Decrease Jet Installation Noise

ENODISE 2nd Public Workshop

ADVANCED POROUS TREATMENT, LINERS AND META-MATERIALS FOR ENGINE AND AIR FRAME NOISE MITIGATION

with the participation of DJINN and INVENTOR

RWTH Aachen University, Germany 07 November 2022

Presentation of publicly available documented validation bench-marks

DJINN

F. Gand (ONERA)

Overview

- Definition of open test cases (“Generic Test Cases”) for validation of HiFi CFD methods
  - In particular, assess the accuracy of the jet noise prediction at high Strouhal number
  - Also used in the project as baselines to evaluate Noise Reduction Technologies

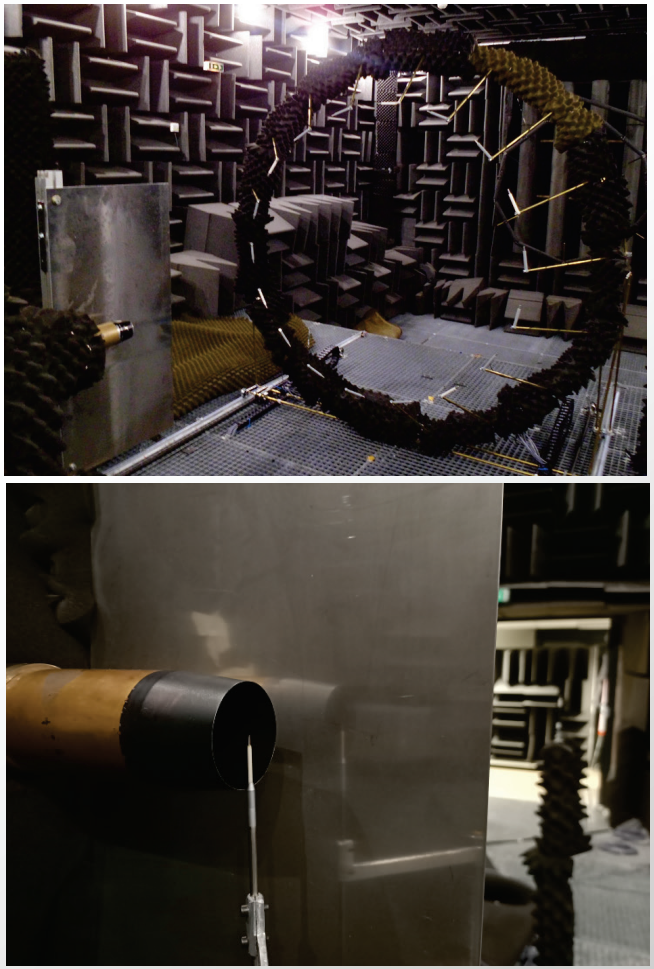
- Two variants selected based on CNRS-Pprime and Southampton University experiments
  - Both have **isolated** and **installed** jet configurations
  - Extensive flow and noise measurements available for CFD validation

Data and specifications report for simulations available upon request:
https://djinn.online/opentestcases/

CNRS-Pprime experiments

- Resources in addition to DJINN open test cases specification document
  - Brès et al., “Importance of the nozzle-exit boundary-layer state in subsonic turbulent jets”, Journal of Fluid Mechanics, 2018, 851, 83-124. doi: 10.1017/jfm.2018.476
  - Piantanida et al., “Scattering of turbulent-jet wavepackets by a swept trailing edge”, The Journal of the Acoustical Society of America, 2016, 140, 4350-4359. doi: 10.1121/1.4971425

- Key features
  - $Re_D=10^6$
  - M=0.9
  - No external flow
  - Fully turbulent
  - Nozzle exit boundary layer measured (mean flow and RMS)
  - Noise measurements in jet farfield up to St_D~10

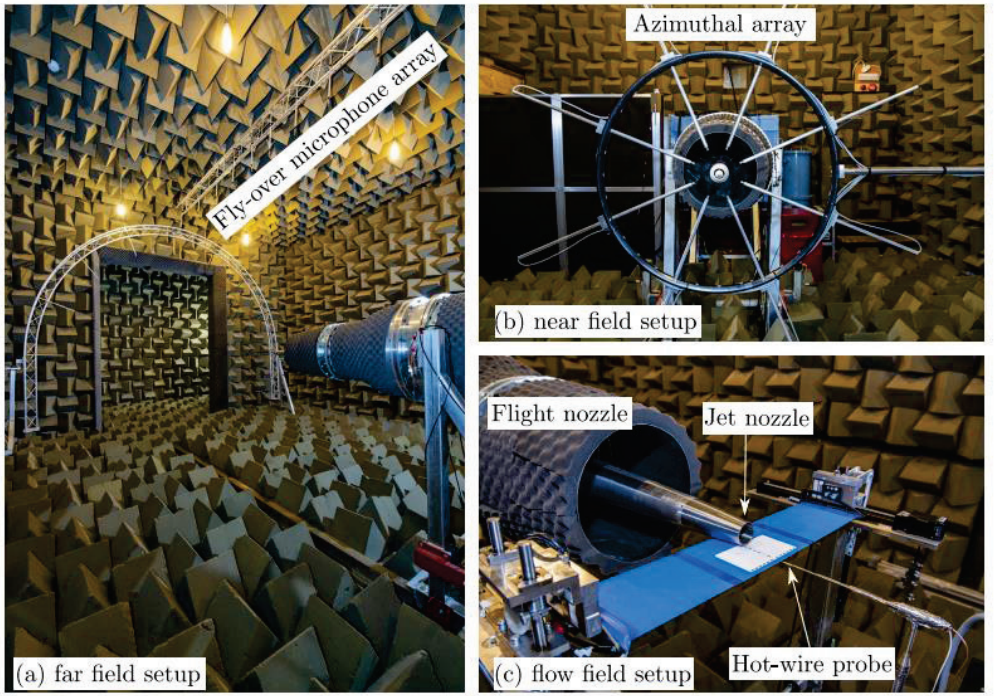


Experimental setup for the installed jet at the “Bruit et Vent” facility, Pprime Institute, Poitiers

Southampton University experiments

- Resources in addition to DJINN open test cases specification document
  - Proença et al., “Experimental Investigation into the Turbulence Flowfield of In-Flight Round Jets”, AIAA Journal, 2020, 58 (8), 3339-3350. doi: 10.2514/1.J059035
  - Gryazev et al., “Flow and Noise Predictions of the Isolated Subsonic Jets from the Doak Laboratory Experiment”, 28th AIAA/CEAS Aeroacoustics 2022 Conference. doi: 10.2514/6.2022-2935

- Examples of key features
  - Re_D=8 10^5
  - M=0.8
  - No external flow
  - Fully turbulent
  - Nozzle exit boundary layer measured (mean flow and RMS)
  - Noise measurements in jet farfield up to St_D~10



Experimental setup at the Doak Laboratory, Southampton