School of Aeronautical, Automotive, Chemical and Materials Engineering
National Centre for Combustion and Aerothermal Technology (NCCAT)

Loughborough University

Research Associate – Computational Fluid Dynamics of Spray Combustion

Job Ref: REQ240269

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

Project Description

This is an exciting opportunity to join our team in the National Centre for Combustion and Aerothermal Technology (in collaboration with Rolls-Royce). We are looking for a post-doctoral researcher for a 24-month contract to support a programme of work which aims to validate and improve Computational Fluid Dynamics (CFD) analysis techniques for afterburner or 'reheat' systems. The work would involve simulating various aspects of a simplified but representative system, including spray formation and combustion. Suitable numerical methodologies will be tested for different aspects, such as high-fidelity interface resolving methods for atomisation and Large Eddy Simulation with a turbulent chemistry model for combustion. Results will be compared to experimental results to improve modelling capability and establish recommendations for improved modelling. Applications are encouraged from researchers with experience in one or both of reacting flow or spray modelling CFD.

The National Centre for Combustion and Aerothermal Technology (NCCAT)

The National Centre for Combustion and Aerothermal Technology (NCCAT) opened in 2020 and is a global centre of excellence that was funded through a partnership comprising the Department for Business, Energy and Industrial Strategy, the Aerospace Technology Institute, Innovate UK and with support from Rolls-Royce. The Centre builds on the long-standing strategic partnership between Loughborough and Rolls-Royce which was formalised in 1991 when the Loughborough based Rolls-Royce University Technology Centre in Combustion System Aerothermal Processes (UTC) was established. The UTC (which is located within NCCAT) is an innovative strategic partnership which brings together a leading UK University with one of the world's foremost aerospace companies. The partnership provides a unique infrastructure in which Rolls-Royce and University staff work together to advance understanding and provide design capability in the field of Combustion Aerodynamics and Aerothermal technology. This cutting-edge collaborative research is driven by real industrial challenges and generates innovative technologies for current and next generation low emission gas turbine engines.

Building on the experience of working with industry over the last 30 years, the National Centre incorporates a world leading research group of multi-disciplinary researchers within the fields of fluid mechanics and combustion, primarily targeting highly applied challenges faced by the aerospace gas turbine industry. With Rolls-Royce as a lead industrial partner, NCCAT primarily focuses on the development of future low emission aerospace combustion systems and will play a key role in moving towards sustainability and meeting the Government target of a carbon neutral economy by 2050. NCCAT is an open-access facility, and beyond aerospace, supports commercial customers with the development of key technologies across several UK sectors, such as distributed power generation and the development of measurement technology for harsh environments. This necessitates the development and

application of highly specialised research techniques in bespoke facilities that are also used for commercial activities. In addition, the Centre acts as a training ground for current and future aerospace engineers in a critical skill area for the UK, partially achieved through the current EPSRC Centre for Doctoral Training for Future Propulsion and Power (CDT) also hosted within NCCAT.

The group now represents a critical mass of circa 55 personnel including academic staff, researchers, specialist technical staff, technicians, and an admin support team. To deliver its objectives NCCAT has also developed a state-of-the-art laboratory which incorporates highly bespoke, unique, and technically complex facilities. At any given time the group has a large number of active research projects over a range of Technology Readiness Levels (TRL's).

Job Descriptions

Job Family & Grade: Specialist and Supporting Academic Grade 6

Job Purpose: To improve predictive capability for fuel spray and combustion systems for future gas turbines.

