

**OCAVIA**

**THE OXFORD - CAMBRIDGE ARC  
VIRTUAL INSTITUTE FOR AVIATION.**

**OXFORD —  
CAMBRIDGE  
ARC**

# INTRODUCTION

Over the last sixty years aviation has shrunk the globe in ways beyond the comprehension of the early pioneers of flight. Now there is a need for a renewal of that pioneering spirit to address:

- The urgent need to contain and address environmental impact, requiring a complete overhaul of the aviation system.
- The impact of the global pandemic which has grounded fleets unilaterally through innovation.

To do this will require transformative developments across every part of the sector.

We are at a crossroads; do we drive forwards to address the impact of the sector on the environment? Or do we risk losing international standing as market leaders of innovation and regulatory reform in aviation? By working together in the Arc - with government, industry, and a grouping of universities - we will drive forwards.

No single research Institute or company contains the diverse range of disciplines that will be required. The Oxford to Cambridge Arc, an area of national economic significance, offers a unique combination of capabilities and facilities to tackle challenges of such scale. The Arc hosts the collective capability to address these challenges. We are prepared to develop a fully functional, virtual research Institute to deliver the sort of breakthrough, integrated solutions that are required.



A handwritten signature in black ink, appearing to read 'Iain Gray'.

**Professor Iain Gray CBE FRENG**

Chair of the Arc Sustainable Aviation Working Group



**Pre-pandemic, aviation generated £84bn to GDP and employed close to 1.25m people. 75% of all visitors travel to the UK by air, adding a further £20bn to GDP. Almost 40% of exports left the UK by air.**

The global aviation sector produces 2 to 3% of global CO<sub>2</sub> emissions, as well as NO<sub>x</sub>. Sustainable Aviation has shown how aviation can accommodate a 70% growth in passengers by 2050, whilst reducing net carbon emissions levels from just over 30 million tonnes of CO<sub>2</sub> per year down to zero.

# THE CHALLENGE

**Sustainable Aviation describes a future state where the aviation system produces either zero emissions or as a minimum, net zero emissions. Aviation is a system of systems, with a complex set of interdependencies between stakeholders.**



- The **air passengers** who choose to travel for business or pleasure, selecting carriers on the basis of a range of factors including destination choices, convenience, or costs.
- The **air space managers** looking for efficiencies and effective strategies, ensuring safety in the air and on the ground below.
- The **airlines** are wholly accountable for the safe operations of the aircraft, on the ground, and in the skies.
- The **aircraft manufacturing supply chain** with the responsibilities of performance, reducing environmental impact, and lowering operational costs.
- The **airports**, involving complex and far reaching logistics and planning, all whilst pulling on the resources of the energy network.
- The **aviation regulators** and governments to develop the control safety standards, environmental (and safety) goals, policies (expansion, etc), as well as to enable and fund innovation.

**This is a mature industry which changes at a slow pace, guided by the levels of investments required and regulatory frameworks that have evolved over decades. Work is underway to develop novel technologies and capabilities:**



