Laser micromachining station for riblets structures engraving on aeronautics parts to reduce fuel consumption

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The present work demonstrates the feasibility of high throughput femtosecond micromachining automated workstation to create riblets microstructures on plane engine blades. The goal of this workstation is to efficiently modify the surface structures of the engine blades to reduce drag, hence reducing fuel consumption of the plane. This fuel consumption reduction can then lead to high scale fuel savings and carbon emissions reduction in the plane industry and therefore have strong positive impact on the environment.

The laser processing operations have been optimized for high-speed production by using optical module which provides high quality beam-shaping and beam-splitting.
In addition, the complex 3D geometry of the engine blades is treated by closed-loop measurement system that measure each part and adapt laser machining to compensate for part tolerancing or defects. The closed-loop system also includes parts movement between the measurement system and the micromachining head as well as managing part flipping, to apply riblets on both sides of the engine blades.

Also, the riblets characteristics have been studied by flow simulation, showing promising drag reduction.