



ERCOTAC Autumn Festival Schedule

The Council Room, 170 Queen's Gate, Imperial College London, SW7 5HF

Introduction and welcome

- 9:00 – 9:10 Oliver Buxton (Imperial College London)

Mini session: sustainable aviation

1. 9:10 – 9:30 Rafael Palacios (Imperial College London), Turbulence in the path of sustainable aircraft
2. 9:30 – 9:50 Sebastian Eastham (Imperial College London), Aerospace sustainability as a problem of multiphase reacting flows
3. 9:50 – 10:10 Irene Dedoussi (University of Cambridge), Forward and adjoint atmospheric modelling approaches for sustainable aviation
4. 10:10 – 10:30 Jennifer Wen (University of Surrey), CFD based predictive tools for liquid hydrogen hazards and their limitations

Coffee break

5. 11:00 – 11:20 Kostas Steiros (Imperial College London), New insights on the self-similar behaviour of turbulent flows
6. 11:20 – 11:40 Maarten van Reeuwijk (Imperial College London), CFD modelling of trees: what is the value of the drag coefficient?
7. 11:40 – 12:00 Omar Matar (Imperial College London), Direct numerical simulations of Multiphase Flows in Stirred Vessels and Static Mixers
8. 12:00 – 12:20 Colm-Cille Caulfield (University of Cambridge), In search of stratified turbulence

Lunch

9. 13:20 – 13:40 Emily Manchester (University of Manchester), Modelling turbulence in cardiovascular disease
10. 13:40 – 14:00 Paul Bruce (Imperial College London), Novel surfaces for the control of hypersonic boundary layer transition
11. 14:00 – 14:20 Lidia Caros Roca (Imperial College London), Aerodynamic optimisation of aerofoils for Martian rotorcraft
12. 14:20 – 14:40 Shane Windsor (University of Bristol), How birds interact with air flows

Coffee break

Da Vinci award session

1. 15:00 – 15:20 Neelakash Biswas (Imperial College London, UK), Multiscale energy transfers in the near wake of a model wind turbine
2. 15:20 – 15:40 Christopher Geschwindner (Technical University of Darmstadt, Germany), Optical diagnostics for carbonaceous solid fuels and flame retarded polymers in laminar and turbulent flows
3. 15:40 – 16:00 Daniele Massaro (KTH Royal Institute of Technology, Sweden), Space-adaptive simulation of transition and turbulence in shear flows
4. 16:00 – 16:20 Fabio Pino (The von Karman Institute for Fluid Dynamics, Belgium), Feedback control of liquid metal coating
5. 16:20 – 16:40 Matthias Steinhausen (Technische Universität Darmstadt, Germany), Modeling of near-wall flame dynamics in laminar and turbulent combustion

Coffee break + jury deliberations

- 17:10 – 17:20 Presentation of da Vinci award
- 17:20 – 17:30 Closing remarks (Oliver Buxton)

Dinner at Ognisko (19:30) (*55 Exhibition Road, London, SW7 2PG*)



