AIRBUS

INTERNSHIP

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11-MONTH INTERNSHIP – AIRBUS OPERATIONS SAS -– September 2010 → July 2011

Start date: 2010 (September most likely)
Duration: 11 months
Location: Airbus Operations SAS, Toulouse
Required background: Acoustics, and aerodynamics / turbulence or aero propulsion, programming skills (e.g. Fortran/Matlab) appreciated
Schools: Engineering schools and universities (Masters in Acoustics or Aerodynamics)

TITLE: Impact of Aircraft Architecture on Jet Community Noise

Context:

Jet noise during takeoff remains a major component of total aircraft community noise for airliners. Due to the close-coupling between engine and wing in today's aircraft architecture, acoustic interactions between the jet and the airframe add up to the pure jet noise. The control of the overall installed jet noise at the industrial engine cycles requires a good understanding of the physics involved. For this end, specific prediction methods and tools are under development at Airbus.

The jet noise source phenomenon under investigation is generated by turbulent high-speed exhaust flows of modern turbofan engines and their aerodynamic and acoustic interaction related to aircraft architecture. The framework and mind of the internship is multi-disciplinary in essence, with a need to comprehend turbulent flows, noise generation and propagation.

Description:
The top objectives are the understanding of the physics and the qualification of noise prediction tools. The key point is the read-across between experimental data and outputs of jet aeroacoustics tools.

The intern will address both experimental and numerical aspects:

- First, he will post-process and analyze high-quality jet noise experimental measurements, including data obtained by phased-array techniques. He will derive trends of noise with respect to operating conditions and will then assess the relevancy of analytical prediction tools.
- Second, he will apply aerodynamic and acoustic advanced numerical prediction tools, with source modeling based on CFD stationary solutions: On the flow dynamics side, he will

generate and compute the flow field using state-of-the-art steady methods that provide the source-generating flow fluctuations. On the acoustics side, he will use and tune-up a stochastic method to derive far-field radiation of the jet noise.

Numerical techniques
The intern will run aero-acoustic simulations corresponding to the studied measurement data. He will compare the computed turbulent characteristics in the source volume to PIV aerodynamic measurements. The relationship between turbulent characteristics and far-field acoustics shall be analyzed using space-time correlation computations and Lighthill source localization. The results will be compared to the corresponding measurements.

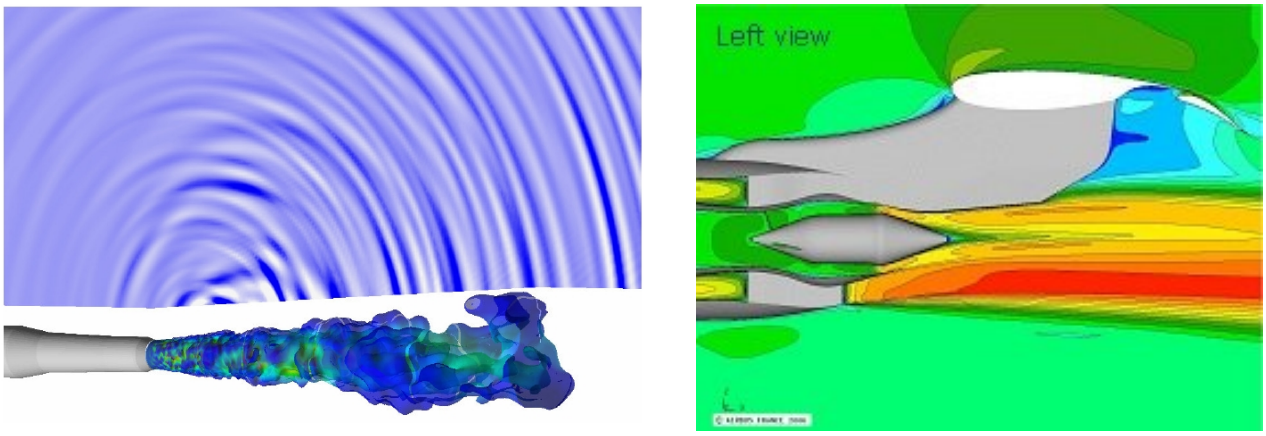

Fig. 1 : Jet aerodynamics and noise (Omais 2008) and view of nozzles installed under wing profile (VITAL, Dezitter 2009)

WORK PLAN

PHASE 1 – SINGLE-STREAM JET NOISE

- Bibliographical study of jet noise
- Analysis of the acoustic wind-tunnel test results on single-stream jets
- Assessment of the existing analytical methods to predict single-stream jet noise
- Bibliography and application of array techniques on experimental data
- Set-up of the numerical test campaign (CFD, CAA tools) and first application of numerical methods to assess jet noise sources
- Reporting: To + 6 Months

PHASE 2 – DUAL-STREAM JET NOISE AND INSTALLATION EFFECTS

- Analysis of the acoustic wind-tunnel test results on dual-stream jets
- Identification of the trends of installation effects to geometrical parameters and flow physics
- Application and refinement of the numerical methods available to assess jet noise with several generating conditions (Mach, temperature) and several nozzle geometries (for example chevrons)
- Comparison of numerical results with experimental data.
- Identification of potential improvements for the studied tools and possible framework of use at Airbus.
- Reporting: To + 10 Months