TRUMPF uses 3D printing to improve satellites and aircraft

TRUMPF showcases new applications for additive manufacturing in the aerospace sector at the International Paris Air Show // The high-tech company is continuing to expand its market share in the industry // TRUMPF offers expertise in both the key methods required by aerospace companies: laser metal fusion and laser metal deposition

Ditzingen/Paris, June 17, 2019: TRUMPF is currently taking part in the world's largest aerospace industry exhibition, the Paris Air Show, where it is demonstrating how additive manufacturing can improve satellites and aircraft. Satellites are subject to a whole array of ever more stringent requirements. On the one hand, they need to be as light as possible, because every kilogram that a launch vehicle carries into space costs the client several hundred thousand euros. At the same time, however, satellites must be robust enough to withstand the tremendous forces experienced during launch. "With a market share of over 20 percent, the aerospace sector is one of the world's most important industrial users of additive manufacturing. We are steadily expanding our market share and helping to establish the process as a key technology," says Thomas Fehn, TRUMPF general manager additive manufacturing (AM) with responsibility for sales. Weight reduction is equally important for aircraft because it leads to a significant drop in fuel consumption. This reduces both their environmental impact and costs. Additive technologies are the perfect match for the aerospace industry because they enable engineers to create parts that are both lightweight and robust. These methods only add material where it is actually needed, while conventional methods such as milling and casting often struggle to eliminate superfluous material. 3D printers are also adept at handling light metals such as aluminum and titanium, and AM engineers enjoy much more freedom in the design process because they are not confined by the limitations of traditional production methods.

The importance of 3D printing in the aerospace industry

TRUMPF offers expertise in both the key methods required by the aerospace industry: laser metal fusion (LMF) and laser metal deposition (LMD). LMF is carried out entirely within the confines of the 3D printer, with a laser building up the part layer by layer from a powder bed. LMF technology is particularly suitable for creating complex parts for engines, combustion chambers, specialist aerospace components and similar applications. In contrast, LMD, or laser metal deposition, uses a laser beam to build up layers on the surface of a part, with the metal powder being injected through a nozzle. LMD can also be used to rapidly generate very large parts. Typical applications include prototype development

and repairs to large parts such as gas turbines and compressor blades. “Thanks to our LMD and LMF capabilities, we are perfectly placed to offer our aerospace customers 3D printing solutions that match their needs,” says Fehn.

Three examples of how 3D printing is improving the aerospace industry:

1. Weight of satellite mounting structure reduced by 55 percent

TRUMPF is taking the opportunity of the Paris Air Show to showcase real-life applications of additive manufacturing in the aerospace industry. The high-tech company has been commissioned by the space company Tesat-Spaceroom GmbH& Co.KG to produce a 3D-printed mounting structure for Germany’s Heinrich Hertz communications satellite, which will be used to test the space-worthiness of new communication technologies. The mounting structure includes strap-on motors that are used to modulate microwave filters. In collaboration with the company AMendate, engineers succeeded in optimizing the topology of the mounting structure and reducing its weight by 55 percent. The mount now weighs just 75 grams instead of 164 grams. “This is just one example of how we can use additive processes in satellite construction to reduce weight and increase payload capacity,” says Matthias Müller, industry manager additive manufacturing for aerospace and energy at TRUMPF. The team of experts printed the redesigned part on TRUMPF’s TruPrint 3000 3D printer. The new geometry cannot be produced using conventional methods. As well as being lighter, the optimized mounting structure is also more robust. During the launch of the satellite the new mounting structure will withstand the same high forces and will hold its shape better. The Heinrich Hertz satellite mission is carried out by DLR Space Administration on behalf of the Federal Ministry of Economics and Energy and with the participation of the Federal Ministry of Defense.

2. Cost of engine parts reduced by three quarters

TRUMPF is also showcasing an AM use case for the aviation sector at the Paris Air Show. In collaboration with Spanish supplier Ramem, the TRUMPF experts have employed 3D printing to optimize a part known as a “rake.” Manufacturers use this part during engine development to measure the pressure and temperature of the engine. These kinds of measurements are an important part of testing aircraft performance. Mounted directly in the engine’s air flow, rakes are exposed to extreme temperatures and high pressure. To deliver accurate measurements, they must conform to precise dimensional requirements. Producing rakes by conventional means is an expensive and time-consuming process. Workers produce the base structure on a milling machine before inserting six delicate tubes, welding them into place and sealing the body of the rake with a cover plate. If just one of these tubes is out of place, the rake has to be scrapped. TRUMPF produced an optimized rake geometry on the TruPrint 1000 3D printer. Redesigning the part in this way makes it quicker for the

manufacturer to produce and reduces the amount of material used by around 80 percent, ultimately slashing the overall cost by 74 percent. “This result shows that 3D printing can save a significant amount of time, material and money in the aircraft industry,” says project manager Julia Moll from TRUMPF Additive Manufacturing.

3. Making engine blades easier to repair

TRUMPF is also presenting some sample applications of LMD technology at the Paris Air Show. These include the LMD repair of a high-pressure compressor blade – also known as a 3D aeroblade – used in aircraft engines. These components have to withstand extreme changes in temperature during flight. They are also in constant contact with dust and water, and they typically show signs of wear on the edges and tips. Aviation engineers have to periodically repair the blades to maintain engine efficiency. The LMD method is perfect for this job. In some sections of the blades, the material is just 0.2 millimeters thick. Conventional methods quickly reach their limits in these kinds of applications. With LMD technology, however, the laser can be positioned with an accuracy of approximately one hundredth of a millimeter before it applies a precisely calculated dose of energy. At the same time, the system feeds in material of exactly the same composition as the part itself. Depending on the application, this process typically takes just a few minutes. It makes it easy to repair the blades multiple times, significantly reducing the cost per part in each engine overhaul. “Laser metal deposition delivers a low dose of energy – and that makes it perfect for aerospace applications. We can use it not only to repair and coat parts, but also to build up three-dimensional structures. That’s simply not possible with conventional welding methods,” says Oliver Müllerschön, head of industry management laser production technologies at TRUMPF.

Heinrich Hertz communications satellite
TRUMPF has printed a mounting structure for the microwave filter in Germany’s Heinrich Hertz communications satellite, reducing its weight by 55 percent in the process. (Source: OHB System AG)

Thomas Fehn
Thomas Fehn is general manager sales, marketing & finance at TRUMPF Additive Manufacturing. (Source: TRUMPF)

TruPrint 1000
TRUMPF used the TruPrint 1000 3D printer to optimize a device known as a “rake”, which is used in aircraft engine development. Their work led to a 74 percent reduction in overall costs. (Source: TRUMPF)

Laser metal deposition
The LMD process shown here on a TRUMPF system is suitable for repairing large parts and developing prototypes in the aerospace sector. (Source: TRUMPF / Claus Morgenstern)

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About TRUMPF

The high-technology company TRUMPF offers production solutions in the machine tool and laser sectors. It is driving digital connectivity in manufacturing industry through consulting, platform and software offers. TRUMPF is the world technological and market leader for machine tools used in flexible sheet metal processing, and also for industrial lasers.
In 2017/18 the company – which has about 13,400 employees – achieved sales of 3.6 billion euros. With over 70 subsidiaries, it is represented in nearly all the countries of Europe, North and South America, and Asia. It has production facilities in Germany, France, Great Britain, Italy, Austria, Switzerland, Poland, the Czech Republic, the USA, Mexico, China and Japan.

For more information about TRUMPF go to www.trumpf.com

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