Middle East, and Africa. Mahdi Jamshid, Director of Market Intelligence at Wohlers Associates, sums up: »Growth continues, but it is more uneven, more regional, and more closely tied to real production outcomes.«

AM STRATEGIES FOR IMPLEMENTERS

It's been a while since 3D Printing moved beyond prototyping – but how do you turn the technology into genuine business value? That's where the new book »Wirtschaftliche 3D-Druck-Strategien« (Economic 3D Printing Strategies) comes in. Alexander Starnecker and Johannes Lutz do not provide yet another introduction to powder bed, filament, or parameter optimization. Instead, they focus on what determines success or failure: the business model.

The book views Additive Manufacturing as a strategic tool and invites the reader to consider 3D Printing as a process rather than simply a machine. The authors also discuss the economic and organizational framework required to scale AM profitably in an industrial environment. The book, which is aimed at »implementers,« is based, among other things, on practical case studies and illustrates where Additive Manufacturing provides measurable benefits and where it does not. This makes the book refreshingly honest and practical.

SUPPORTING THE CAUSE

Advances in support strategies for Additive Manufacturing.

Text: James Woodcock

Primarily recommended as support material for PC-ESD and VICTREX AM, 3DGence's ESM-30 can withstand the elevated chamber temperatures required by some engineering and specialty polymers.

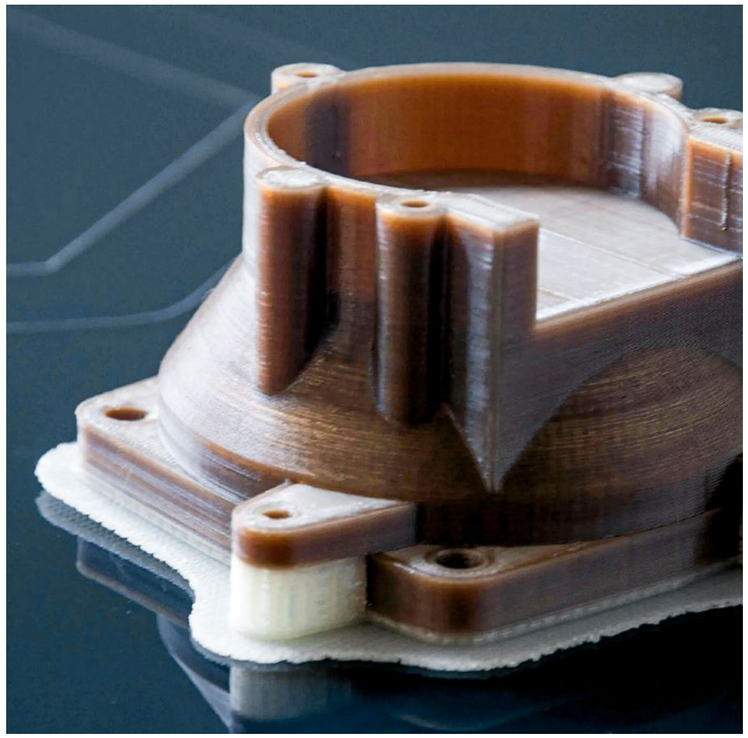
Images: 3DGence

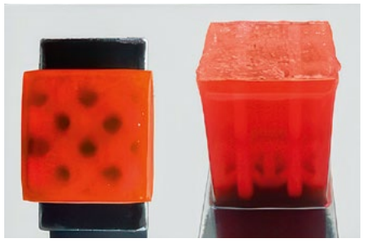
As Additive Manufacturing (AM) pushes into ever more application areas, the conversation almost always comes back to materials. That might mean the growing number of metal alloys available or polymers positioned. What tends to get far less attention is support materials — despite the fact that, for many AM technologies, they are absolutely central to making parts printable in the first place.

For a large proportion of AM processes, supports are what enable the geometric complexity that underpins much of AM's value proposition. As ever, the detail depends heavily on the technology being used and how it is deployed. Support strategies, materials and removal methods therefore vary widely, and need to be considered on a process-by-process basis.

FUSED DEPOSITION MODELING (FDM)

Because of the way FDM systems work to build parts, supports are required for overhangs, bridges and internal voids. Historically, those supports were printed from the same material as the part, typically with a breakaway structure that could be removed by hand or hand tools after printing. While that approach is still common, dual-ex- »





Above:
A gyroid lattice and a reentrant lattice, both with overhanging features that require the use of supports.
At left:
V-Shaper FS-11 support material is designed to be easily dissolved in alkaline solution preventing damage to the model when mechanically removing support structures.

trusion systems have made soluble supports far more practical, particularly for parts with internal channels or enclosed features.

Polyvinyl alcohol (PVA) remains widely used, but materials such as BVOH (butenediol vinyl alcohol copolymer) dissolve more quickly and are less sensitive to ambient moisture. More recently, development has focused on compatibility with high-temperature engineering polymers, which have traditionally been difficult to pair with suitable support materials. A number of options are now available that operate at the elevated chamber temperatures required for materials such as PEEK, PEKK and Ultem, including FS-11 and the AquaSys range (GP, 120 and 180).

Despite these advances, part orientation and design optimisation remain the most effective ways to reduce support requirements. That said, hybrid approaches are increasingly common, combining sparse breakaway supports with a thin soluble interface layer. The result is lower material usage overall, while still allowing clean separation at critical surfaces.

MATERIAL JETTING

In material jetting platforms such as Stratasys PolyJet and 3D Systems MultiJet, support material is fundamental to the process rather than an optional extra. Whether water-soluble or wax-based, these supports are key to achieving the smooth surfaces, fine detail and multi-material capability that make material jetting particularly attractive in medical and dental applications.

At the large-format end of the spectrum, Massivit 3D has introduced Dimengel WB, a water-breakable support designed for very large prints. For tooling and mould applications in particular, this significantly simplifies post-processing compared with more traditional removal methods.

LASER POWDER BED FUSION (LPBF)

For the most part, metal LPBF processes still rely on same-material supports that must be removed mechanically, often through machining. While improvements in generative design and automated removal have helped, support removal remains labour-intensive and continues to act as a brake on wider industrial adoption. As a result, most development in this area focuses on reducing and managing supports, rather than replacing them with true multi-material solutions.

