UNIVERSITY OF LEEDS

CANDIDATE BRIEF

Research Fellow in Atmospheric Ice Nucleation, Faculty of Environment

Salary: Grade 7 (£37,099 – £44,263 p.a. depending on experience)

Reporting to: Professor Benjamin Murray

Reference: ENVEE1744

Fixed term for up to 24 months to complete specific time limited work

Location: University of Leeds (with scope for hybrid working)

We are open to discussing flexible working arrangements

Overview of the Role

Would you like to help to bring about the transition to sustainable aviation fuels (SAFs) that will help reduce the climate impact of aviation, do you have an established background in experimental cloud and aerosol research, and do you want to further your career in a one of the world's leading atmospheric science institutes?

You will become a key member of the SAFice team focused on quantifying the concentration of ice-forming particles emitted from burning SAF in jet engines rather than fossil kerosine. SAFice is a new NERC funded project based in Leeds involving partners in Sheffield and Imperial. It will make use of the new PINE chamber, for counting ice-forming particles (Ponsonby et al. 2024), and also the new jet engine test rig at the Translational Energy Research Centre (TERC) in Sheffield. SAFice is one of 10 projects funded through a NERC call focussed on understanding aviation's non-CO_2 impacts on climate, which is in turn part of a £1.7 Billion investment in making the UK's aviation sector more competitive (Innovate UK, ATI). Hence, you will be well-positioned in the expanding field offering a solution to a climate problem.

Contrail cirrus clouds, that evolve from line-shaped clouds that form in the wake of aircraft in the middle and upper troposphere, are an important part of the climate impact of aviation. The increasing use of sustainable aviation fuels (SAFs) may not only reduce CO_2 emissions but is also thought to have the advantage of shorter-lived contrails. However, to quantitatively predict the magnitude of this benefit we need to improve our fundamental understanding of contrail formation and the emission of ice-forming particles from the use of different SAFs and SAF-blends.

The radiative properties and lifetime of contrail cirrus are strongly affected by the number concentration of ice-forming particles in the engine exhaust. Contrails form when ambient air and exhaust plumes mix resulting in a supersaturation with respect to water where liquid water can condense on particles. At temperatures below homogeneous freezing (~-38°C), these droplets almost instantly freeze and then grow into ice crystals. If the background atmosphere is supersaturated with respect to ice, then these crystals continue to grow forming a persistent contrail. The fewer aerosol that are emitted the fewer ice crystals that can form, the larger these crystals grow, that are emitted the fewer ice crystals that can form, the larger these crystals grow, the more rapidly they sediment and the shorter the lifetime of the contrail, thus reducing the fraction of the atmosphere containing contrails.



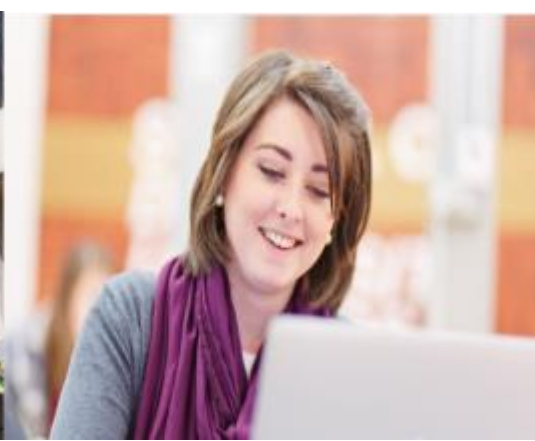
The overarching goal of SAFice is to quantify the change in the contrail radiative effect on transitioning to sustainable aviation fuels from standard fossil Jet A1 fuel. We will do this through a combination of laboratory experiments with modelling. The laboratory experiments will make use of a new instrument for counting ice forming particles (the PINE) and a jet engine test facility that we can power with both standard kerosine and SAF fuels.

This project is timely because we are at the cusp of the transition to SAF (with the first 100% SAF trans-Atlantic flight having taken place in Nov '23) and we need to understand the impact of this transition. The newly opened Translational Energy Research Centre (TERC) has developed a state-of-the-art facility comprising a turbine engine (APU) that has been shown to run on SAF fuels as well as having the connections to SAF producers and end users through the SAF clearing house. In Leeds we have developed an instrument for quantifying the concentration of ice forming particles – PINE. In Imperial we have developed modelling tools (pycontrails) which require our basic experimental input to make predictions of the effect of the switch to SAF on global contrail cirrus radiative properties. The team have also recently published the first ever study on the role of lubrication oil droplets in contrail formation and collaborated on the first 100% SAF flight operated by Virgin Atlantic, where TERC was used to measure changes in particle emissions resulting from the SAF used for the flight.

The overarching goal is to quantify the change in the contrail radiative effect on transitioning to sustainable aviation fuels from fossil Jet A-1 fuel. This will be achieved through:

- Probing experiments: Aerosol chamber and PINE (Portable Ice Nucleation Experiment) measurements in Leeds to examine the competition between non-volatile soot and lubrication oil, as well as between aircraft emissions and proxies of background atmospheric aerosol.
- Gas turbine experiments: Experiments in Sheffield to examine the contrail-ice-forming potential of turbine exhaust using a range of SAFs and blends making use of an aircraft turbine engine and our PINE. This will be much more detailed than could ever be achieved flying aircraft.
- Global contrail simulations: Define new parameterisation based on the laboratory data and use them to quantify contrail properties and radiative effects with a range of SAF usage scenarios.





