# Written evidence from Dr Simon Blakey

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Led by the University of Birmingham, along with, Sheffield University, Manchester Metropolitan University, Herriott Watt University, Cardiff University and Aston University the NewJet Network+ is one of the 5 low carbon transport networks funded by the EPSRC. The project brings together an innovative research community, focused on exploring the advantages offered by the increasing levels of low carbon, synthetic fuel or modified conventional fuel production beyond the existing fuel specification. The network will create a forum (free from commercial restraints that would limit freedom of forward and more strategic thinking) where an exploration of a new jet fuel specification for 2040 and beyond can be investigated. It will specifically focus on the improved performance over conventionally refined, fossil fuel feedstocks and the design of aircraft and engines that can maximise benefits from such fuels. The goal of NewJet is to provide new understanding and insights into the benefits and barriers to a new fuel specification by 2040. The outcome of NewJet will be a virtual centre of excellence linking the chemical properties of a fuel to improved performance properties. This approach will have parallels in the marine sectors and is consistent with UK government plans to become world leader in low emission technologies.

A thriving aviation sector sits at the heart of the UK's vision for a global and connected Britain. Aviation and aerospace contribute more than £22bn a year to the UK economy, supports half a million jobs and is recognised as the second largest aerospace sector in the World[1]. R&D in electric and hybrid aircraft technology is essential in the journey to decarbonise aviation, but will be realised initially in short haul travel. Medium and long-haul aircraft, whose emissions account for 97% of UK aviation emissions[2], will remain dependent on liquid fuel for the foreseeable future.

The expected growth of the air transport industry will create significant environmental and societal challenges over the coming decades. By 2050 the number of commercial flights landing and taking off in Europe is forecast to be 18.6 – 26.1 million per annum which is 2 - 2.7 times the number of 2012[3,4]. Much of this growth is likely to be accommodated by existing large hub airports, and growth where capacity is available. In doing so, new communities may be exposed to an enhanced level of aircraft exhaust emissions through changes in local air quality.

The COVID-19 pandemic has impacted the aviation sector massively. The anticipated growth in the sector is now in question and the business model for many airlines is challenged. Amongst others, a reduction in the need for business related travel, the increase in cost of travel to pay for the higher prices of SAF fuels, and the public's willingness to fly need to be considered when assessing the long term impact on the sector. If the sector does return to it's previous rate of growth, it is highly likely that the Paris Agreement target for temperature increase will not be met[5].

As aviation is a global, cross-border transport sector, both UK national and international

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[1] DfT (2018) Beyond the horizon: The future of UK Aviation. Next steps towards an aviation strategy.
[2] Calculated from DfT Aviation forecast 2017, available at: https://www.gov.uk/government/publications/uk-aviation-forecasts-2017
[3] Eurocontrol Challenges for Growth 2013, available at: http://www.eurocontrol.int/sites/default/files/content/documents/official-documents/reports/201307-challenges-of-growth-summary-report.pdf
[4] Flightpath 2050 Europe's Vision for Aviation, (2011), ISBN 978-92-79-19724-6, available at: https://ec.europa.eu
[5] Grewe et al., Evaluation the climate impact of aviation's emissions scenarios towards the Paris agreement including COVID-19 effects, Nature Communications, 2021

regulatory and policy making bodies intend that growth within the sector is achieved with a minimum impact on the environment and whilst maintaining the safety of flight, and should be engaged with as part of any enquiry. Principal policy and regulatory authorities are listed below:

**UNFCCC**: The legislated 2050 target for a reduction of at least 80% of $CO_2$ emissions reductions implied by the Paris Agreement (COP21) will require the UK to develop new technologies and processes. Actions required to meet the emission targets will include both sector-specific and cross-cutting areas like CCS, greenhouse gas removal, and the appropriate use of sustainable bioenergy.

**ICAO**: Carbon Offsetting and Reduction Scheme for International Aviation, which is an emission mitigation approach for the global airline industry. A pilot stage will commence from 2021-2023 with a voluntary stage between 2024-2026 with full implementation in 2027-2035.

**Europe**: Europe's long-term goal, as stated in the EU 2010 Transport White Paper, is for aviation to use minimum 40% sustainable alternative fuels in Europe by 2050. In addition, the Strategic Research and Innovation Agenda of the Advisory Council for Aviation Research in Europe (ACARE) has set a goal of a 75% reduction in $CO_2$ emissions by 2050[6].

**UK**: In response to its commitments to reduce $CO_2$ emissions from aviation the UK Government has published its Net Zero strategy. This will address the need to limit UK aviation emissions to the level assumed when the fifth carbon budget was set (i.e. around 2005 levels by 2050 – accommodating a 60% potential increase in demand)[7] . For the UK to achieve carbon

**Leading Fuel Specifications:** The US ASTM specification groups and associated R&D support developed and maintain world leading specifications for conventional and synthetic fuels, and the processes by which new fuels are introduced. The UK MoD Defence Standards generally follow their lead. Other specification around the world (apart from Russia and China) adopt ASTM/DEFSTAN requirements. Therefore engagement with ASTM and DEFSTAN is critical to success.

