UROP - Available Projects

The UROP is designed to support undergraduates studying at the University of Cambridge who are going to return for at least one more year of undergraduate study.

Final year undergraduates and postgraduate students should not apply.

Some projects with external funding have additional restrictions, such as those funded by EPSRC.

If you have any questions please contact Joe Goddard, Industrial Placements Coordinator, who administers UROP projects for the Department of Engineering.

Further information can be found below:

- Student click here.
- Staff click here.

Available Projects

Transonic wind tunnel experiments for low-drag aero-engine intakes under crosswind conditions

Primary Supervisor Details

Name: Luke Dickinson, ld599@cam.ac.uk

Industrial Collaborator

Edward Jinks, Siemens

Project Description

Future aviation decarbonisation targets require substantial improvements in turbofan propulsive efficiency. Ultra-high bypass ratio engine architectures aim to achieve this by reducing fan pressure ratio, increasing propulsive efficiency and lowering fuel burn. However, maintaining thrust with lower fan pressure ratios requires larger fan diameters and nacelles. To avoid a cruise, drag penalty from increased nacelle wetted area, future intakes must become shorter and more aerodynamically aggressive.

These aggressive intake geometries are more susceptible to boundary-layer separation during off- design operation, particularly under crosswind conditions during take-off and climb. In this regime, the windward engine ingests crossflow which must negotiate a strongly curved intake surface, producing adverse pressure gradients, transonic shock–boundary-layer interaction and possible flow separation. This can generate stagnation pressure loss and fan-face distortion, reducing compressor stability margin, engine operability and overall performance. The unmet need is both aerodynamic and industrial. For companies such as Siemens, there is continued economic interest in improving the predictive capability of industrial CFD tools for this difficult flow class: high-Reynolds-number, transonic, curved-surface shock–boundary-layer interaction with incipient separation. Current numerical methods are widely used to guide aerodynamic design, but their reliability depends on validation against representative experimental data. At present, there is limited high quality experimental data for sharp intake geometries under crosswind-relevant transonic conditions, which creates uncertainty in CFD-driven design decisions and increases the risk of costly late-stage redesign.

This project will build on an existing experimental rig at the Cambridge University Engineering Department transonic wind tunnel facility that reproduces representative crosswind intake flow conditions. A summer UROP student will investigate simple passive boundary-layer control concepts, including surface roughness and low-profile vortex generators, to delay or suppress separation. The project will generate targeted validation data and design insight to help Siemens assess and tune CFD modelling approaches, de-risk future aerodynamic design studies, and support progression of passive flow-control concepts from early proof-of-principle towards higher TRL development and future collaborative projects.

Essential Knowledge, Skills, and Attributes

Proficiency in CAD and MATLAB/Python. Wind tunnel experimental experience would be a bonus.

Timing

- Application closing date: Rolling review (nominally end of term)
- Project start and end dates: 6th July 2026 – 28th August 2026

Continuation Opportunities

Fourth-year projects run every year in the transonic wind tunnel, so this UROP would provide excellent preparation for a potential follow-on MEng project.

Application Details

Name and email of the person receiving the applications: Luke Dickinson – ld599@cam.ac.uk

Deadline for applications

Rolling review (nominally end of term)

Bilt - novel low order physical systems modelling tool

Primary Supervisor Details

James Emberton, Aviation Impact Accelerator, Whittle Lab, Dept of Engineering

Project Description

Bilt is a novel low order computational modelling tool. We are developing a completely novel approach to support analysis of complex physical systems, in an accessible way, based on functional programming principles. This project is based at the Aviation Impact Accelerator at the Whittle Lab and supports work to de-carbonise aviation. However, we anticipate that the Bilt tool can be applied more generally in the world of systems modelling.

A number of potential projects are available depending on the student's skills and interests. These could include:

- design and evaluation of novel computational and static analysis infrastructure
- prototyping new physical systems toolboxes
- developing cloud compute and data workflows

This is an opportunity to help shape the future of a novel open-source computational tool with enormous potential.

Essential Knowledge, Skills, and Attributes

All projects require strong familiarity with Python as a minimum and a strong interest in sustainable aviation.

Depending on the project the following skills may be useful:

- Programming languages such as Rust, OCaml, or Haskell
- Knowledge of computational graphs, compilers, computer algebra, or functional programming
- Array computation (e.g. JAX), compiler infrastructure (e.g. LLVM), or symbolic mathematics (e.g. CasADi)
- A background in Chemical, Mechanical, Electrical, Aerothermal Engineering or Computer Science
- Interest in open-source software development

Timing

Applications will be assessed on a rolling basis

Any applicants will be expected to start their 8–12-week placement in July

Continuation Opportunities

There is potential to support continuation work for undergraduate thesis or MSc projects.

Supporting Information

https://aiazero.org/

Application Details

If you would like to apply, please send your CV and a short cover letter to Anna Petrosyan, ap2522@cam.ac.uk.

Source URL (modified on 16-06-26): https://teaching.eng.cam.ac.uk/content/urop-available-projects