One area of ongoing research looks at modifying the microstructure at the interface between the support and the part, enabling selective chemical etching of the support without affecting the finished component. At the same time, near-support-free LPBF systems have emerged — most notably from Velo3D — alongside a steady stream of academic work exploring overhang capability and process stability.

Extrusion-based metal systems such as Markforged's Metal X and Desktop Metal's Studio System have taken a different approach for some time, using thin ceramic release layers between the part and its supports. These non-bonding interfaces allow supports to be removed without tools after sintering, reducing finishing effort and improving consistency.

VAT POLYMERISATION

Vat polymerisation processes are, by their nature, limited to a single resin, which means supports must be carefully designed and mechanically removed after printing. However, recent research at MIT has demonstrated a technique known as selective solubility vat photopolymerization (SSVP). This uses two light sources — visible and UV — to create two chemically distinct forms of the same material. Exposure to visible light produces a rigid, dissolvable thermoplastic, while UV exposure creates a crosslinked thermoset that resists dissolution.

Alongside this, bi-directional printing approaches — such as those introduced by Duplex — have the potential to dramatically reduce, or in some cases almost eliminate, the need for traditional support structures.

SELF-SUPPORTING TECHNOLOGIES

Some AM processes benefit from being inherently self-supporting. In selective laser sintering (SLS) and multi jet fusion (MJF), unfused powder provides full support during the build. Unlike LPBF, parts are generally less prone to distortion and do not need to be anchored to the build plate.

The same principle applies to binder jetting systems, whether in metals, sands or polymers. These are effectively »cold« build processes, with high-temperature sintering or infiltration taking place as a separate downstream step, removing the need for conventional supports during printing.

REDUCING THE NEED, REDUCING THE IMPACT

Across AM, support materials are slowly shifting from disposable scaffolding to more considered, engineered solutions. The emphasis remains on reducing or eliminating supports through design and process optimisation, but where supports are unavoidable, the focus is on making them easier to remove — cleanly, quickly and with minimal downstream effort.

+ FURTHER INFORMATION:
» formnext.com/fonmag

»IN THE FAST LANE«

After years of consistently high growth, the orthopedics sector has become a key user industry. Post-processing specialist Dyemansion, however, believes there's still plenty more development potential.

Text: Thomas Masuch

Opposite page:
Orfi 3D-printed ankle-foot orthoses (AFO), printed by Nowecor: depowered blank to rear, smoothed and dyed finished parts at the front.

Above:
Emil Wörgötter at Formnext 2025, to the right we see multiple AFOs in lightweight, custom-fit designs

Images: Emil Wörgötter, Thomas Masuch, Lester Hitch

While orthopedic technology is not mentioned explicitly in most market analyses, except as part of the higher-level Medical/Healthcare category, it has slowly developed into one of the most important user industries for Additive Manufacturing. According to market experts, this is thanks to years of consistently high growth. For most orthopedic and prosthetic products, AM is even today able to replace or at least complement traditional manufacturing processes. The increasingly widespread adoption of digital manufacturing processes offers opportunities for manufacturers along the entire AM process chain, from 3D scanning and CAD software to 3D Printing and post-processing, and for AM service providers in particular.

Despite the lack of available data, the successful development can be measured by numerous indicators: »25 to 30 percent of our qualified leads at Formnext 2025 came from the O&P (Orthopedics & Prosthetics) sector,« reports Emil Wörgötter, who has been working as an AM engineer in orthopedic technology for almost ten years and is an application consultant at Dyemansion with responsibility for the EMEA and APAC regions. Among the more than 1,300 systems in active use at Dyemansion, a similar percentage is used for manufacturing O&P products, according to Wörgötter's estimate. A definitive statement is difficult, however, as much of the business is conducted via service providers. The importance of the orthopedics market for the provider of end-to-end post-processing workflows (which encompass depowdering and finishing to the dyeing of 3D-printed plastic parts) is also evident from the fact that two of DyeMansion's application consultants, Emilie Simpson (USA) and Emil Wörgötter (EMEA & APAC), specialize in the O&P market.

MARKET AND GROWTH

The stable growth of AM in orthopedics is the result of a constantly growing overall market (driven, in part, by an aging society in many industrialized countries) and the ever-increasing use of AM by the industry. Between 2008 and 2024, according to figures from the National Association of Statutory Health Insurance Funds (GKV-Spitzenverband), expenditure by statutory health insurers on medical aids such as orthoses and prostheses as well as glasses and hearing aids, etc. increased by 105 percent to € 11.7 billion.

This development is being accelerated by a continued decline in the capital expenditure required to set up professional digital manufacturing processes and get started with Additive Manufacturing. Depending on system size, purchase prices for some powder bed 3D Printing systems (for polymer materials) are now in the five-digit range. Together »

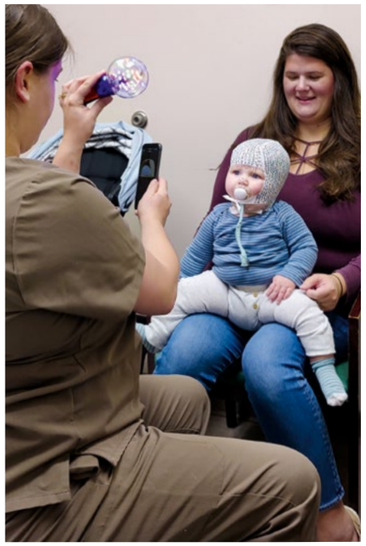
with increasingly affordable 3D scanners, an entry-level AM production line can now be set up for less than € 100,000, says Wörgötter. Dyemansion is also playing its part by offering the VX1, a chemical smoothing system, in the lower price range. Wörgötter expects further dynamic application growth, in particular due to the increasing automation and simplification of design processes. According to him, this represents the biggest hurdle on the horizon. He sees opportunities for orthopedic technology companies and AM service providers as well as some urgency to get involved: »AM in this industry really is in the fast lane. If you don't get on board now, you risk being left behind.« The success of those who are already successfully working digitally is the result of the work of recent years. »Now is a good time to act, because the solutions are mature, but the market is still catching up.«

