



Facts

Challenge

Develop and build a multi-fuel burner capable of using gaseous and liquid fuels.

Solution

Additive Manufacturing of a burner with an optimized footprint and functionality on the EOS M 290.

Results

- Flexible: can use gaseous and liquid fuels
- Profitable: integral functionality allows fuels that are difficult to burn to be used
- Efficient: 20% reduction in the size of the combustion chamber
- Economical: low unit costs despite small batch sizes
- Environmentally effective: reduces nitrous oxide emissions



Free choice of fuel: thanks to its complex channels, the burner produces a fuel / air mixture and can burn both gaseous and liquid fuels. (Source: EOS GmbH)

Small burners, big variety



Euro-K designs and builds micro-burners for the optimized combustion of gaseous and liquid fuels featuring EOS technology

Short profile

Euro-K GmbH offers first-class development services in the field of small energy converters. Its portfolio ranges from advice on energy technology issues, including process analysis and optimization, to project planning, simulation, testing and production.

Further information

www.euro-k.de/en

For centuries, a streamlined prow was believed to be the only practical shape for the front section of a boat hull until David Watson Taylor invented the bulbous bow. This nose-shaped design allows the water to flow perfectly around the boat almost without any bow waves. A new shape therefore allowed an undreamed-of increase in efficiency. Euro-K experienced something similar with the construction of optimized burner geometry for gases and liquids – by using Additive Manufacturing technology provided by EOS.

Challenge

During the combustion of gaseous and liquid fuels, various methods are used to prepare the fuel and form the fuel / air mixture. Whereas the mixture formation with gaseous fuels can be achieved using relatively simple mechanisms, it always represents a challenge with liquid fuels.

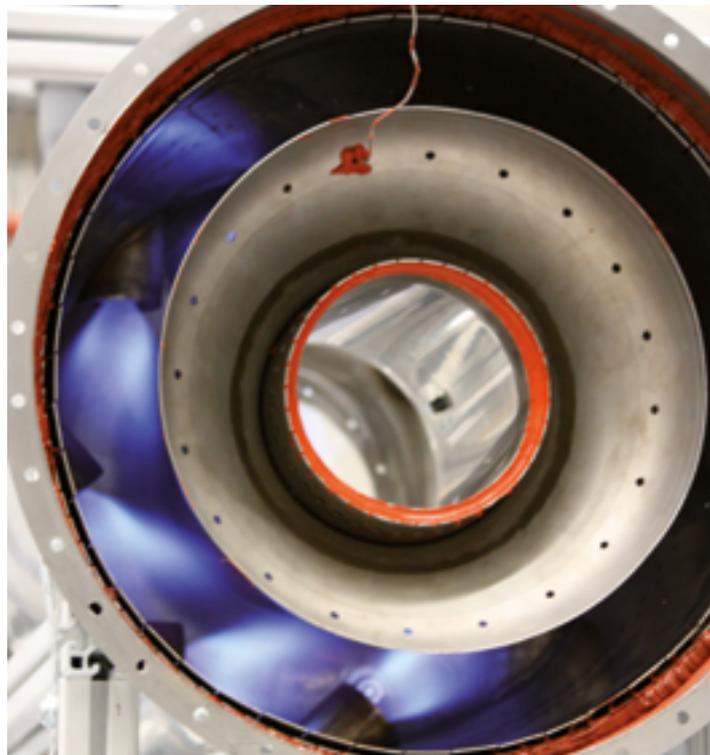
The reason? Liquid fuels need to be mixed in a suitable manner with the combustion air. But before this can take place, the surface area of the liquid fuel must be greatly increased. This is generally done by spraying it in a very fine spray using pneumatic, mechanical or pressure differential principles.

This means that the availability of burners that support the use of gaseous as well as liquid fuels of all compositions is greatly limited. Euro-K refused to accept this and set about developing optimized burner geometry. The idea was for the geometry to make the types and formats of fuel usable without having to change the burner. The burner's volume was also reduced to a minimum. The challenge therefore lay in the demand for flexibility, minimized product size and integral functionality.

Solution

The production technology to match this challenge was quickly located: Additive Manufacturing. With this process, a laser builds the product layer by layer from a fine metal powder.

Euro-K benefited from the design freedom that this solution offered. Unlike conventional production methods, the limits to manufacturability, such as those



Unique portfolio of services: Euro-K offers experience in burner design, expertise in Additive Manufacturing and also has access to test rig technology. (Source: Faculty of Combustion Engines and Aircraft Propulsion, Prof. H. P. Berg, BTU Cottbus - Senftenberg)

experienced with machining or the flow properties of cooling cast materials, were virtually non-existent. EOS technology is also able to produce small batch sizes cost-effectively, allowing assembly costs to be reduced by 20%. Euro-K was also more than familiar with the innovative technology, since the company had already established a considerable level of expertise in the past through a number of projects.

Euro-K GmbH offers a unique portfolio of services. Managing Partner Sebastian Kießling explains: "We not only have a successful history in the design of efficient burners for various fuels, but we also have considerable expertise in Additive Manufacturing. For our customers, we have designed a burner that allows fuels in various physical states to be used and which also demonstrates a low component volume." In addition to experience and equipment – the project team used an EOS M 290 from technology supplier EOS – Euro-K was also able to access a further, highly valuable resource: its own test rig and simulation technology. This made it possible to start development with an

already high level of maturity. For the actual design work, CAD software was used that allowed its data to be transferred quickly and easily to the EOS system following definition of the final shape and size of the burner. In terms of material, the project team chose EOS NickelAlloy IN718, a heat and corrosion-resistant nickel alloy that has excellent tensile strength, resilience, creep resistance and fracture resistance at temperatures up to 700 °C. With this material and this production technology, the engineers created the perfect burner – ready for use in the micro-gas turbines of a Berlin-based plant builder.

Results

The new burner is able to use gaseous and liquid fuels equally effectively. The new, optimized geometry also allows the use of liquid fuels that are classified as difficult to burn, such as fusel oils that are created from the distillation of alcohol. Another positive effect is that the burner's innovative design allowed the size of the combustion chamber to be reduced by 20%.

There is another advantage for end users, however: up to now,

the plant operator had to choose the type and format of the fuel used. It was therefore impossible to offset the fluctuating prices of different fuels, since switching to a different fuel was generally impossible or only possible with costly and time-intensive conversions of the micro-gas turbines. The new burner design brings a considerable degree of flexibility for users.

Frieder Neumann, Deputy Head of Micro-Gas Turbine Development at Bilfinger in Berlin, confirmed the advantages: "The actual combustion process has been optimized, we are able to guarantee our customers the freedom of choice in terms of fuel, and switching to other fuels after the plant has been purchased can be easily arranged. Euro-K is also able to offer the technology at an attractive price. We are absolutely delighted by our partner's expertise in design and production, as well as by the EOS technology that makes it possible."

This once again demonstrates that it can sometimes be worth rethinking established practices and breaking new ground – not just in shipbuilding.

"EOS technology gave us the opportunity to offer exactly the right solution for our customers who have a specific challenge. Our many years of experience in the industry, coupled with our expertise in Additive Manufacturing, enabled us to achieve measurable added value for users."

Sebastian Kießling, Managing Partner at Euro-K GmbH

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