

National Centre for Combustion and Aerothermal Technology (NCCAT)

Opening 2019



Loughborough
University



4* Hotel/Conference Centre

StemLab

Conference Centre

Aeronautical and
Automotive Engineering

Rolls-Royce UTC

NCCAT

This development has been funded
by a partnership comprising



Innovate UK



Advanced Technology
Innovation Centre



Set to open in early 2019, the National Centre for Combustion and Aerothermal Technology (NCCAT) will act as the UK's primary hub for research and development of future low-emission aero gas turbine combustion technologies.

As the boundaries between research, design and development become increasingly blurred, NCCAT will support activities over a range of Technology Readiness Levels (TRL 1-6) through the alignment of early research activities with future commercial goals. This will promote multi-disciplinary and integrated design methodologies which will ensure the fast pull through of new technologies.

Beyond aerospace applications NCCAT will also provide wider exploitation potential in the automotive and energy sectors, as well as areas such as power generation, marine propulsion, and thermal management applications.

NCCAT welcomes the engagement of its capabilities in several ways with flexible R&D packages tailored to the specific needs of clients. This includes access to its facilities on a purely commercial basis, through to collaborative ventures with NCCAT's own experienced research staff.

We look forward to welcoming you.

Professor Jon Carrotte

Director of the National Centre for Combustion
and Aerothermal Technology

Rolls-Royce/Royal Academy of Engineering Professor
of Aerothermal Technology

Introduction

The National Centre for Combustion and Aerothermal Technology (NCCAT) is funded through a partnership comprising the Department for Business, Energy and Industrial Strategy (BEIS), the Aerospace Technology Institute (ATI) and Innovate UK, with support from Rolls-Royce plc and Loughborough University.

NCCAT will lead research excellence and technology deployment in low emission aero gas turbines, strengthening the UK's ability to benefit from the predicted growth in the civil aerospace market. It will enable industrial problem-owners to visit and work closely with world-class academic researchers to ensure that new technologies are translated from theory to practice as quickly and as efficiently as possible.

NCCAT builds on the experience of a large, well-established research group whose activities span more than a quarter of a century, with its original roots traced back to the late 1960s. The state-of-the-art facilities and in-house expertise, coupled with the wider facilities available on the University campus offers clients a unique package.

NCCAT will be situated on the Loughborough University Science and Enterprise Park (LUSEP), one of the UK's largest science parks host to 70+ companies on a 53-hectare site. Co-located with the existing Unsteady Fluid Mechanics Laboratory, NCCAT will provide:

- Access to both state-of-the-art facilities and world leading research expertise for industrial partners.
- Access to facilities for fundamental research supported by various National and European funding streams; critical to the development of next generation combustion systems.
- A training ground for current and future aerospace engineers in a critical skill area for the UK. This will include access to the EPSRC Centre for Doctoral Training (CDT) in Gas Turbine Aerodynamics (a partnership between the Universities of Cambridge, Loughborough and Oxford).



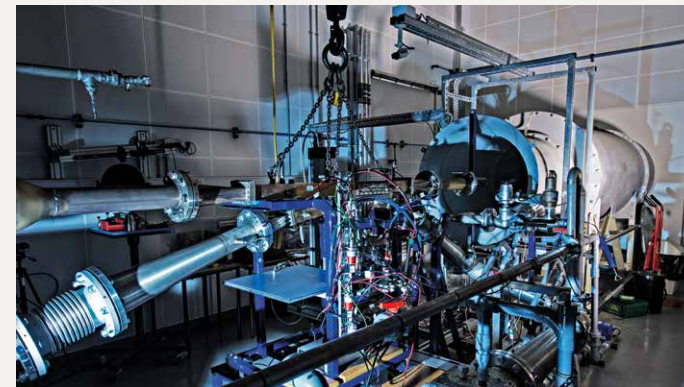
Capabilities

NCCAT will support a range of low/mid TRL activities crucial to the development of future gas turbine combustion systems. The development includes:

- A new 850m² purpose-built laboratory incorporating eight new test cells.
- Specialist plant and equipment which provides the infrastructure to support single-phase and two-phase, non-reacting and reacting flow experiments over a range of conditions:
 - Sub-atmospheric (240K, 0.3BarA, 0.8kg/s),
 - Atmospheric (288K, 14kPa, 4kg/s),
 - Elevated pressures and temperatures (up to 900K, 11Bara at various flow rates).
- Access to a range of instrumentation of various levels of fidelity:
 - Standard aerothermal measurement techniques (eg miniature five-hole probes, hot-wire anemometry and scalar gas tracing),

- Advanced state-of-the-art laser diagnostics (eg particle image velocimetry, planar laser induced fluorescence, emission reabsorption laser induced fluorescence, particle doppler anemometry, pressure sensitive paint, thermographic liquid crystals),
 - Techniques for rapid evaluation of fuel injector characteristics (e.g. effective area, flow number, cone angle, patternation),
 - State-of-the-art gas sampling/analysis systems and reacting flow diagnostic techniques.
- A 100m² state-of-the-art workshop to service the test cells, including a range of manufacturing equipment (CNC milling machine, CNC lathe, manual milling machines and lathes, a welding booth).