There are around 5,300 medical supply stores in Germany, spread across just under 2,200 owners, 1,465 of whom are sole entrepreneurs with only one location. Every year, these supply the population with almost 25 million medical aids, according to data provider PM Pflegemarkt.com. Emil Wörgötter estimates that in the DACH region (Germany, Austria, Switzerland), around 10 to 20 percent of orthopedic technology companies have adopted digital technology to some extent, i.e., a 3D scanner at the very least. »This is, in a sense, the ticket to the digital world.« Design and manufacturing can also be outsourced if necessary, so that not »all steps have to be taken at once,« thus avoiding overburdening the company and its employees. AM service providers or partners such as the Nowecor AG purchasing association (see report on page 17) can help with this. Only a small proportion manufacture printed, ready-to-deliver »definitive supplies« themselves; examples include innovative, family-run orthopedic companies such as Kriwat (see article on page 16) or large companies such as Otto Bock.

STILL PLENTY OF POTENTIAL

Even though the industry has grown steadily in recent years, Wörgötter estimates that less than 5 percent of orthotic and prosthetic devices are currently 3D printed. Extrapolated to the total number of devices, this is already a considerable number of products in Germany alone, but it also shows that there is still great, untapped market potential. Wörgötter expects the share of 3D-printed orthopedic products to increase significantly in the future: »We are in a phase where pragmatists are starting to follow the tech-savvy early adopters in jumping on the bandwagon because the advantages are so obvious. The proportion of 3D-printed products on the market will therefore surely rise. The big question is when.« Precise predictions are difficult here, as market dynamics and health policy decisions play a big part.

To further advance and accelerate the development of Additive Manufacturing in the field of orthopedics, DyeMansion works closely with all 3D printer manufacturers in the polymer powder bed sector to offer complete solutions. With HP, for example, it produces industrial, automated solutions for large companies in the O&P sector. Both companies organize seminars and workshops on digitalization in orthopedic technology. One success story is end user Orfi (orthopedic shoe technology company from Mörfelden-Walldorf, Germany), which has many of its products and components 3D-manufactured by DyeMansion partner Nowecor AG.



Scanning process for a cranial helmet at Hanger Clinic Prosthetics & Orthotics in Baltimore (USA) for taking patient-specific measurements for the manufacture of custom cranial orthoses.

INTERNATIONAL DIFFERENCES

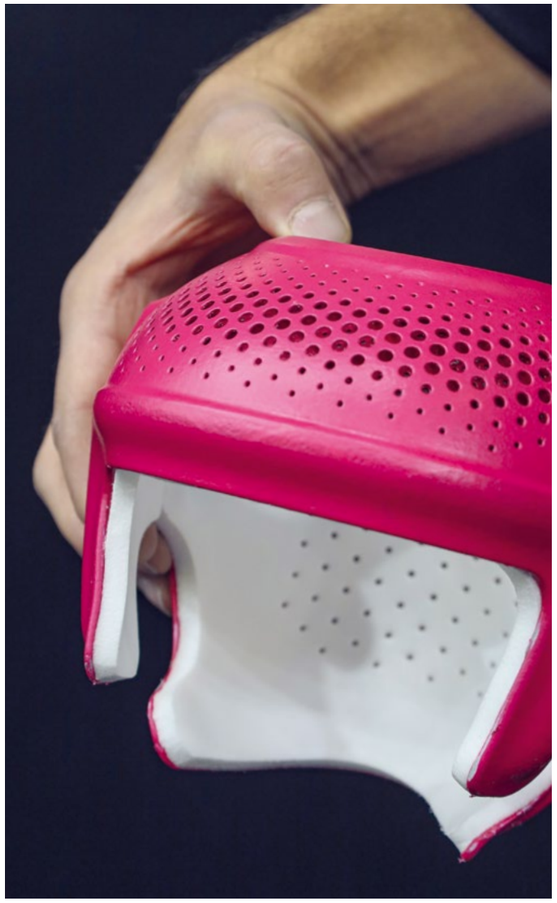
DyeMansion has been focusing on the orthopedic sector for years and, in 2021, supported Otto Bock with FDA 510(k) clearance for the Mycro Band cranial helmet (manufactured by HP MJF from PA12 with Dyemansion's Deepdye Coloring). DyeMansion technologies are also used in the finishing of the Sprout3D cranial helmet from Surestep (a Hanger Corporation company).

Such cranial helmets are used to correct head deformities in infants, either for medical or aesthetic reasons. In Germany, the costs for aesthetic treatments are not usually covered by health insurance. In the US, too, such helmets often have to be paid for privately. However, according to Wörgötter, it is more common for people in the US to pay for medical services out of their own pockets, which is why such helmets are in high demand there.

ADDED VALUE IS KEY

Paying orthopedic products out of the patient's pockets leads to greater competition and pressure to innovate. »Suppliers must offer patients and their parents real added value.« The advantages of 3D-printed cranial helmets are significant and range from more precise pressure distribution on the head to lower weight and better ventilation to more comfortable care not only for children but also for their parents (scanning eliminates the need for plaster casts).

This development has led to cranial helmets increasingly being produced on 3D printers in the US. »We are already seeing a trend here toward Additive Manufacturing replacing conventional manufacturing,« says Wörgötter. This is also due to another special feature of the US orthopedic market: Care in the US is primarily determined by large companies. Global player Hanger, for example, has an estimated market share of around 20 percent. »And these large companies are also more willing to roll out digital manufacturing processes than small businesses with a tradition of craftsmanship, such as those in Germany.«



Cranial helmet, which was presented by Dyemansion at Formnext 2025.

