Experimental Installed Jet Databases Including Noise Mitigation

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With the increase of the jet diameter of modern aeroengines and to be able to maintain an acceptable ground clearance, the engine is brought closer to the airframe. The increased proximity of the exhaust jet with the wing results in aerodynamic and/or aeroacoustic interactions that ultimately increase the radiated noise. This has then to be considered in the development of the airplane platform and certification procedure. Although many jet noise mitigation techniques have been thoroughly studied in literature, only few studies, considered jet installation effects. The DJINN (Decrease Jet Installation Noise, GA 861438) project aimed at covering this gap by studying numerically and experimentally a large variety of noise reduction techniques for installed jet configurations.

The present work collects databases produced on reduced scale installed-jet experiments, and that also implements noise reduction techniques. All noise measurements are taken in anechoic environments of the different contributors to produce reliable data for numerical validation. Those are complemented by flow measurements using hotwire, pressure probes or PIV to provide further comprehension of the complex flow mechanisms occurring in installed jet configurations. The nozzles have the same diameters, and the side plates/wings have similar dimensions and positioning in the different facilities. A common acoustic Mach number of 0.6 is used for all flow conditions at the nozzle outlet. A proper cross-comparison between facilities has been performed on the isolated jet configuration.

Different noise reduction technologies have been tested, as illustrated in Fig. 1. VKI used slanted nozzles, pushing the shear layer interaction with the plate further downstream and rectangular nozzles, increasing the radial distance between the shear layer and plate. To act on shear layers properties, SOTON used different type of serrations enhancing higher mixing in the jet shear layers and influencing the corresponding interaction with the plate. Finally, DLR acted on the flap side by using porous inserts, damping pressure fluctuations at the flap trailing edge. All noise reduction technologies showed substantial noise decrease at different part of the noise spectrum depending on the noise mechanism targeted.

All the open databases are released on the ERCOFTAC Knowledge Base Wiki.

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Fig. 1 Implemented noise reduction technologies

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