Orbex Builds World’s Largest Single-Piece Rocket Engine 3D Printed on the SLM® 800 Selective Laser Melting Machine

Orbex has introduced the world’s largest metal rocket engine 3D printed in a single piece on the SLM® 800. Founded in 2015, the UK-based spaceflight company develops small satellite launch vehicles and introduced Prime, their revolutionary and environmentally-friendly rocket at the grand opening of their new headquarters in Forres, Scotland. The novel Orbex launcher not only uses 100% renewable fuel to cut carbon emissions by 90% and a novel zero-shock staging and payload separation resulting in zero orbital debris, but was also design-optimized for selective laser melting, helping to create a structure 30% lighter and 20% more efficient than any other launch vehicle in its category.

Orbex has received £30 million ($40 million) in public and private funding from sources including the U.K. Space Agency and venture capital firms Sunstone Technology Ventures and the High-Tech Gründerfonds and has been able to attract top development talent with experience from leading space organizations including NASA, ESA and Ariane. Orbex aerospace engineers partnered closely with the applications engineering team at SLM Solutions headquarters in Lübeck, Germany to ensure success transferring the design into selective laser melting production – a feat that required the partnership of the equipment provider due to the complexity and size of the component.

Lukas Pankiewicz, Applications Specialist, headed the consulting team inside SLM Solutions to develop a unique set of parameters optimized for this particular geometry. Working closely with the design team at Orbex, Pankiewicz consulted on the various design features and orientation options, while ensuring the part built successfully with the required material properties and dimensional accuracy. “Our aim during the process was to fulfill the quality expectations of the Orbex team, keep the functionality of the part and make it suitable for additive manufacturing. Every single support structure used in data preparation has been customized to obtain the best quality in every section of the engine, taking post-processing into consideration as well.”

The SLM® 800 large-format metal additive manufacturing system features a 260x500mm powder bed that can build parts 800mm tall, allowing the Prime engine to be built in a special nickel alloy in a single piece. The SLM® HUB unpacking system for the SLM® 800 integrates contactless powder handling and automated build chamber conveyors to transfer the finished part to an unpacking station designed to remove powder through vibration and rotation. Pankiewicz ensured a powder removal strategy was incorporated into the build with purpose driven delivery channels to be certain as much powder was removed from the build as possible while reducing material loss. After production, reference samples built together with the engine were analyzed in the SLM Solutions’ metallography lab, where porosity level and distribution were proven to meet the quality acceptance criteria. The rapid iteration times inherent to the SLM process allowed Orbex to realize both time and cost reductions – saving 90% in turnaround time and over 50% in costs compared to traditional CNC machining production.

“This has always been what SLM Solutions is about,” said Dr. Axel Schulz, Chief Sales Officer of SLM Solutions. “Members of our team helped invent the selective laser melting technology! We’ve always
wanted that technology to succeed – which isn’t just about selling SLM machines but creating that paradigm shift for the customer to be successful with their process. SLM Solutions consulted Orbex on how to make the technology best work for them and transferred that knowledge to ensure their successful implementation as they ramp up to production.”

Jonas Bjarnoe, Chief Technology Officer of Orbex, stated: “The SLM Solutions team showed true dedication and in-depth knowledge of our work. I’m looking forward to continuing this collaboration in 2019 and onwards. Orbex and SLM Solutions have solved some important puzzle pieces which will change the space business.” Pankiewicz concluded, “I think it is a dream of every engineer to build a rocket and I feel honored to be a part this project with SLM Solutions and Orbex.”

About SLM Solutions
SLM Solutions’ robust metal additive manufacturing systems optimize fast, reliable and cost-efficient part production. With multi-laser options, bi-directional recoating and closed-loop powder handling, Selective Laser Melting® machines achieve best-in-class safety and increased build speeds for complex, completely dense metal parts. SLM Solutions takes a vested interest in long-term success by working with customers at each stage of the process, providing support and knowledge-sharing to elevate use of the technology and maximize their return on investment. A publicly traded company, SLM Solutions Group AG is headquartered in Germany with offices in France, Italy, Russia, India, China, Singapore and the United States.

About Orbex
Orbex is a UK-based spaceflight company, with subsidiaries and production facilities in Denmark and Germany. The company is constructing a completely re-thought and re-designed orbital launch vehicle, called Prime, to deliver small satellites into Earth’s orbit. Prime launchers are up to 30% lighter and 20% more efficient than any other vehicle in the small launcher category, packing more power per cubic litre than many heavy launchers. Orbex staff members have professional backgrounds with NASA, ESA and several other commercial spaceflight organisations. The company is funded by two of Europe’s largest venture capital funds, Sunstone Technology Ventures and the High-Tech Gründerfonds, as well as strategic investor Elecnor Deimos Space, the UK Space Agency (UKSA), the European Space Agency (ESA) and the European Commission Horizon 2020 programme.