Loughborough University

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

Research Associate in Hydrogen Combustion Systems for Zero Carbon Jet Engines

Job Ref: REQ250018

Project Description

This is an exciting opportunity for a post-doctoral researcher to join the team in the National Centre for Combustion and Aerothermal Technology (NCCAT). Current activities of the Centre include the development of low emission gas turbine combustion systems for civil aerospace applications using various fuels. This includes the potential use of hydrogen for zero carbon, low NOx emissions. The planned work activities include those being undertaken within a programme grant involving various universities aimed at solving the considerable scientific challenges of the fuel system when cryogenic liquid hydrogen (LH2) stored within an aircraft is pressurised, heated and supplied in gaseous form to the combustion system. Key to LH2 gas turbines is the combustion system performance. In addition to consideration of steady state performance (e.g. NOx emissions, flame stability and other characteristics), consideration will be given to the potential impact of transient changes in fuel delivery and fuel properties on the combustion process. The successful candidate will have experience of numerical methods associated with hydrogen fuel up to PhD level along with knowledge of experimental facilities and techniques.

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 stateof-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 Description

Job Family & Grade: Specialist and Supporting Academic Grade 6

Job Purpose: To investigate the use of hydrogen for future low-emission aero gas turbines with particular emphasis on the combustion system performance.

Job Duties

- To be responsible for undertaking the main research activities.
- To develop scientific and technical research using suitable numerical methods and experimental techniques/data
- To develop geometries/models based on specific test cases that can then be tested experimentally.
- To undertake suitable numerical predictions and experimental measurements to assist in the investigation and understanding of gaseous hydrogen combustion with particular emphasis on when this process occurs within a LH2 system.
- To suitably analyse, interpret, present and report on the data and research outcomes generated by the research.
- To help develop methods, configurations and geometries offering the potential of improved performance.
- To support the NCCAT engineers during the experimental campaign.
- To assist in the modification of existing experimental rigs to evaluate combustion performance, emissions and operability. Where necessary, to liaise with outside manufacturers and University technical staff to support the manufacture, construction, or modification of experimental facilities.
- To provide guidance and support to collaborators including other Universities working on this application and Industry colleagues
- To attend and present work at progress meetings at UK and European sites as and when required.
- To collaborate and work with other researchers within NCCAT as and when necessary to meet research project objectives.
- 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: Professor Jon Carrotte (NCCAT Director)

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
3 – Presentation

Essential Criteria:

Area	Criteria	Stage
Experience	Recent relevant research in an academic or industrial environment.	1, 2, 3
	Research areas involving complex flows and combustion.	1, 2
	Experience of undertaking numerical predictions (to PhD level) using computational fluid dynamics relating to Hydrogen combustion. Including various types of turbulence modelling (e.g., RANS, DES/LES).	1, 2
	Knowledge of combustion modelling (e.g., Chemical Reactor Networks, Flamelet Generated Manifold in CFD).	1, 2
	Knowledge of experimental facilities, instrumentation etc. relating to reacting flows.	
	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 experimental and/or numerical methods	1, 2
	Ability to write project reports and make technical presentations to industry, academic research groups, conferences etc	1, 2
	Use of data analysis software (e.g., MATLAB, Tecplot, C++)	1, 2
	Use of modelling software (e.g. Cantera)	1, 2
	Use of CFD software (e.g., ANSYS Fluent, StarCCM+)	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 always observing the University's Equal Opportunities policy.	1
	Commitment to always maintain confidentiality	1, 2
	Willingness to travel	1, 2

Desirable Criteria

Area	**Criteria**	**Stage**
Experience	Knowledge of gas turbine engines	1, 2
	Knowledge of gas turbine combustion systems	1, 2
	Knowledge of hydrogen combustion.	1, 2
	Experience of designing and operating experimental facilities for the measurement of complex fluid flows with combustion.	1, 2
	Knowledge of various types of fluid mechanic instrumentation.	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 6 months. Salary will be on Specialist and Supporting Academic
Grade 6, £34,866 - £45,163 per annum (pay award pending), 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 equality 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/

Informal Enquiries

Informal enquiries should be made to: Jon Carrotte

Applications

The closing date for receipt of applications is 23RD January 2025