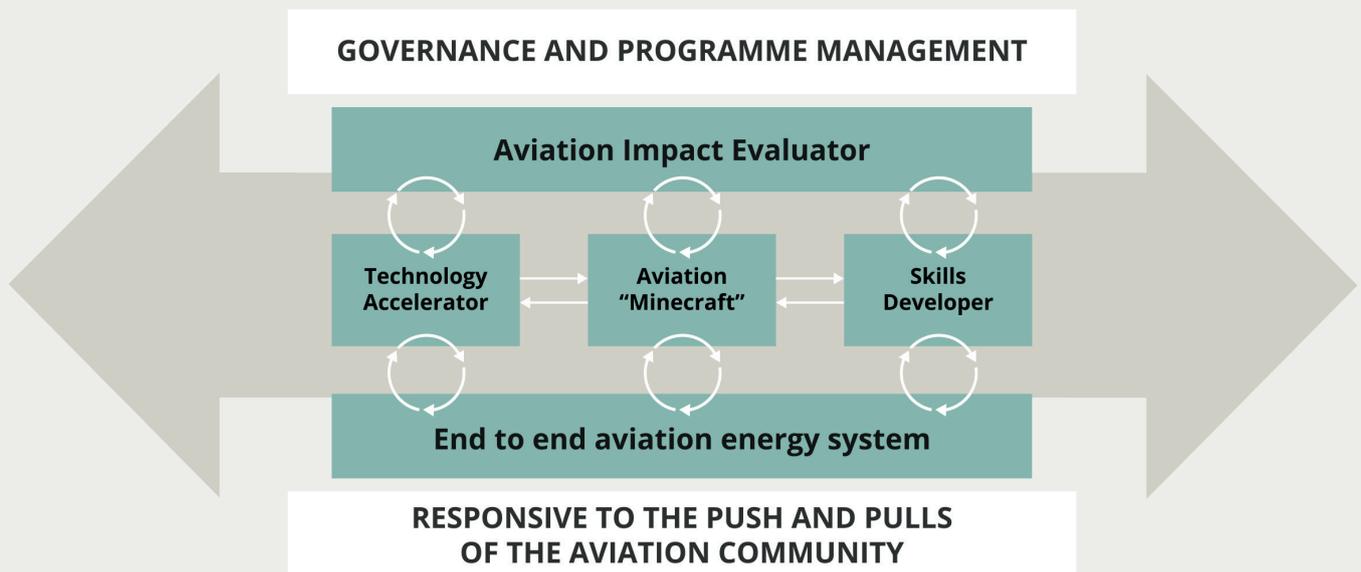
- The Jet Zero Council (JZC) is a partnership between industry and government, bringing together ministers and chief executive officer-level stakeholders to drive the ambitious delivery of new technologies and innovative ways to cut aviation emissions.
- The Aerospace Technology Institute (ATI) is supporting the investment into both current and future aircraft.
- ATI’s Flyzero programme, an aircraft design concept, will produce a technology blueprint for zero emissions aircraft, equipping UK-based businesses to lead on sustainable aviation

- transformations internationally.
- The Future Flight Challenge is developing an aviation system capable of safely operating new aircraft, incorporating electric and autonomous systems which have been “born green”.
- Work is taking shape to consider the sourcing and provision of sustainable aviation fuels.

There is a pressing need to address sustainable aviation as a system, not a series of technology interventions.

# OCAVIA - SYSTEM LEVEL RESEARCH AND DEVELOPMENT

OCAVIA is a virtual institute of research and development to overcome the challenges of delivering zero emissions aviation. OCAVIA offers an approach to enable real time modelling and integration of products into aircraft, and aircraft into wider operations and the supply chain. The capabilities of OCAVIA will create:



1. A system of systems Aviation Impact Evaluator to consider environmental, economic, and social implications of innovations.
2. A Technology Accelerator incorporating physical rapid prototyping to consider technologies in the context of aircraft integration from the outset.
3. An Aviation "Minecraft" enabling aviation stakeholders to simulate operational requirements incorporating an array of technology transformations.
4. An Aviation Skills Developer informed by the research and development programme to deliver the skills required by academia and industry for a zero-emissions aviation sector.
5. A model of end to end energy requirements to support the aviation system in its energy transition and transformation.



**Our approach will enable an early ‘spread betting’ across solutions in the safer confines of balancing research alongside virtual models of future aviation systems. As the research progresses then so too will the quality of the virtual models which will then continue to attract interest and further investment as OCAVIA establishes itself as the enabler of system level integration.**

**OCAVIA will bring together research, facilities and capabilities from across the region to address the challenges:**

- Economists, environmentalists, and social scientists connecting with airports, airlines, and manufacturers to develop an approach to evaluate developments holistically.
- Propulsion prototyping, thermal management, and aircraft integration capabilities all working together to accelerate technology developments.
- Airport designers, developers, air traffic controllers, and logisticians modelling new modes of operation in a zero emissions airport.
- A region-wide effort on skills development, harnessing the pull of industry and the push of technology development.
- Energy, environment, economics combining to evaluate the energy demands and requirements of zero emissions airports and airlines.



# WORKING GROUP

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Professor Iain Gray CBE	Chair, Director of Aerospace, Cranfield University
Dr Phil Clare	Deputy Director, Research Services (Knowledge Exchange and Engagement), University of Oxford, Co-Chair Arc Universities Group Operating Board
Dr Ruth Mallors-Ray OBE	Project Lead, RMR Consultants
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Professor Rob Miller	Chair in Aerothermal Technology and Whittle Lab Director, University of Cambridge
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