FOCUS ON EFFICIENCY

In Germany, DAFO (dynamic ankle foot orthosis) is a device for which many companies already use 3D Printing. This is partly because it is one of the most common medical devices to custom make, and partly because it fits into smaller printer build spaces and is easy to »pack.« Since such products are usually covered by health insurance, Wörgötter says that, in addition to the added value of the product, specialist companies are primarily focused on increased efficiency and standardization in the processing of care services. Here, too, 3D Printing can offer a real advantage: Digital workflows relieve the few available specialists by eliminating simple production steps such as pouring plaster and allowing the orthotic shells to be produced overnight in the printer instead of having to be deep drawn by hand. Personnel costs for production are reduced, and specialists can devote more time to delivering added value to the patient. »This is a particularly important factor in view of the shortage of skilled workers.«

And because the investment required for Additive Manufacturing as a whole poses greater challenges for a small specialist company than for global players such as Össur or Otto Bock, the majority of supplies in Germany are ordered through service providers. »Even though most of the service providers do not specialize exclusively in orthopedic products, their expertise in this area is growing,« says Wörgötter. Service providers also offer certificates confirming the biocompatibility of the materials used and post-processing steps. This is a special responsibility that Dyemansion also honors.

FURTHER INFORMATION:
» formnext.com/fonmag
» dyemansion.com

»THE PRINTERS HAVE ABSOLUTELY PAID FOR THEMSELVES«

Kiel-based orthopedic company Kriwat GmbH has set up a large 3D print center where it produces the majority of its insoles and orthoses.

Text: Thomas Masuch

When Lais Kriwat became increasingly involved in the family business Kriwat GmbH around ten years ago as a trainee orthopedic shoemaker, he also became interested in the potential of Additive Manufacturing for orthopedics. Today, the company is a pioneer in the 3D Printing sector: The family-owned business produces most of its orthoses and orthopedic insoles at its own large AM production facility in Kiel.

The adoption and expansion of 3D Printing was not an overnight success and was not purely driven by technological enthusiasm. The traditional company, which now employs 60 people, was founded by Lais Kriwat's grandfather, who supplied orthopedic shoes to wounded war veterans in the aftermath of World War II. Lais Kriwat's father later expanded the portfolio to include insoles for athletes and the general public. When Additive Manufacturing was first adopted, his father and grandfather insisted that products should only be 3D printed if the result was of a higher quality than using the traditional manual process. »And we continue to be guided by this principle,« says Lais Kriwat, who has since completed his further training as a master orthopedic technician and took over management of Kriwat GmbH last year.

The first step on the journey to 3D-printed orthoses was the purchase of a small FDM printer »to better understand with the technology,« recalls Lais Kriwat, who also familiarized himself with PC modeling and scanning. Over the years, other larger FDM, SLA and SLS printers followed. Instead of ordering 3D-printed orthoses from service providers, Kriwat focused on setting up its own in-house AM production. »That was the only way to keep expanding our technical expertise.« This is just one reason why he is also always keen to discover the latest innovations at the annual Formnext in Frankfurt.

AM production in Kiel now comprises 15 3D printers, which are manned by three permanent employees. Even though Kriwat GmbH, with its seven branches, is certainly one of the larger orthopedic specialist companies in Germany, the purchase of the larger printers and peripherals represented a considerable investment. According to Lais Kriwat, however, »They have absolutely paid for themselves.«

Lais Kriwat holds up various orthopedic insoles.

Image: Orthopädiebetrieb Kriwat

PRODUCTS: INSOLES, ORTHOTICS, AND MORE

At Kriwat GmbH, 3D Printing has now replaced traditional manufacturing for orthopedic shoe insoles (which are produced using SLS or FDM printing) and ankle orthotics.

3D Printing is also used in the manufacture of custom-made orthopedic shoes, but has not yet replaced traditional methods. »These shoes are extremely complex and consist of different materials,« explains Kriwat. »We only use AM to manufacture individual components.«

VARIOUS ADVANTAGES FOR PATIENTS

3D Printing makes the orthosis manufacturing process much more comfortable for patients too: »In the past, the arm would be put in a cast to create a hand orthosis,« explains Kriwat. After the cast had hardened, it would be cut open and poured out so that the orthopedic technician could obtain a model of the arm. The orthosis was then manufactured around this model. »This process would usually take around five days,« says Kriwat. Today, the arm is simply scanned in and the orthosis is modeled, 3D printed, and post-processed. »The patient can usually pick up the orthosis the very next day.

+ FURTHER INFORMATION:

» formnext.com/fonmag

» kriwat.de

STATE-OF-THE-ART TECHNOLOGY FOR SMALL MEDICAL SUPPLY STORES

Text: Thomas Masuch

3D-printed headgear (l.) and a newly printed orthosis.

Images: Nowecor

The Nowecor service association has 210 member companies, all of which are master orthopedic technology craftsman businesses. When Jens Rosenau, who heads up the »extended workbench« at Nowecor, talks to these companies about Additive Manufacturing, the answers could hardly be more different: While some specialist companies have already fully digitized their production of orthoses and insoles and generate the necessary data using scanners, others remain completely committed to traditional craftsmanship.

Nowecor is a purchasing association that was founded 35 years ago and whose member companies operate around 600 locations throughout Germany. Its services include the »extended workbench,« which is available exclusively to members.

Initially, inserts were manufactured on milling machines. Later, Nowecor expanded its machine park to include two 3-axis milling machines (which can be used to mill models for thigh shafts for use as positive models for later prosthesis construction) and a 7-axis robot (for milling entire leg and arm models and seat shell blanks, for example). In 2019, the company entered the field of Additive Manufacturing: First, an HP Multi Jet Fusion 4200 was purchased, followed in 2024 by an HP Multi Jet Fusion 5400W (»W« stands for »White«). In addition to technical manager Rosenau, the company currently has five employees in production and two in design.

»With the ›extended workbench‹ machinery, even small medical supply stores can offer their customers modern technologies that would otherwise be virtually unaffordable for a single store,« explains Rosenau.

