

**Title: Experimental investigation of broadband noise reduction devices**

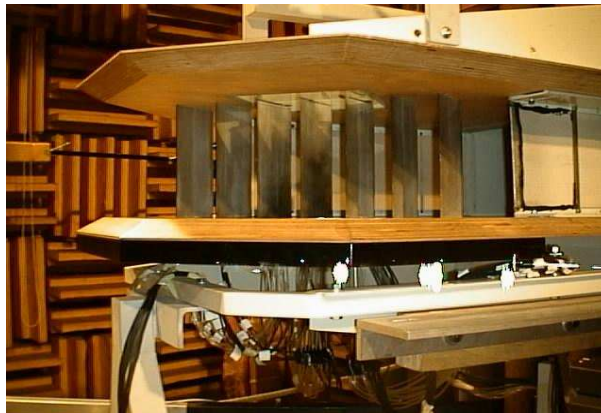
**Context**

The Laboratoire de Mécanique des Fluides et d'Acoustique (LMFA) is a CNRS/Education Nationale research facility located nearby Lyon at the Ecole Centrale de Lyon (ECL). In the framework of the recently approved European Project FLOCON, about broadband noise generation by turbomachine fans and OGV's, it offers the possibility of a Phd fellowship in the field of aeroacoustics, unsteady aerodynamics and turbulence. The project relies on a close co-operation with Europe's leading engine manufacturers (Rolls Royce, SAFRAN-SNECMA, VoIVO, FIAT AVIO etc..), research institutes in the field of aeronautics and aerospace (DLR, NLR, ONERA..) and some of Europe's best Universities (U. Cambridge, ISVR, ECLyon, TUBerlin, etc..).

The project is devoted to the development, validation and implementation into industrial environment of new noise reduction solutions for both tonal and broadband noise sources. Various aerodynamic noise generation mechanisms associated with the Fan/OGV stage of modern ultra high by-pass ratio engines, such as rotor trailing edge, rotor/stator interaction, fan tip/ turbulent boundary layer interaction will be tackled by reduction devices in this project.

**Job description**

In this context, the goal of the Phd thesis is to test, compare and analyse several broadband noise reduction devices on a open cascade facility that is available at the Laboratoire de Mécanique des Fluides et d'Acoustique of Lyon. The open cascade rig is designed in order to allow for acoustic far field measurements in air at rest in ECL anechoic wind tunnel. Various trailing edge geometries and/or soft leading edges will be compared to a reference configuration and the Phd-candidate will carry out a thorough flow characterisation in order to identify the underlying sound generation mechanisms. The experimental study will have to be supported by suitable modelling efforts in order to identify and optimise the main parameters of the noise generation and reduction processes and to provide a better understanding of the reduction devices.



*Open cascade rig in ECL's anechoic wind tunnel*

## Requirements

Applicants who are expected to have completed their Master of Science (or equivalent) in a field related to the PhD topic, should have a good background in fluid mechanics and applied mathematics. Special skills in unsteady aerodynamics, aeroacoustics and turbulence are expected to allow a prompt start.

Beside these requirements, it would be useful if the applicants were familiar with aerodynamic measurement techniques and CFD. No prior knowledge about turbomachines is required for this upstream research project.

Of course, the applicants should speak English fluently and some knowledge in French would be useful.

**Location:** mostly Lyon

**Duration:** 3 years, starting fall 2008

## Job application:

Applicants, who are expected to have completed their Master of Science (or equivalent) in a field related to the PhD topic, should send a CV, 2 recommendations letters, a list of the courses they attended as well as the scores they obtained to:

Dr. Marc JACOB or Prof. Michel ROGER,  
Centre acoustique du LMFA,  
Ecole Centrale de Lyon,  
36, av. Guy de Collongue  
69134 ECULLY CEDEX – FRANCE

e-mail: [marc.jacob@ec-lyon.fr](mailto:marc.jacob@ec-lyon.fr)  
phone: 33(0)472.18.6003  
Fax: 33(0)472.18.9143

## Related references (a selection):

On benchmark experiments for broadband interaction noise computations:

Jacob M.C., Boudet, J., Casalino, D. & Michard, M., *Theo ret. Comput. Fluid Dyn.* (2005), **19(3)**, pp. 171-196.

On analytical models for airfoil noise:

Roger & Moreau, *J.Sound Vib.* (2005) **286(3)** pp.477-506.

On Fan tip broadband noise measurements:

Grilliat, J., Jacob, M.C., Camussi, R. & Caputi Gennaro, G., 2007, *AIAA paper 2007-3684*.

And :

Camussi, R., Caputi Gennaro, G., Jacob, M.C, Grilliat, J., 2007, *AIAA paper -2007-3685*.