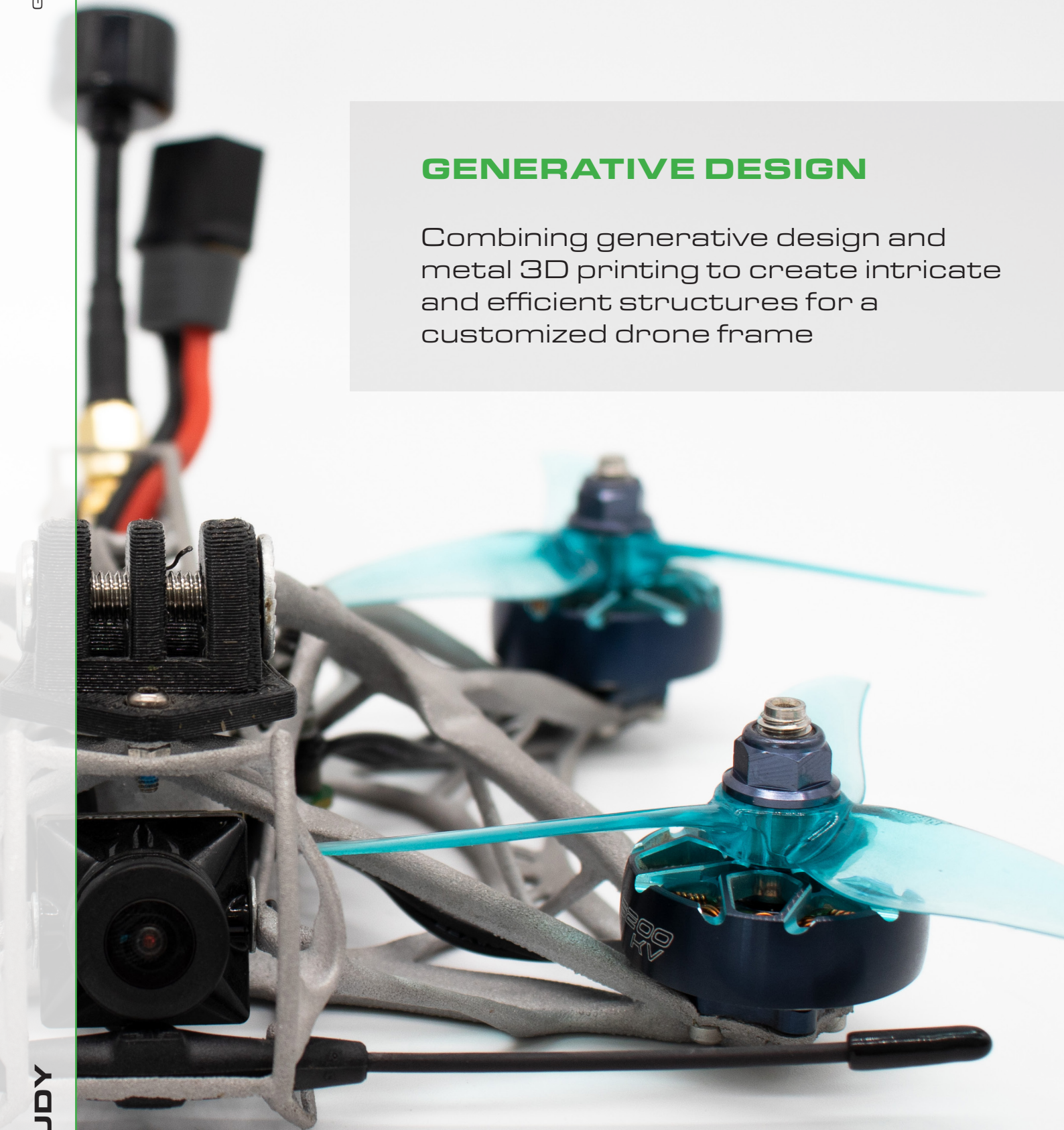




GENERATIVE DESIGN

Combining generative design and metal 3D printing to create intricate and efficient structures for a customized drone frame



THE CHALLENGE

Design and production of a customized drone frame by using the possibilities of generative design and additive manufacturing

The overall challenge of the drone project was to explore the capabilities of generative design and metal 3D printing to create intricate and efficient structures for a customized drone frame. By leveraging generative design and metal 3d printing, the challenge was to demonstrate the potential of additive manufacturing in producing complex yet lightweight components.



