# FACELIFT: FLUIDIC ACTUATORS FOR CONTROL OF STEALTH AIRCRAFT

## OBJECTIVES

The FACELIFT project aims to improve strategic surveillance capability, survivability and operational resilience for future stealth aircraft, which will be more stealthy and more maneuverable than the current generation of military assets such as the European MALE-RPAS. This will be achieved using fluidic actuators (sweeping jets and synthetic jets) integrated in front of the wing control surfaces. These control surfaces will then be more efficient and can be downsized thus reducing the Radar Cross Section.

Fig. 1: Relevant aircraft to consider in scale-up study of WP8: European MALE RPAS (https://www.airbus.com/en/products-services/defence/uas)

## HOW THIS WILL WORK

Both types of actuators will be assessed.

### > SWEEPING JET ACTUATOR (SWJ)

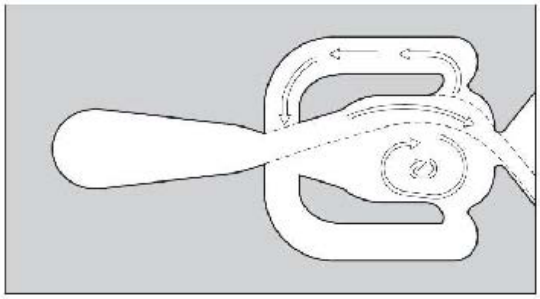


Fig. 3: Schematic showing the sweeping jet actuator operation(1)

SWJ are devices that exploit the self-reinforcing effect of a high velocity air jet in the vicinity of two bounding walls to produce an unsteady, usually periodic, airflow without requiring additional mechanical or electrical actuation.

### > SYNTHETIC JET ACTUATOR (SJA)

SJA consist in a reciprocating piston which compresses a cavity connected to an exhaust nozzle. By actuating the reciprocal motion, the cavity intakes and blows back alternatively an oscillating air flow using only outside ambient air source. These synthetic jets only require an electrical power supply for the piezoelectric actuators which drive the reciprocating motion. No air supply is needed which simplifies the use compared to the sweeping jet.

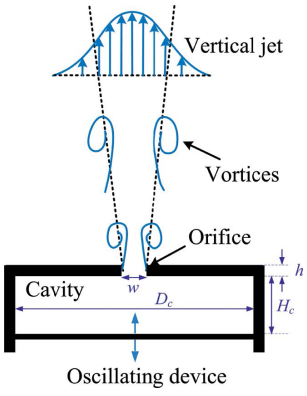



Fig. 2: Schematic showing the synthetic jet actuator operation(2)

## PARTNERS

FACELIFT is a project funded by the UE and the consortium consists of 3 SME partners from 3 different member states (Cedrat Technologies (FR), NAVASTO (DE) and ESC DEFENCE (CZ) and a RTO (ONERA (FR)). The consortium will collaborate with the aircraft manufacturer Pipistrel Vertical Solution (Slovenia).

(1) Vasta, V.N., Methi, K., Wygnanski, I.L., Ehab, F.; Numerical Simulation of Fluidic Actuators for Flow Control Applications, 6th AIAA Flow Control Conference, 2012

