Aerospace Europe Conference 2023
Joint 10th EUCASS – 9th CEAS Conference

Abstract #XXX *(to be filled by the organizers)*
Preferred Topics: TURBO
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Type: Oral
Status of corresponding author: Regular

Title

Keeping turbofans cool: Aerodynamic upgrade of bypass surface heat exchangers (EU Project SACOC)

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Abstract
New generation turbofan aeroengines are facing a challenge regarding thermal management and, hence, heat exchangers are becoming a key factor in their development. In this context, the EU-funded Clean Sky 2 project SACOC [1] addressed the aerodynamic upgrade of finned heat exchangers mounted on the inner wall of the secondary duct (bypass) of a turbofan. Such a design implies a significant trade-off between the improvement in heat exchanger thermal performance and the aerodynamic penalties, which are measured by drag or pressure loss. In addition, vibration and noise generation are also of concern, and thus the fluid-structure interaction must be investigated.
However, in the case of large turbofan aero engines, full-scale tests are time-consuming and expensive, and thus reduced-scale testing in wind tunnels is much preferable. There are different approaches to designing these reduced-scale wind tunnels, such as a very narrow channel [2] or, in case of heat exchangers situated before the outlet guide vanes, a twisted wind tunnel [3-4].
In this work, we present a summary of the design of a new, cost-effective, reduced-scale wind tunnel that reproduces turbofan bypass conditions [5], and then we focus on aerothermal and vibration results obtained during the experimental campaign of project SACOC, comprising a baseline standard heat exchanger design and two aerodynamically-upgraded heat exchanger geometry proposals.

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