The design and manufacturing process must enable different requirements of the drone frame:

Lightweight production

A lightweight is crucial for drone frames to optimize flight performance, extend battery life, and increase payload capacity, enabling diverse applications such as aerial photography, surveillance, and delivery services.

Complex bionic structures

Complex structures are necessary to optimize strength-to-weight ratios, enhancing durability and flight performance while minimizing overall weight.

Fast development method

Fast production methods are crucial to enable streamlined processes that facilitate the rapid production of new iterations and customization, ensuring continuous improvement of drone designs.

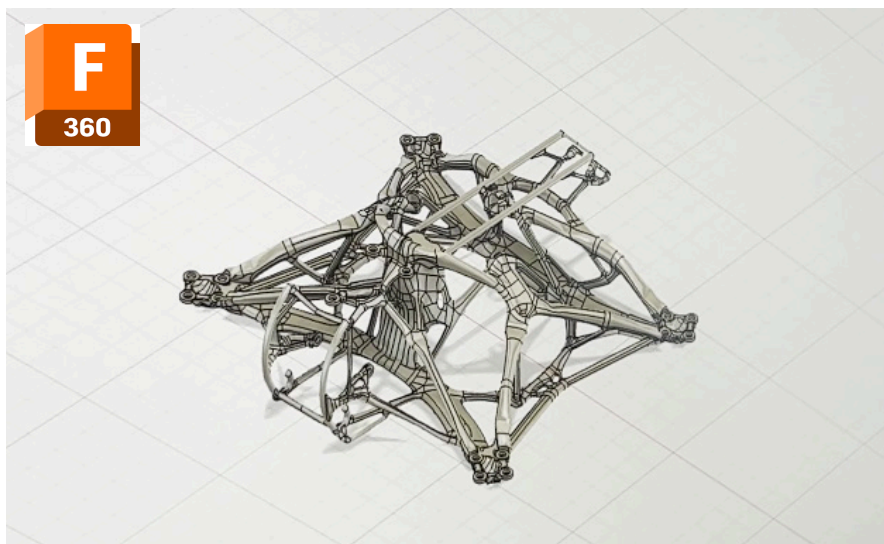
THE SOLUTION

Generative Design and Additive metal manufacturing enabled designer Till Blaser to create and manufacture the desired drone frame .

Using Generative Design within Autodesk Fusion 360 significantly streamlined the process of optimizing and tailoring the design of a complex drone frame. By harnessing the power of the Fusion 360, designer Till Blaser was able to explore a vast array of design iterations, allowing for the creation of a highly customized structure that perfectly balanced strength, weight, and aerodynamics. The iterative nature of Generative Design facilitated rapid prototyping and iteration, enabling the team to quickly converge on an optimal solution.

Furthermore, Metal Additive Manufacturing played a pivotal role in bringing the design to life. By using additive manufacturing, the team was able to print the complex drone frame with high precision and detail. Metal 3D printing allowed for the creation of geometrically complex structures that would be challenging to produce using traditional manufacturing methods. This not only enabled the realization of the optimized design but also showcased the capabilities of additive manufacturing in pushing the boundaries of what is achievable in drone frame construction.

The drone frame shows a high strength in use, due to the use of StrengthAI Aluminium alloy. As a result, the mounted drone is able to fly optimally and reliably.



Design by Till Blaser

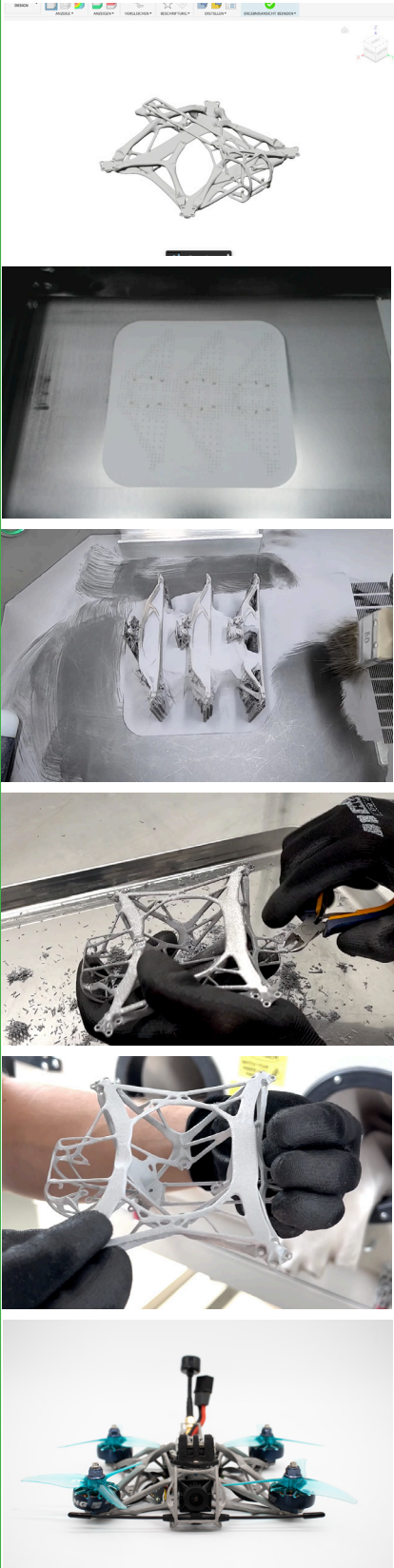
What is generative design?