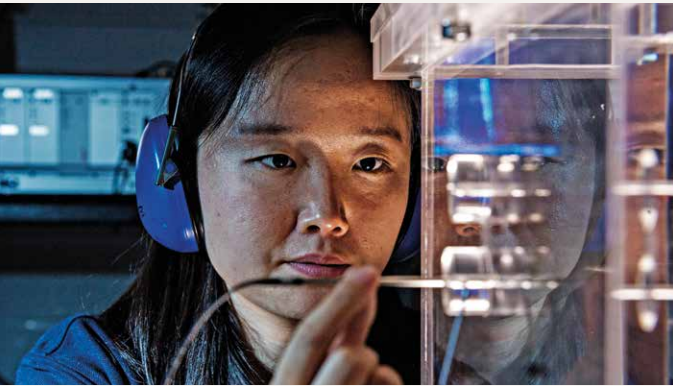
Access to NCCAT's test facilities can be tailored to suit individual business needs, with flexible short and long-term arrangements, and can include access to staff expertise, whether on a fee for service or collaborative basis.



Expertise

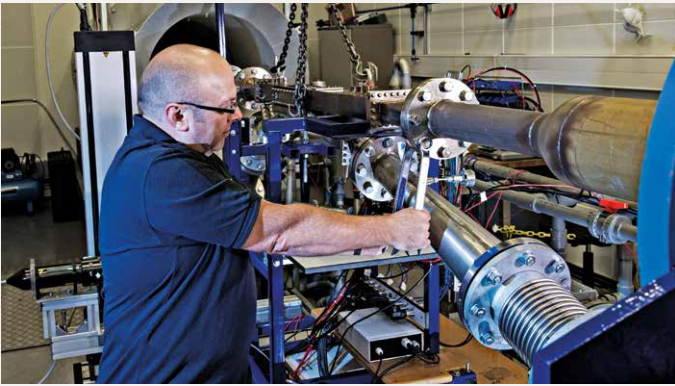
Loughborough University is renowned for partnering organisations to boost productivity, and NCCAT is no exception, providing the ideal environment for knowledge exchange, innovation and mutually beneficial collaborations. With almost 100 years combined experience the existing research team can offer partners seamless access to a wide breadth of expertise. This includes:

- Fundamental fluid mechanics (e.g. diffusing flows, boundary layer separation, wake mixing, secondary flows, the effects of swirl, curvature and pressure gradients, aeroacoustics and two-phase flows).
- Fluid mechanics of gas turbines (e.g. low emission combustor architectures, the compressor/combustor interface, integrated outlet guide vane design, advanced pre-diffuser development, fuel injector and two-phase flows (sprays), cooling technologies and heat transfer, aero acoustics, combustion instabilities, the combustor/turbine interface, installation and transition duct aerodynamics).



- Design and operation of advanced, state-of-the-art test rigs and associated infrastructure.
- Development of advanced, high-fidelity instrumentation and imaging techniques.
- Development and use of advanced computational fluid dynamics and high-performance computing (including RANS, LES and DNS, isothermal, multi-phase (sprays) and reacting flow simulations, particle tracking, acoustically forced flows). NCCAT partners will also be able to negotiate access to HPC Midlands Plus, a tier-2 high-performance computing centre housed at Loughborough University.

NCCAT will also be supported by a dedicated Technical Operations Manager and a team of specialist research technicians.



On-site benefits

In addition to the test facilities and staff expertise, partners can enjoy:

- Top specification fully serviced office spaces, with additional space available for future development
- Remote working arrangements, enabling confidential access to test facilities
- Boardroom and break out meeting spaces
- Car parking, bike stores and showers
- Fully equipped kitchen areas
- Secure site, card swipe access, CCTV

Wider campus benefits

- Super-fast broadband, fully wireless campus
- Award-winning conference facilities
- 4 and 3-star hotels
- World-class sports facilities
- Free campus shuttle bus
- Extensive library, free borrowing
- Graduate and student recruitment
- Cafes and daily fresh delivery service
- Shops, banks, ATMs

 REF 2014 A TOP 10 RESEARCH UNIVERSITY IN ENGLAND	 INTERNATIONAL QS STARS SCHEME AWARDED 5* FOR RESEARCH	 WORLD-CLASS FACILITIES
 THE GUARDIAN UNIVERSITY GUIDE 2018 RANKED 6TH	 TIMES HIGHER EDUCATION STUDENT EXPERIENCE SURVEY 2017-18 BEST STUDENT EXPERIENCE	 THE COMPLETE UNIVERSITY GUIDE 2018 RANKED 10TH
 7 QUEENS ANNIVERSARY AWARDS	 17,800 STUDENTS	 OUTSTANDING CAMPUS BENEFITS

One of the most accessible sites in the UK

- M1 (J23) – 1 mile
- East Midlands Airport – 7 miles
- London – 90 minutes by rail



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