Mini Biographies

- *Rafael Palacios*: is the Professor of Computational Aeroelasticity at the Department of Aeronautics, where he has been since 2007. He is an aeronautical engineer from Universidad Politécnica, Madrid and Ph.D. in Aerospace Engineering from the University of Michigan. Between both degrees, Rafa worked as R&D engineer in aeroelasticity and structural dynamics at Airbus (1998-2001). At Imperial he leads the Load Control and Aeroelasticity lab, that investigates computational methods for dynamic analysis, control and optimization of flexible air vehicles and offshore wind turbines. Rafa is also the director of the Brahmal Vasudevan Institute for Sustainable Aviation, Imperial's flagship multidisciplinary research centre in net-zero aviation technologies, and Deputy Head of the Department of Aeronautics. He is associate editor of the Journal of Aircraft, having also been in the editorial board of the Journal of Fluids and Structures (2016-22) and Progress in Aerospace Sciences (2018-22). Rafa is the lead author of Dynamics of Flexible Aircraft, published by Cambridge University Press in June 2023, an Associate Fellow of the American Institute of Aeronautics and Astronautics, and a Fellow of the Royal Aeronautical Society.
- *Irene Dedoussi*: is an Associate Professor in Sustainable Aviation and Energy in the Department of Engineering of the University of Cambridge and a member of the Whittle Laboratory. Her research interests revolve around better understanding the environmental impacts of aviation and other transportation and energy sectors, including how emerging energy sources and technologies can effect change. Prior to joining the University of Cambridge, Irene was an Associate Professor in the Faculty of Aerospace Engineering of TU Delft, with which she remains affiliated. Irene is a fellow of the Netherlands Academy of Engineering and a member of the Young Academy (De Jonge Akademie) of the Royal Dutch Academy of Arts and Sciences (KNAW). Irene holds a PhD in Aeronautics and Astronautics from MIT, an SM in Aeronautics and Astronautics from MIT, and a BA (Hons) and MEng (Hons w/ Distinction) in Engineering from the University of Cambridge.
- *Sebastian Eastham*: is a Senior Lecturer in Sustainable Aviation in the Department of Aeronautics, and a member of the Brahmal Vasudevan Institute for Sustainable Aviation. His research is dedicated to understanding how the aerospace sector affects the environment, and identifying new ways to mitigate those impacts so that we can continue to enjoy the benefits of the sector without the environmental costs. This work can range from trying to understand how aircraft condensation trails (contrails) interact with natural cloud, to looking at the potential benefits of cleaner rocket fuels. Other areas of interest include local and regional air quality effects of aviation, aerospace-induced changes in the ozone layer, CO₂ and non-CO₂ climate impacts resulting from aerospace emissions, and investigating new ways to deploy aerospace assets so that we can more closely and accurately observe the environmental effects of the aerospace sector. Seb's work is mostly computational, relying on the development and application of computational models of Earth's atmosphere such as the GEOS-Chem global atmospheric chemistry transport model and the APCEMM aircraft plume physics model. However this is complemented by the use of observations from both Earth observation platforms (e.g. geostationary satellites) and aircraft measurement campaigns, and by the development and application of machine learning techniques to interpret those observations.
- *Jennifer Wen*: is Professor in Energy Resilience in the School of Mechanical Engineering Sciences, University of Surrey. She leads the "Energy and Environment Programme" at the pan-university Institute for Sustainability. Jennifer's research has been applied to a wide range of safety-critical scenarios. She developed physics-based models to simulate accidental releases of flammable gases/liquid, the resulting fire, and explosions within the frame of open-source computational fluid dynamics (CFD) code OpenFOAM®; and provided some modified versions to industrial sponsors and other collaborators. Working with industry and HSE, Jennifer studied critical safety issues underpinning UK's decarbonisation activities, covering batteries, hydrogen, and transport of CO₂ for CCS. Jennifer is currently an Associate Editor for the Proceedings of the Combustion Institute, Chair for the UK Explosion Liaison Group (UKELG) and Vice-Chair Research for the



International Association for Fire Safety Science (IAFSS). She also serves as a member and Task Force Leader of the European Safety Panel on Hydrogen Safety (EHSP) established by Clean Hydrogen Partnership of the European Commission.