Generative design is an innovative product development approach where software automatically generates diverse design variations using algorithms and parametric models, considering specific criteria and constraints.



THE PROCESS



Design

The design process was done by using Autodesk Fusion 360 software, which enables generative design.

Upload & Print

Once the design is finalized, the file is uploaded directly to the MPRINT, the printer of One Click Metal. Within 36 hours, the three drone frames printed on one build plate are ready for the next step.

Unpack

The printed drone frames are then moved to the MPUREpro, the unpacking and sieving station of One Click Metal. Here, they get depowdered, with any remaining unmelted powder transferred to the automatic sieving station to prepare it for future prints.

Support removal

Once the drone frames are free of loose powder, support structures are removed using simple tools like pliers, ensuring a clean finish.

Sandblasting

To enhance the aesthetics of the drone frames, they undergo sandblasting, resulting in a smoother surface finish.

Mounting

With post-processing complete, the drone is assembled with all necessary parts, ensuring it is ready for flight.

THE ADVANTAGES



Light weighed part

Metal Additive Manufacturing facilitated the production of the generative design drone frame using StrengthAI by m4p, a very lightweight and robust material, resulting in a final product weighing just 74 grams. This not only ensured the drone's agility and efficiency during flight but also showcased the potential of additive manufacturing in creating light-weight yet durable structures.



Geometric freedom

The layer-by-layer additive manufacturing process enables an unprecedented degree of geometric freedom. Generative Design's capability to create intricate geometries was seamlessly translated into the manufacturing process through Metal AM, allowing for the production of the drone frame as a single, complex unit. By eliminating the need for assembly of multiple parts, this integration streamlined the manufacturing process and reduced the risk of structural weaknesses or points of failure.

The ability to design three-dimensionally made it possible to achieve a much higher stiffness of the frame compared to the classic drone frame structure of superimposed 2D cut-out panels. This is particularly beneficial during rapid direction changes and acceleration.



Fast development cycles

The synergy between Generative Design and Metal AM accelerated the development cycles of the drone frame, thanks to the rapid generation and optimization of complex designs. This iterative approach allowed engineers to quickly explore various design iterations, identify the most efficient configurations, and promptly move towards final production, ultimately shortening development timelines and enhancing overall project efficiency.

TECHNICAL INFORMATION



Material	StrengthAl
Technology	LPBF with 200W fiber laser
Number of layers	6885 (20 µm layer thickness)
Build time	36h (3 pieces)
Material usage	21,8cm ³ / part
Weight	59g / part

What is Strength Al?

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StrengthAl by m4p is an advanced aluminum alloy engineered for high-performance applications in motorsport and aviation. Through sophisticated metallurgy and precise melt treatment, components made from this alloy achieve exceptional specific strength comparable to titanium. With a yield strength nearly twice that of common aluminum alloys, StrengthAl is ideal for lightweight construction in various industries. While initial strength is impressive, further enhancement through heat treatment is possible, albeit with a slight reduction in formability. Additionally, anodizing can be applied for decorative surface effects on components.

m4p

ONE CLICK METAL MADE WITH MIND

We believe that metal AM technology can be made understandable to everyone and available with one click. Especially technology beginners are our concern. For them, we develop simple and intuitive product solutions.



About One Click Metal

Founded in 2019, One Click Metal is an industrial B2B company and a subsidiary of INDEX Werke, based in Tamm near Stuttgart. We believe that technologies can be made understandable and usable for everyone. That's why we simplify our product solutions so that anyone can use them successfully. With our metal 3D printing system, we primarily serve small and medium-sized enterprises and thus ensure that metal 3D printing technologies become accessible to the general public. We are working on this with a strong team and a lot of motivation.

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