Main duties and responsibilities

- Working with and in support of Professor Ben Murray and the SAFice team to ensure the objectives and deliverables of the SAFice project are successfully met;
- Conducting an experimental study on the competition between different classes of ice-forming particles making use of the PINE instrument and the Leeds aerosol chamber;
- Improving and adapting the existing instrumentation to achieve the goals of SAFice;
- Leading the deployment of PINE to make measurements of ice-forming particles in the exhaust of a jet engine at TERC in Sheffield in close collaboration with our partners;
- Interaction and supplying key ideas and data to our partner in Imperial who will be conducting the modelling part of SAFice;
- Generating and pursuing independent and original research ideas in the appropriate subject area;
- Developing research objectives and proposals and contributing to setting the direction of the research project and team including preparing proposals for funding in collaboration with colleagues;
- Evaluating methods and techniques used and results obtained by other researchers and to relate such evaluations appropriately to your own work;
- Preparing papers for publication in leading international journals and disseminating research results through other recognised forms of output;
- Working both independently and also as part of a larger team of researchers, engaging in knowledge-transfer activities where appropriate and feasible;
- Maintaining your own continuing professional development and acting as a mentor to less experienced colleagues as appropriate;
- Contributing to the training of both undergraduate and postgraduate students, including assisting with the supervision of projects in areas relevant to the project.

These duties provide a framework for the role and should not be regarded as a definitive list. Other reasonable duties may be required consistent with the grade of the post.



Qualifications and skills

Essential

- A PhD or near completion - i.e. the initial thesis needs to have been handed in at the point of application in a relevant Physical Science or field of Engineering or a closely allied discipline;
- A strong background in experimental science working with complex instrumentation;
- Experience of working with experimental data and of processing experimental data to address scientific questions and hypotheses;
- Experience working with aerosol particles and knowledge of aerosol science;
- Good time management and planning skills, with the ability to meet tight deadlines, manage competing demands and work effectively under pressure without close support;
- A track record of peer-reviewed publications;
- Excellent written and verbal communication skills including presentation skills;
- A proven ability to work well both individually and in a team;
- A strong commitment to your own continuous professional development.

Desirable

- A strong background in scientific programming (e.g. Python, Fortran);
- Knowledge of aerosol-cloud interactions;
- Knowledge of atmospheric ice nucleation;
- Knowledge of the role particles play in contrail formation;
- Experience in working with complex instrumentation;
- Knowledge of aviation-climate impacts.

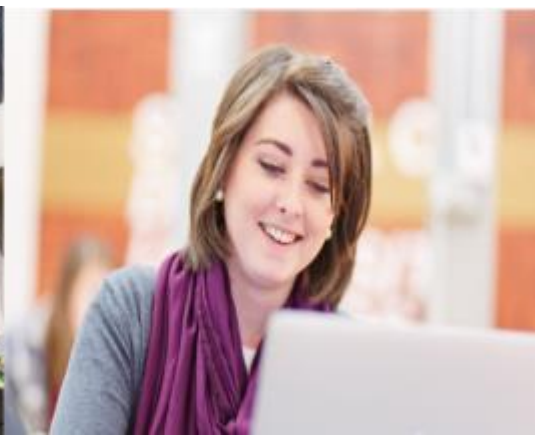
Additional information

Please note: If you are not a British or Irish citizen, from 1 January 2021 you will require permission to work in the UK. This will normally be in the form of a visa but, if you are an EEA/Swiss citizen and resident in the UK before 31 December 2020, this may be your passport or status under the EU Settlement Scheme.

Find out more about the Faculty of Environment.

Find out more about the School of Earth and Environment.





Find out more about our Research and associated facilities.

Find out more about Equality and Inclusion in the faculty.

Working at Leeds
We are a campus based community and regular interaction with campus is an expectation of all roles in line with academic and service needs and the requirements of the role. We are also open to discussing flexible working arrangements. To find out more about the benefits of working at the University and what it is like to live and work in the Leeds area visit our Working at Leeds information page.

Our University
As an international research-intensive university, we welcome students and staff from all walks of life and from across the world. We foster an inclusive environment where all can flourish and prosper, and we are proud of our strong commitment to student education. Within the Faculty of Environment we are dedicated to diversifying our community and we welcome the unique contributions that individuals can bring, and particularly encourage applications from, but not limited to Black, Asian, people who belong to a minority ethnic community; people who identify as LGBT+; and disabled people. Candidates will always be selected based on merit and ability.

The Faculty of Environment has received a prestigious Athena SWAN silver award from Advance HE, the national body that promotes equality in the higher education sector. This award represents the combined efforts of all schools in the Faculty and shows the positive actions we have taken to ensure that our policies, processes and ethos all promote an equal and inclusive environment for work and study.

Information for disabled candidates
Information for disabled candidates, impairments or health conditions, including requesting alternative formats, can be found on our Accessibility information page or by getting in touch with us at hr@leeds.ac.uk

Criminal record information

Rehabilitation of Offenders Act 1974
A criminal record check is not required for this position. However, all applicants will be required to declare if they have any ‘unspent’ criminal offences, including those pending.



Any offer of appointment will be in accordance with our Criminal Records policy. You can find out more about required checks and declarations in our Criminal Records information page.

Visa Information

Please note that this post may be suitable for sponsorship under the Skilled Worker visa route but first-time applicants might need to qualify for salary concessions. For more information please visit: www.gov.uk/skilled-worker-visa.

For research and academic posts, we will consider eligibility under the Global Talent visa. For more information please visit: https://www.gov.uk/global-talent