Job Duties:

Overall:

- To be responsible for undertaking the main research activities.
- To undertake suitable CFD predictions of spray combustion systems using appropriate methods. e.g., RANS or LES with suitable closures such as Flamelet Generated Manifold for combustion or Coupled Level-set Volume of Fluid for spray formation.
- To develop geometries, computational meshes and CFD solutions based on an experimental test facility.
- To make use of commercial, open-source and in-house CFD codes including modification of in-house codes if necessary.
- To suitably analyse, interpret, present and report on the data and research outcomes generated in the CFD predictions. Reporting will be through internal reports, reports delivered to project partners or conference/journal publications as appropriate.
- To suggest (and where appropriate develop) improved numerical methodologies for more accurate and/or robust predictions.
- To collaborate and work with other researchers within NCCAT and the UTC as and when necessary to meet research project objectives.
- To provide guidance and support to the industrial partner (Rolls-Royce) and other collaborators.
- To attend and present work at progress meetings at UK and European sites as and when required.
- To develop new lines of research and the writing of research proposals.
- To undertake such other duties as may reasonably be requested and that are commensurate with the nature and grade of the post.

Points To Note: The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures. All staff should hold a duty and

commitment to observing the University's Equality & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equality & Diversity legislation and University policies/procedures. Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Respecting Diversity and, where appropriate, Recruitment and Selection.

Organisational Responsibility

Reports to: Dr Andrew Garmory

Person Specification

Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

1 – Application
2 – Interview

Essential Criteria:

Area	Criteria	Stage
Experience	Recent relevant research in an academic or industrial environment	1, 2
	Experience of the numerical prediction of complex fluid mechanics and/or aerodynamics to PhD level	1, 2
	Experience of multiphase (e.g. VoF, Lagrangian spray tracking etc) and/or reacting (e.g. Flamelet Generated Manifold) CFD simulation methods.	1, 2
	Experience of turbulence modelling (e.g., RANS, DES/LES)	1,2
	Experience of technical computing such as use of HPC systems and linux.	
	Experience of data processing techniques relating to complex fluid flows	1, 2
	Ability to coordinate project activities, manage project tasks, prioritise, and meet deadlines	1, 2
	Evidence of writing academic papers or equivalent	1, 2
Skills and abilities	Ability to work independently and as part of a team	1, 2
	Excellent inter-personal and communication skills – both written and oral	1, 2
	Ability in problem solving, particularly related to numerical	1, 2
	Ability to write project reports and make technical presentations to industrial and academic research groups	1, 2
	Use of CFD software (e.g., OpenFOAM or Siemens StarCCM+)	1, 2
	Use of 3D CAD software (e.g., Siemens NX)	1, 2
	Use of data analysis software (e.g., MATLAB, Tecplot, Paraview)	1, 2
Training	A willingness to undertake further training as appropriate and to adopt new procedures as and when required	1, 2
Qualifications	A 2.1 or higher first degree in a relevant engineering discipline	1
	A relevant PhD qualification (or near completion) in a relevant subject area	1
Other	Commitment to observing the University's Equal Opportunities policy at all times.	1
	Commitment to maintain confidentiality at all times	1, 2
	Willingness to travel	1, 2

Desirable Criteria

Area	Criteria	Stage
Experience	Knowledge of gas turbine engines	1, 2

	Knowledge of afterburner / reheat systems	1, 2
	Knowledge of gas turbine combustion systems (inc. emissions)	1, 2
	Knowledge of various types of fluid mechanics instrumentation	1, 2
	Experience of using in-house software including compilation.	
Skills and abilities	Ability in programming languages such as Fortran or C++	1, 2
	Experience in helping to formulate research proposals	1, 2
Other	Licensed for driving in the UK	1

Conditions of Service

The position is full-time and fixed term for a period of 24 months. Salary will be on Specialist and Supporting Academic Grade 6, £ 33,966 - £44,263 per annum, depending on experience. A starting salary will be confirmed on offer of appointment.

The appointment will be subject to the University's Terms and Conditions of Employment for staff grades 6 and above, details of which can be found here.

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which can be found here.

The University offers a wide range of employee benefits which can be found here.

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html

In addition, the University is supportive, wherever possible, of flexible working arrangements. We also strive to create a culture that supports equity and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see http://www.lboro.ac.uk/services/hr/athena-swan/