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SYNTHETIC JET FLOW CONTROL CFD AND CHARACTERIZATION

PROJECT OBJECTIVES

The H2020 Cleansky 2 project SYNJET3C aims at reducing the aircrafts energy consumption by decreasing flow separation on the wings. Active Flow Control (AFC) consists in a mechanism which pulses air from a nozzle at high flow and velocity. Among these systems, Synthetic Jet Actuators (SJA) are AFC with zero net mass flux. SYNJET3C studies a SJA actuated by a piezoelectric membrane and designed by FRAUNHOFER ENAS. The objective of the project is to improve the understanding of SJA behavior and to define the next generation of SJA. That consists in several tasks divided between the partners:

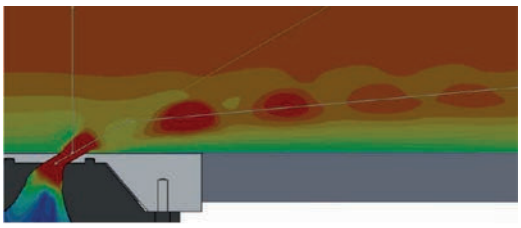

Figure 1: CFD Simulation for SJA optimization

- **TRISITEC** does the experimental testing in quiescent air condition.
- **ONERA** performs CFD calculation and experimental testing in cross flow condition, as the entity owns a Wing Tunnel equipment.
- **CEDRAT TECHNOLOGIES (CTEC)** builds system model of the synthetic jet actuator. The characterization of the existing actuator will allow to define the performance to be reached by the next generation of SJA. Then the partners will design, manufacture, and test a prototype of this new generation.

INNOVATION

Previous projects have already studied and designed AFC solutions. We can mention VIPER which focused on the development of a Pulsed Jet Actuator, an actuator with non-zero mass net flux, and ASPIC, whose target was a SJA based on Amplified Piezo Actuators (APA®) of large dimensions.

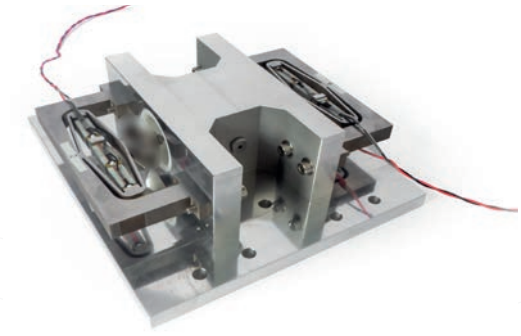

Figure 2: SJA Prototype from CTEC

In SYNJET3C there are some innovative objectives. First, one of the main goals is to capitalize the knowledges about the SJA. The experimental testing, modelling and computation are performed both in quiescent air condition and in cross flow condition that is an unusual approach. Different models of SJA were studied to explore different solution of SJA (membrane, piston).

The H2020 Clean Sky 2 project SYNJET3C is funded by the EU under call H2020-CS2-CFP04-2016-02 and Project Id 754811.

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CTEC CONTRIBUTION IN THE PROJECT

CTEC has the role of coordinator for this project to manage the proceedings of experimental testing, calculation, and modelling.

> CTEC OVERSEES:

- Building a system model of the SJA in quiescent air condition and cross flow condition. This model will be a tool to predict the performance of a new SJA,
- Participating to the understanding of SJA behavior and performance,
- Designing and manufacturing a prototype of SJA of the new generation,
- Manufacturing of drive electronics & sensors.

RESULTS

Results obtained with the new SJA prototype, working with APA® and piston, were encouraging.

First, a good fitting between numerical model and experimental tests was observed. Secondly, a jet flow close to 200 m/s was experimentally measured, for high voltage supply.

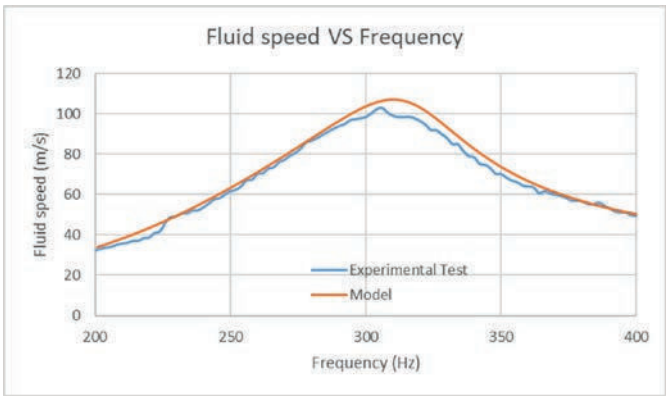

Figure 3: Comparison between experimental tests and numerical model at 60 V pk-pk.

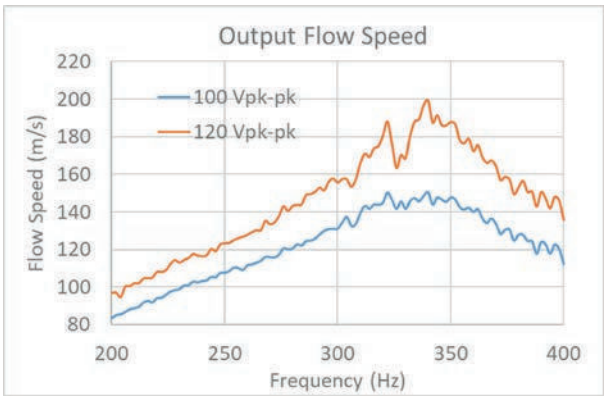

Figure 4: Maximum flow speed measured for high voltage supply.

PARTNERS

- CEDRAT TECHNOLOGIES: Coordinator
- FRAUNHOFER ENAS: Topic Manager
- TRISITEC UG: Partner
- ONERA: Subcontractor

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