- *Kostas Steiros*: is a Lecturer in Experimental Fluid Mechanics at the Department of Aeronautics of Imperial College London. Kostas earned his PhD from the Department of Aeronautics at Imperial, and subsequently held a postdoctoral research position at Princeton University. Kostas has been awarded an Imperial College London Research Fellowship and an ERC starting grant to work on the physics of turbulent flows.
- *Maarten van Reeuwijk*: is a Professor of Urban Fluid Mechanics at Imperial College London. Maarten's research interests center on transport processes in fluids, with a particular focus on wall-bounded turbulence and buoyancy effects. His work spans various applications, including pollution dispersion, urban heat islands and microclimates in urban areas; atmospheric flows such as convection and clouds; building ventilation involving stratified environments, plumes, jets, and exchange flows; and oceanographic and coastal processes.
- *Omar Matar (FREng, FAPS, FICHEM)*: is a Professor of Fluid Mechanics, and Head of Department of Chemical Engineering at Imperial College London. His research interests include the use of multi-scale, physics-informed, data-driven methods for the solution of complex non-isothermal multiphase flows with phase change. OKM is the Principal Investigator of the £6.5M programme PREMIERE (PREdictive Modelling with QuantIfication of UncERtainty for MultiphasE Systems) funded by the Engineering and Physical Sciences Research Council, UK, which involves Imperial, Birmingham, Cambridge, UCL, the Alan Turing Institute, and a number of industrial and healthcare partners. He has co-authored over 360 refereed papers (>13000 citations and h-index 63) and given over 80 invited talks. He is co-Editor-in-Chief of the *Journal of Engineering Mathematics* and on the editorial boards of *International Journal of Multiphase Flows*, *Droplet*, and *Engineering*.
- *Colm-Cille Caulfield*: is Professor of Environmental and Industrial Fluid Dynamics in the Department of Applied Mathematics and Theoretical Physics (DAMTP) at the University of Cambridge, and a faculty member of the Institute for Energy and Environmental Flows (IEEF). He is a Professorial Fellow in Mathematics at Churchill College, Cambridge, and was elected a Fellow of the American Physical Society (Division of Fluid Dynamics) in 2014. He is Editor (in Chief) of the *Journal of Fluid Mechanics*. He studied for his BSc degree in Mathematics at the University of Ulster at Coleraine, graduating in 1987. He then obtained an MAST degree through studying Part III of the Mathematical Tripos at Cambridge in 1988, and subsequently completed his PhD in DAMTP in 1991. From 1992-1994 he was a postdoctoral fellow on a joint project between the Department of Physics at the University of Toronto and the Department of Engineering Science at Hokkaido University. From 1995-1999 he was a lecturer in the School of Mathematics at the University of Bristol, and then moved to the Department of Mechanical and Aerospace Engineering at the University of California, San Diego, where he was an assistant (then associate with tenure from 2001) professor of environmental engineering. He returned to Cambridge in 2005 to take up his present position, was promoted to (full) professor in 2015, and since 2020 has served as Head of Department of DAMTP.
- *Emily Manchester*: is a Research Fellow in Cardiovascular Fluid Dynamics at the University of Manchester. She received her PhD in Cardiovascular Engineering from Imperial College London in 2021. Her primary research interests are developing and utilising numerical models to understand cardiovascular disease and improve patient outcomes. Specifically, her research is focused on developing accurate and efficient numerical and imaging-based methods to quantify turbulence in the cardiovascular system, with the long-term goal of correlating turbulence with heart and artery disease progression. This research will allow us to understand how turbulent blood flow affects disease in individual patients and ultimately seek improvements in treatments for these patients.



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Flow, Turbulence And Combustion

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- *Paul Bruce* is a Reader in High-Speed Aerodynamics at Imperial College London. His research focuses on fundamental and applied aspects of experimental high-speed aerodynamics for supersonic and hypersonic applications using Imperial's high-speed wind tunnels. He is an active member of the Royal Aeronautical Society and chair of the RAeS Aerodynamics Specialist Group.
- *Lidia Caros Roca* is a Research Assistant and PhD candidate in the Department of Aeronautics at Imperial College London working on aerodynamic optimisation of aerofoils for Martian rotorcraft using direct numerical simulations. She holds an MSc in Computational Methods for Aeronautics from Imperial College London and a BEng in Aerospace Engineering from UPC, Spain. As part of her research, she collaborates with the ROAMX team at NASA Ames and the Mars Wind Tunnel team at Tohoku University.
- *Shane Windsor* is Associate Professor of Bio-Inspired Aerodynamics in the Faculty of Engineering at the University of Bristol, where he leads the Bio-Inspired Flight Lab. Over his academic career at the Universities of Auckland, Oxford and Bristol, Dr Windsor has researched the fluid dynamics and biomechanics of birds, bats, insects, fish and single cells. Using inspiration from these biological systems he is involved in the development of bio-inspired technologies for aerospace, with a particular focus on uncrewed air vehicles.