FROM TRADITIONAL CRAFTSMANSHIP TO DIGITAL WORKFLOW

Some medical supply stores have their own scanners with an established digital workflow within their companies. »They send us digital data sets that are specially optimized for 3D Printing,« says Rosenau. To simplify data creation for medical supply stores, Nowecor has developed an app for digital management of patient data captured during scanning (NoweScan app) and its own modeling software (NoweCAD), which is specialized for the requirements of the orthopedic technology sector and is continuously being further developed. At Nowecor, parts are manufactured according to the desired specifications, which, in the case of 3D Printing, also includes surface finishing and dyeing. However, this process is still far from being the norm: »Many orthopedic technology companies have so far only focused on individual steps of digitalization, such as scanning or digital modeling, while Additive Manufacturing is still largely missing as a final step,« explains Rosenau. For example, the molds on which orthopedic technology companies often manually create orthoses in their workshops are milled. And because even the traditionalists among orthopedic technicians will sooner or later recognize the advantages of digitalization and Additive Manufacturing, Rosenau still sees a great deal of potential for 3D Printing in orthopedic technology.

Besides improving production efficiency, Sebastian Bärthel, CEO of Nowecor, also believes that Additive Manufacturing can be helpful in addressing the shortage of skilled workers that is affecting the industry in Germany: »There are far too few people practicing this wonderful craft. At the same time, people are getting older, which means that our industry will always be needed.«

+ FURTHER INFORMATION:

» formnext.com/fonmag

» nowecor.de

FROM FUEL ELEMENTS TO BIPOLAR PLATES

Text: Thomas Masuch

In the wake of the rapid growth of AI and the data centers required to support it, the energy sector has again become an industry with exciting prospects. Additive Manufacturing is playing an important role in the development of this industry.

The energy, oil, and gas industry is extremely diverse. Something that is also reflected in the many possible applications of Additive Manufacturing, which range from the development of new generators to bipolar plates, as used in the hydrogen industry, to numerous power plant components. And wherever energy is converted, heat exchangers are also used. AM and integrated cooling channels can be used to make these exchangers more powerful and efficient.

POWER PLANTS

In coal, gas, and nuclear power plants, for example, AM is used in pump parts called labyrinth discs, which are found in valves and improve maintenance work, as well as numerous parts and components found in turbines.

Siemens Energy has been using AM for almost 20 years, with various centers of excellence, including one in Finspång, Sweden, being a key driver of development. In 2017, an important milestone was reached with the first 3D-printed gas turbine blades, which were successfully tested in the turbine under full load conditions. Today, AM at Siemens Energy does much more than prototyping: The company is involved in the series production of complex parts such as burner nozzles and turbine blades.

AM components are also frequently used in nuclear power plants. Vattenfall, for example, is using 3D-printed spare parts and components to enhance the operational safety and increase the service life of older reactors built in the 1970s and 1980s. Westinghouse, one of the world's leading nuclear power technology companies, also uses AM on an industrial scale. In 2020, it installed the first safety-related AM component, a thimble plugging device, in a commercial reactor. Just four years later, it produced its thousandth additively manufactured component for VVER-440 fuel elements. These are only used in Soviet pressurized water reactors, but after Russia's war in Ukraine, Western companies such as Westinghouse have also begun to qualify these hexagonal fuel elements for delivery to countries using former Soviet reactor technology (in Eastern Europe and Finland, for instance).

Additive Manufacturing also plays an important role in the development of new generators: Founded in 2015, the US company Hyliion operates its own M-Line system from Colibrium Additive, using it to print complex components (heat exchangers with internal cooling channels) for its innovative thermodynamic Karno generator, among other things. Hyliion's goal is not only to make power generation more decentralized, but also to make it more efficient than today's gas-fired power plants. The reactors, which can also be powered by hydrogen or biogas, are currently being tested by the US Navy, among others.

Hydrogen compressor developed by Bosch in cooperation with Nikon. The component, which is made from AlSi10Mg, was produced in 48 hours in a NXG XII 600 and combines lightweight construction with various in-built features, designed to improve overall performance.

Images: Thomas Masuch

OIL AND GAS

The extraction and processing of oil and gas is a classic application sector in the energy industry. Prototypes have been made using AM for around 25 years, functional metal parts for around 15 years, and certified industrial applications for around 10 years. The oil and gas industry often requires small quantities at short notice, which are produced flexibly in a decentralized manner (e.g., on oil rigs). And if production is affected because of a missing spare part, it rarely matters if a component is slightly more expensive, as long as it can be delivered quickly. In some cases, 3D printers are operated remotely on oil platforms. By now, almost every major player in the industry is likely to be using AM with applications ranging from heat exchangers and pressure vessels to drilling components and alignment systems for oil and gas wells.

HYDROGEN

Bipolar plates were on display at numerous booths at Formnext 2025. These play a central role in the use of hydrogen as an energy source, whether in its production in electrolysers or in its conversion into electricity in a fuel cell. The leak-tight bipolar plates distribute the reaction gases hydrogen and oxygen, conduct the electric current between the cells, provide cooling, and at the same time separate the individual cell compartments from each other. Thanks to AM, complex cooling structures with integrated flow channels can be produced that are difficult or impossible to achieve using conventional methods. This reduces pressure losses and allows better utilization of the reaction surfaces, for example. Another advantage is that AM can reduce the weight of the bipolar plates, which is extremely important for aircraft engines, for example. The topic is also being advanced in research. For example, the Chair of Digital Additive Production (DAP) at RWTH Aachen University is working with partners from industry and research to develop innovative additive solutions along the entire hydrogen value chain. These range from optimized, scalable cell architectures for electrolysers to hydrogen-compatible pipelines and industrial burner systems.