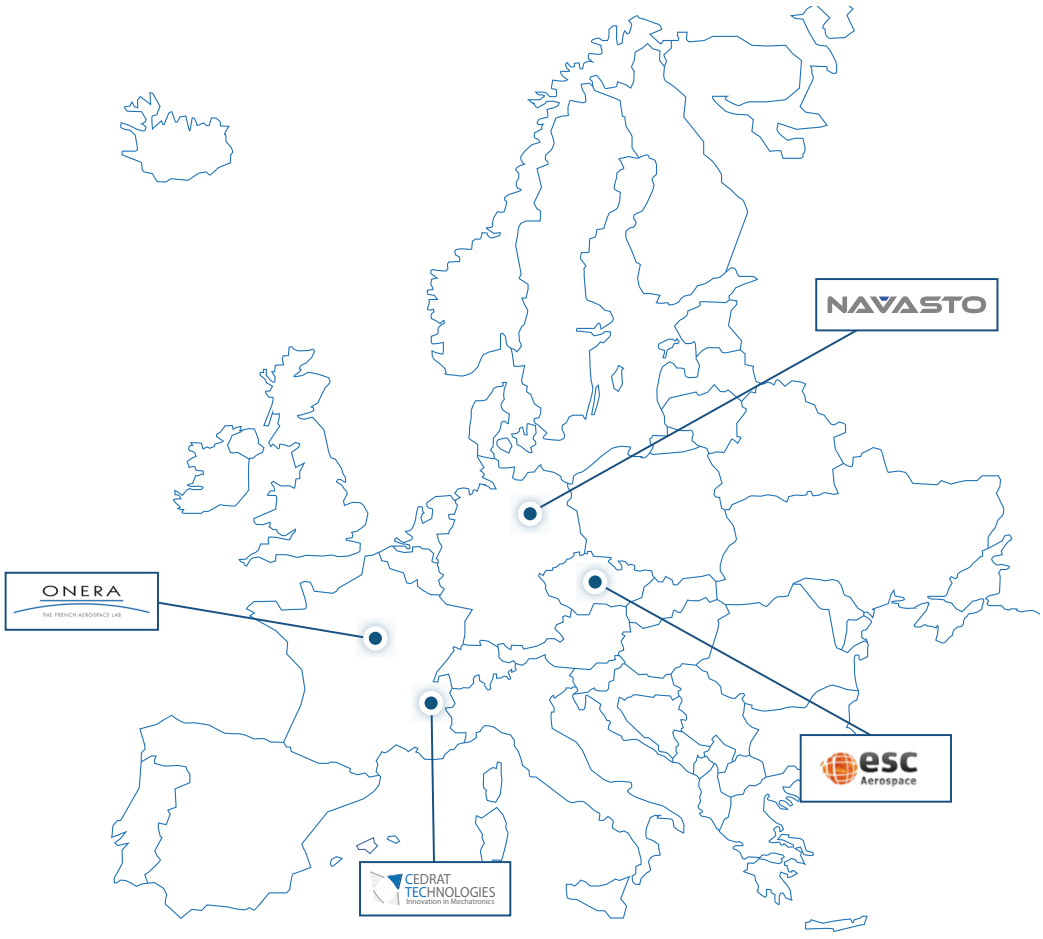
(2) Wang, J., & Feng, L. (2018). Synthetic Jet. In Flow Control Techniques and Applications (Cambridge Aerospace Series, pp. 168-205). Cambridge: Cambridge University Press. doi:10.1017/9781316676448.009

CEDRAT TECHNOLOGIES is the coordinator for this project and will report to the European Union on behalf of the consortium. CTEC will design the Synthetic Jet Actuator. They will be internally assembled and tested before integration on the wing prototype and on the aircraft wings.

ESC will design avionics part of the system in terms of onboard computational (OBC) and monitoring unit, interface peripheries and data exchange bus, and power management and distribution, while respecting a safety-critical manner of the application. Based on actuator designs and an appropriate sensor setup ESC will also design data acquisition unit for the sensor readings processing. The readings will be further in cooperation with the OBC unit evaluated and used for actuators' control. The control laws will be designed in cooperation with ONERA. ESC participates in all phases of the project.

As part of the project, NAVASTO is currently engaged in the development of pulsed jet actuators, drawing on over a decade of expertise in active flow control technology and utilizing cutting-edge engineering tools that integrate advanced simulation techniques with the in-house developed machine learning and deep learning framework NAVPACK.

ONERA is the French Aerospace Lab, supervised by the French Ministry of the Armed Forces. ONERA will define the aerodynamic performance requirements for the synthetic jet and sweeping jet actuators and participate in the design of the synthetic jet actuator jointly with CTEC. Actuators integrated on aerodynamic models will be tested in ONERA's wind tunnels. ONERA will provide closed-loop control law for the synthetic jets. Finally, ONERA will lead the feasibility study of a scaled-up aircraft designed from the clean sheet with embedded active flow control technology.

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