

**Vacancy in Mechanical and Aeronautical Engineering,
with emphasis on Multiphysics problems**

The present proposal for a full time academic position in Aerodynamics, with emphasis on Multiphysics problems, aims to contribute to the teaching offer of the Brussels School of Engineering in the field of fluid mechanics, aero-thermo-dynamics and computational fluid dynamics, for the third year BSc in civil engineering and the Aeronautic option of the MSc in Electromechanical Engineering - Bruface.

In particular, the teaching charge of the chair will be mainly articulated around the following courses:

- Fluid mechanics II
- Numerical methods in Aerothermodynamics
- Computational Fluid Dynamics

All the aforementioned courses are quite specific in the training of an Aeronautic engineer and it is crucial that they are offered by a professional with a teaching and research background in fluid mechanics, aeronautics and numerical methods. The resources currently available at ULB do not allow the coverage of these areas, as the available profiles fall in the field of high-temperature multi-component thermodynamics, reacting flows (numerical and experimental) and turbomachines. To give an example, the third year *Fluid Mechanics and Transport Processes* (Bachelor in Engineering: Architecture, Bachelor in Bioengineering, Bachelor in Engineering Sciences) course is presented using a process engineering perspective (both coordinators have a chemical engineering background) and it is then important to offer a fluid-dynamic perspective to the students, especially the ones proceeding with the Aeronautic option.

Based on the inventory of the competences available at both ULB and VUB in the field of aeronautic engineer, it is safe to say that one of the most pressing need for the Aeronautic option is to recruit a full-time professor with a background in fluid mechanics, aerodynamics and numerical methods.

Such a profile has the potential of developing an original research line in the field of multi-physics problems for innovative aerospace technologies, but also to contribute to many of the research activities ongoing within EPB. There is indeed a potential of establishing synergies with the activities carried out within the ATM Department, in the field of reacting flows, atmospheric flows and turbomachines. Moreover, given the EPB involvement in the development and testing of UAV systems, an expertise in fluid dynamics and aerodynamics would certainly consolidate ULB position on the topic. Moreover, extending the view the Belgian and Walloon landscape, there is a quite realistic opportunity (mandatory in the current funding scenario) to create strong (non-competitive) synergies with the fluid mechanics research groups at UCL (Profs. G. Winckelmans and Ph. Chatelain) and ULiège (Profs. V. Terrapon and K. Hillewaert) and KULeuven (Prof. Maria Rosaria Vetrano).

We also believe that this faculty positions offers a unique opportunity to maintain and reinforce the relationships between ULB and a world-class center in fluid dynamics, the von Karman Institute for Fluid Dynamics. During the years, a number of VKI professor have contributed to the teaching mission of ULB (Profs. Herman Deconinck and Jean-Marie Buchlin, both retired) and ULB professors to that of VKI (Prof. Gérard Degrez is a part time professor at VKI, and others professors from EPB are regularly called to contribute to the VKI lecture series program). While new research collaborations

have been established during the years, thanks to the activities of several EPB departments, e.g. ATM (Profs. Hendrick, Parente and Coussement) and TIPS (Profs. Haut and Scheid), the lack of a strong connection, previously ensured by the existence of these shared professor positions, might weaken the traditionally strong links between the two institutions. This would imply the loss of a strategic partnership for ULB, in a rapidly changing context characterized by the establishment of new partnerships between VKI and the main Belgian Universities.

We therefore think that a “Unité Mixte de recherche” could be formalized in the scope of the proposed vacancy. The idea is also supported by the VKI Dean, Prof. J. Van Beeck. The advantages of creating a mixed research unit are multiple:

- The newly appointed professor at ULB could benefit from a strategic partnership with a world-class center, accessing to state-of-the-art installations (hypersonic wind tunnels, plasma torches, plasma reactors at VKI, combustion test benches, fuel cell test benches and rocket engine test benches at ULB). The strategic partnership could facilitate the access to new funding support research activities at both institutions. Specifically, we have approached BELSPO to investigate the possibility of providing stable funding for activities in the field of hypersonic flows. This would allow the EPB to develop a new research activity, in a field that is becoming strategic for both EU and ESA, thus indicating the excellent funding prospects. Indeed, further hypersonic planes are seen as the future of long-distance transportation but also space launch vehicles because of their advantage in operational costs and environmental impact. Actual research worldwide and its governmental support are very clear in this direction.
- The candidate will teach in the Bruface program but also at VKI. Having access to the VKI master program is very appealing opportunity to supervise and select highly skilled PhD and post-doctoral candidates.
- The mixed research would also allow a reinforced collaboration in the field of turbomachines and aircraft propulsion (Prof. Hendrick), supersonic combustion (Prof. Coussement) and atmospheric flows (Prof. Parente). New research collaborations might be also established with other ATM laboratories working in the field of plasma flows (Profs. Delplancke and Godet) and transport phenomena (Prof. Haut and Prof. Debaste). Today collaborations exist based on individual initiatives. A mixed research unit would provide a framework to that, for the definitions of common research programs, joint PhDs, etc.

Finally, we would like to stress that the present position would also alleviate the loss of competencies associated to combined departures of Chris Lacor, Herman Deconinck (part-time professor) and, shortly, Ghader Ghorbaniasl and Gérard Degrez. Those Professors were/are active in the field of numerical methods, fluid mechanics, computational fluid dynamics, aircraft performance and stability. Through their activity, they have contributed to the international reputation of ULB/VUB in the broad field of fluid mechanics. Therefore, their retirement has already and will continue to strongly impact the organization and sustainability of the MSc in Electromechanical Engineering, option Aeronautics, jointly coordinated by Ecole polytechnique de Bruxelles at ULB, and Faculteit Ingenieurwetenschappen at VUB.

The recently filled position at VUB to replace Chris Lacor (Julien Blondeau) was more oriented towards thermodynamics and energy-related aspects, and the enrollment of Axel Coussement at ULB can only partially alleviate the experience and the loss of know-how.

In summary the proposed vacancy aims at:

- Develop a new research activity in spaceplanes and space technology, where EPB needs to be more present with respect to other engineering Schools at European level, given the strategic role of this sector in the coming years.

- Consolidate the links with VKI, to create a center of excellence and access new ESA and EU funding.
- Assuring the wellbeing of the Aeronautics Master as advised by the Educational Council of the Electro Mechanics Master.