RENEWABLE ENERGY

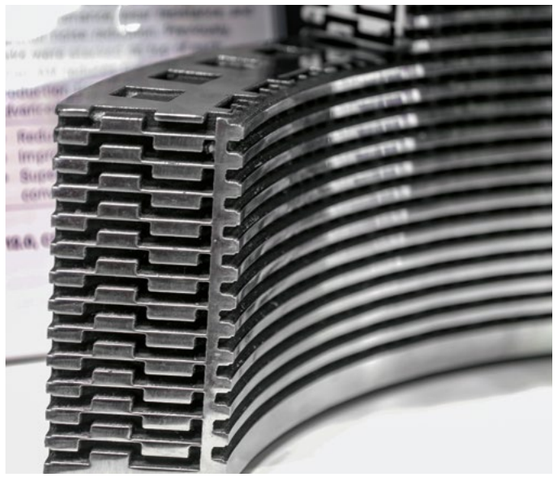
Although renewable energy generation may not be a central field of activity for AM, it has numerous applications in this area as well. These range from repairing turbines in hydroelectric power plants to brackets and heat sinks in the production of solar modules to 3D-printed foundations for wind turbines. GE Renewable Energy is one of the most active players in this field in collaboration with Cobod and Holcim, among others. The 3D Printing of concrete segments weighing several tons is intended to simplify logistics, among other things. In addition, even larger foundations (and thus taller turbines) are conceivable, which have not been practical until now due to maximum dimensions for road transport.

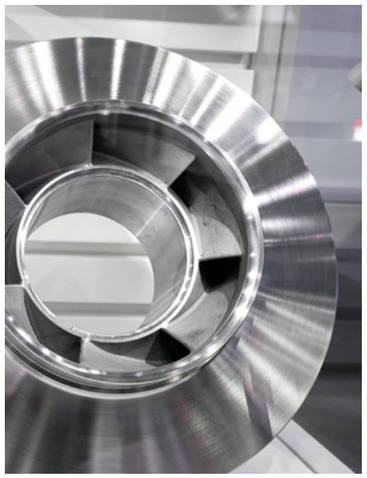
OPPORTUNITIES FOR SERVICE PROVIDERS

The possible uses for Additive Manufacturing within the energy sector are also illustrated by the company KSB. The world's leading manufacturer of pumps and valves has set up an Additive Manufacturing facility at its Pegnitz site, where it offers services to other companies under the KSB SupremeServ brand. In December 2023, the Additive Manufacturing facility received DNV certification (from the Norwegian testing agency Det Norske Veritas) for Noribeam 625 material for AMC3 impellers, which are typically used in pumps. To date, KSB has delivered many 3D-printed impellers as spare parts, including to an Equinor oil platform and for a nuclear reactor.

+ FURTHER INFORMATION:
» formnext.com/fonmag

Image on the right: Labyrinth cage for control valves: AM has cut total production time and enables advanced designs.
Image on the far right: This impeller for a KSB HVR multistage pump is used for seawater injection pumps on oil platforms.





»WE ARE NOW REAPING THE REWARDS«

Additive Manufacturing has long been an integral part of the aviation industry. Many components are already made using Additive Manufacturing, making aircraft lighter and engines more efficient, for example. However, the importance of AM in aviation has now reached a whole new level with new models such as the H140 helicopter at Airbus Helicopters.

Text: Thomas Masuch

Perhaps surprisingly, Airbus Helicopters' 3D Printing center in Donauwörth has written its biggest AM success story to date not with components for helicopters, but with 3D-printed latch and drive shafts for the doors of the Airbus A350. The doors, which are mass produced in Donauwörth, have been fitted with 3D-printed latch shafts since 2017. »The latch shafts are 43 percent lighter and 23 percent less expensive to manufacture than the conventional design, and the component consists of just one part instead of the previous ten,« explains Frank Rethmann, Head of the 3D Printing Industrial Service Center at Airbus Helicopters. In the past eight years, around 17,500 latch shafts have been 3D printed in Donauwörth, which makes the shafts the »bread and butter« for 3D Printing at Airbus Helicopters in Donauwörth.

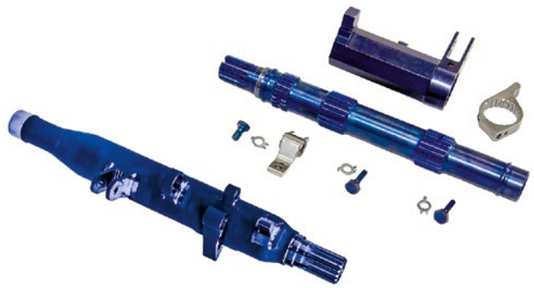
The latch shafts are a good example of how Additive Manufacturing has gradually gained a foothold in the aviation industry: For years, systematic investigations were conducted to determine whether aircraft components could be successfully 3D printed, either for weight savings or improved function. An important, often limiting factor was the industry's strict approval regulations, which meant that manufacturers such as Airbus started using AM for less critical (i.e. non-safety-relevant) parts and components first.

»SIGNIFICANT WEIGHT SAVINGS«

New aircraft and helicopter models offer even greater potential for the use of Additive Manufacturing – as demonstrated by the H140 helicopter, a lightweight, twin-engine helicopter that was unveiled a year ago and is scheduled for initial delivery to customers in 2028. AM did, in fact, play an important role in the development of test vehicles and demonstrators for the H140 some years ago. However, according the Rethmann, AM will also set new standards in series production for the H140. The number and nature of the 3D-printed parts to be installed in the H140 is still a well-kept secret within Airbus, »but it's a large proportion,« reveals Rethmann. As a rule, the 3D-printed components at Airbus Helicopters are 40 percent lighter than their conventionally manufactured predecessors. In the H140, this means that the 3D-printed metal parts bring »significant weight savings« with a maximum take-off weight of around 3.2 tons. »Such weight savings enable longer flight times or larger payloads. In air rescue, for example, it means that more equipment can be carried,« explains Jörg Michel, press spokesman for Airbus Helicopters.

»Long development processes are standard for the aviation industry,« says Rethmann. »The design of the H140 was developed and finalized years ago.« Not only were existing components and parts replaced with 3D-printed alternatives in the H140, but the possibilities and design freedom offered by Additive Manufacturing were also considered during the helicopter's design phase. A fact made possible by the AM experience of the engineers and designers at Airbus Helicopters, who had been working with metal 3D Printing for around eight years, supported by numerous design training courses. »We are now reaping the rewards of our years of work with AM.« »

Images: Airbus Helicopters



3D-printed latch shafts.
Frank Rethmann, Head of the 3D Printing Industrial Service Center at Airbus Helicopters.

Airbus Helicopters' AM Tech Center in Donauwörth was opened in fall 2023.

AM IN DONAUWÖRTH

With the 3D Printing of latch shafts for the A350 doors and numerous other components, the AM division in Donauwörth has also continued to grow. »We wanted to understand the entire AM process from the outset,« explains Rethmann. An important step in this direction was the opening of Airbus Helicopters' AM Tech Center in fall 2023. Besides an extensive arsenal of AM systems (six PBF systems for metal production, eight professional plastic systems, and several desktop printers), the center also houses systems for post-processing and quality assurance. These include depowdering, heat treatment, pickling, and non-destructive testing (NDT). The high quality requirements mean that 70 percent of the total effort involved in manufacturing a 3D-printed metal part is spent on post-processing, while 3D Printing itself accounts for only around 30 percent, according to Rethmann.

The AM Tech Center not only prints prototypes and series parts, but also numerous production aids, such as drilling templates and flight test mounts. The 3D-printed components are used exclusively within the Airbus Group, even though there have been numerous inquiries from external companies, as Rethmann reports. He repeatedly mentions »his customers« in conversation, but is referring exclusively to colleagues from other Airbus programs.

Spare parts for existing helicopters are not yet printed at Airbus, although Rethmann sees this as an area with potential that is »worth considering.« After all, older military helicopters are still in use around the world – some have been flying for more than 50 years. »The design drawings were drawn in ink back then, so the issue of spare parts is a real challenge.« 3D Printing is not straightforward in this area either, however – after all, even aging machines have to meet high standards. For 3D Printing, this would certainly mean years of qualification work.

+ FURTHER INFORMATION:

» formnext.com/fonmag

» airbus.com

Text: Thomas Masuch

HOW CERAMIC 3D PRINTING CAN REDUCE KEROSENE CONSUMPTION

One of the key drivers of technological progress in civil aviation is the pursuit of greater efficiency. And 3D-printed ceramic casting cores could potentially play an important role in this.

According to data from the International Air Transport Association (IATA), kerosene costs now account for almost 30 percent of airlines' total costs, making this the single largest cost factor. More efficient engines also play an important role in the quest for lower kerosene consumption. And Safran, one of the world's leading manufacturers, is using ceramic 3D Printing, among other things, for their further development.

Ceramic AM systems manufacturer Lithoz recently reported that French engine manufacturer Safran Aircraft Engines has installed three CeraFab S65 printers at its plant in Gennevilliers, near Paris, to develop a new generation of its engines. This investment will enable Safran to establish industrial-scale series production of complex cast cores, thereby meeting the high cooling requirements of next-generation aircraft engine turbine blades, according to Lithoz.

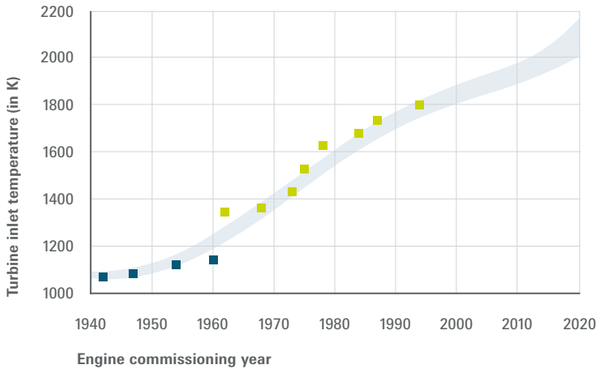
The reason for using ceramic 3D Printing is the turbine inlet temperature (TIT), which is an important factor in engine efficiency. Generally speaking, the higher the TIT, the more efficiently an engine can be operated (in terms of kerosene savings). Studies by NASA and various universities have shown that an increase in TIT of 100 degrees Celsius can result in savings of between 3 and 6 percent. It is therefore not surprising that engines are operating at ever higher temperatures – over the past 80 years, the TIT has risen from around 1,100 K (equivalent to around 730 °C) to over 2,100 K (around 1,830 °C) today.

Such temperatures place a heavy strain on the individual components, especially the turbine blades, and are only possible through a combination of various technological developments, »

Above:
Quality assurance for an M88 engine.
At right:
3D-printed ceramic casting cores.

Images: Adrien Daste/Safran, Lithoz

Safran production line for the final assembly of LEAP engines.



Rising temperatures
This chart illustrates the increases in turbine inlet temperature with each new turbine generation - which is also thanks to increasingly sophisticated cooling solutions.

■ Not cooled ■ Cooled ■ Technological developments

Source: Aviation Stack Exchange

including high-temperature nickel-based alloys, single-crystal blades (manufactured using a special casting process), ceramic coatings, and sophisticated cooling systems.

The use of Lithoz's precise LCM (Lithography-based Ceramic Manufacturing) technology is expected to improve cooling. This technology is not used to produce the turbine blades on a 3D printer. Instead, the casting cores are used to manufacture the highly stressed turbine blades in an extremely complex process involving special ceramic formulations that have been developed jointly by Lithoz and Safran in recent years. »The ceramic casting cores allow for even more complex cooling channels in the turbine blades,« explains Nobert Gall, Head of Marketing and Corporate Communications at Lithoz.

Safran's main products include the LEAP and CFM56 engines for short- and medium-range jets and the M88 for the Dassault Rafale military jet. It is not yet known which of these will use the turbine blades manufactured with the 3D-printed cores, nor when they will go into series production. But Gall interprets the mere fact that Safran is using three AM systems as »the first step toward series production. Further steps and scaling will certainly follow.« Johannes Homa, CEO of Lithoz, also sees the installation of the three Kamerik 3D printers at Safran as »a real milestone for both Lithoz and the aerospace industry.«

+ FURTHER INFORMATION:
» formnext.com/fonmag
» safran-group.com
» lithoz.com

MORE THAN 25,000 FLIGHT-READY PARTS PER YEAR

Polymer parts have also significantly changed aircraft construction. Airbus alone prints more than 25,000 flight-ready parts annually with its 3D printers. According to Stratasys, Airbus has comprehensively introduced AM and taken it to a new level, starting with an initial component, a replacement part for a crew seat. More than 200,000 certified Stratasys polymer parts are now in active use.

Airbus manufactures components for the A320, A350, and A400M models using Stratasys Ultem 9085 Filament Certified Grade (CG) material on several Stratasys industrial FDM printers. »We can produce certified, reproducible components faster and are less dependent on complex supply chains. This manufacturing flexibility reduces costs and improves responsiveness,« says Serge Senac, Airbus Industrial Leader for Polymer Additive Manufacturing.

The parts meet stringent aerospace requirements while enabling faster and more cost-effective replacement of various components throughout the aircraft. Thanks to decentralized manufacturing, Airbus can produce parts where and when they are needed, reducing aircraft downtime, minimizing inventory, and avoiding costly delays in the supply chain.

3D-PRINTED REAR FRAME FOR NEW ENGINE CONCEPT

Visitors to Formnext 2025 were able to get a glimpse of the next generation of aircraft turbines at the Nikon SLM Solutions booth, where the 3D-printed rear frame from the CFM RISE development program was on display. The RISE program is a collaboration between Safran Aircraft Engines and GE Aerospace through their joint venture CFM International.

RISE, which stands for Revolutionary Innovation for Sustainable Engines, was launched in 2021 with the goal of reducing fuel consumption by a further 20 percent compared to the most efficient engines currently available, while also making them cleaner and quieter. The revolutionary aspect of the RISE program is the »open fan« concept, in which the large fan rotor blades operate without external fairings (nozzles/nacelles) to reduce weight and drag.

The aim is also to achieve a high bypass ratio, which significantly increases thrust efficiency and fuel efficiency. To this end, the concept also includes a smaller, more thermally efficient high-pressure core with new materials and improved cooling (see also the article on Lithoz and Safran on page 23). According to Nikon, the component was printed as a step toward the final design for the RISE demonstration engine planned for 2030. Series production is scheduled to begin in 2035 and will also be carried out using 3D Printing.

Images: Adrien Daste/Safran, Airbus

A SPIRIT OF (RE-)INVENTION

Text: Thomas Masuch

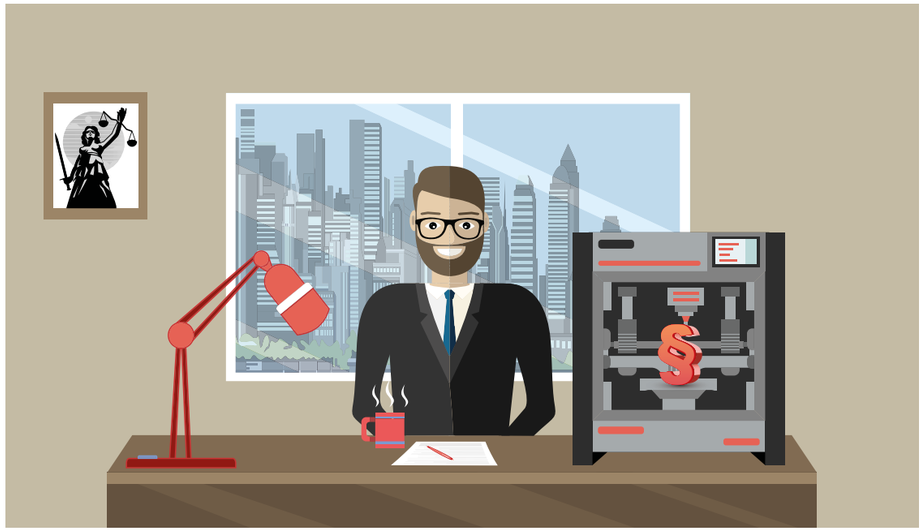


Illustration: feedbackmedia.de, iStock/Iuliia Anisimova, JoyImage, mitay20, Nick Molokovich

Almost three years ago, New York lawyer Steven A. Schwartz received some unwanted media attention and notoriety after using AI tool ChatGPT to help prepare for a lawsuit against Colombian airline Avianca Airlines, for his client who was allegedly hit by a metal service cart on a flight. In court, the lawyer referenced several legal cases supplied by Chat GPT. The only problem was, the cases did not exist and were in fact an AI hallucination.

Besides the fine of USD 5,000, the reputational damage suffered by Schwartz and his law firm was significant, given the international media coverage. The lawyer later claimed that he was »unaware« that ChatGPT's content could be false.

What this whole debacle demonstrates is just how enticing the promise of AI efficiency has become and the extent to which we are prepared put our trust in it. It is apparent that our lives are increasingly shaped by AI, with ChatGPT only a small part of the overall picture. For most of us, it has become almost impossible to tell genuine content from fake, AI-generated material on YouTube, for example, let alone photos and texts.

The boom in AI was also reflected on the stock markets, where Nvidia and other major players for a long time continued on a seemingly never-ending upward trajectory. From the point of view of some investors, Additive Manufacturing is already old hat or yesterday's news compared to the booming AI sector. However, the AI trend has triggered a certain amount of creativity in the AM sector too. Instead of describing themselves as AM or 3D Printing companies, new start-ups seeking investors now prefer to call themselves »digital manufacturing« providers. What they mean by this is that they employ a combination of software, 3D Printing, and robotics, powered by AI of course. Even the company profiles of traditional 3D Printing providers now include such terms as »manufacturing technology company« or provider of »advanced production platforms«.

For critics, there is little new in this development, because it was already offered by the additive process chain years ago. Proponents on the other hand consider it a new business model that incorporates 3D Printing. The example of Divergent illustrates that the idea of »digital manufacturing« is certainly appealing to investors: The California-based company has now raised almost USD 1 billion in funding in ten rounds of financing (and has also invested part of this in numerous PBF systems) and is currently (as at March 2026) valued at around USD 2.3 billion.

The new business concept does reflect a general development in the AM industry: Sales are increasingly shifting to the service sector, while providers of AM systems, particularly in Western countries, often have to accept a more modest outlook.

This is not necessarily a sign of decline in AM, but rather an indicator of strong potential for the future. As an enabling technology, AM has reached a certain level of maturity. After all, it is not used to invent parts, but to build them layer by layer.

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