*What contribution can operational efficiencies make to reduce emissions from aircraft / shipping vessels and over what timescale could these have an effect on emissions?*

For aviation, operational efficiencies will make a meaningful contribution to the reduction in emissions. Route optimisation and avoiding sensitive regions of the climate for particular flights have been shown to have a significant impact. In general, flying lower and slower will reduce fuel consumption, however this is not the direction that the sector has previously been heading in. Faster and cheaper flights are not the choice with the lowest environmental impact.

*How close are zero carbon fuels to commercialisation for aviation / shipping?*

Sustainable Aviation Fuels (SAFs) are commercialised and are being produced at a limited number of locations globally. The production costs are higher than those for conventional fuels and this has limited the rate of growth. The UK has an opportunity to develop a SAF industry at this early stage in the production of fuels from sustainable sources.

*How effective will the Jet Zero Council be in catalysing zero emissions technologies?*

The implementation of a mandate for SAF is highly likely to be effective in bridging the gap in the economic case for producing and using SAF.

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[6] ACARE (2017) Delivering Europe's Vision for Aviation. Strategic Research and Innovation Agenda
[7] Committee on Climate Change (2018) Reducing UK emissions, 2018 progress report to parliament.

*What role should transitional fuels such as alternative hydrocarbon fuels play?*

Transitional hydrocarbon fuels such as SAF remain the only alternative to conventional fuels which will require minimal changes to the fuel supply system, ground handling on airports, and aircraft and engine hardware. SAF fuels are already approved for flight and are already being used, albeit in small but increasing volumes. As such it should be viewed as one of the most important changes to the sector since the dawn of the jet age in the 1960s.

The aviation sector has a long term commitment to hydrocarbon fuels for medium and long haul flight. This is due to the energy density of the liquid hydrocarbons, and a wide global availability.

It is possible that electric and hydrogen powered flight replace hydrocarbon fuels for short haul flight up to 2,500km in range (future developments in hydrogen powered flight may push this out to 6,000km, but is highly uncertain). Although these technologies are yet to be available for commercial flights.

*What new technologies are there to reduce emissions from aircraft / shipping vessels and how close to commercialisation are they?*

SAF fuels are the closest to commercialisation and likely to have the biggest impact the GHG and environmental impact of the sector. Large reductions in $CO_2$ emission across the whole life cycle have been demonstrated and must be implemented at a large scale over the time frame up to 2050.

In addition SAF fuels over a number of advantages over conventional fuels in terms of engine performance and the non-$CO_2$ impact of SAF fuels needs to be assessed. This is critical. If the non-$CO_2$ impact of SAF can be accounted for properly, it will increase the viability of the SAF industry and potentially reduce the gap in fuel price.

There is also a need to explore the re-optimisation of airframe and engine around 100% SAF fuels. This has the potential to reduce fuel consumption and consequently reduce the environmental impact of the sector further still. The NewJET Network+ currently estimates that this potential is at least somewhere between 7-10% reduction in fuel burn in use, which is comparable with some of the more advanced engine and airframe technology options. The NewJET Network+ will continue to work on assessing this potential.

The uptake of more advanced engine architectures, such as geared turbofans will also contribute significantly to reduction in fuel consumption (25% for the Rolls Royce Ultrafan) and are already commercialised in the GE LEAP engine.

Flying lower and slower is also a technology which is currently available and will reduce emissions.

Many other technologies exist and further reductions will be possible through their implementation, however those with large impacts (greater than a 50% reduction in emissions across the life cycle) require significant investment in ground based infrastructure to enable their use. Commercial hydrogen and electric flight are currently not possible at a national or international scale.

*How should the Government's net zero aviation strategy support UK industry in the development and uptake of technologies, fuels and infrastructure to deliver net zero shipping and aviation?*

Importantly it is the medium and long haul flight which contribute to the majority of the UK's aviation related emissions (97% as stated earlier). This should drive any support for technological improvements towards this aspect of the sector.

SAF fuels should be a major focus to reducing this emission, care should be taken to account for the likely green electrical and green hydrogen requirements to enable a SAF industry in the UK in any planning in the growth of these two parallel energy sectors.

*What is the most equitable way to reduce aircraft passenger numbers (e.g. reforming air passenger duty and taxes, frequent flyer levies, bans on domestic flights where trains are available, restrictions on airport capacity)?*

It is likely that the implementation of CORSIA and national mandates will increase the cost of flying and this will ultimately be passed onto the consumer or traveller. This will radically change the business model for many airlines.

*Are there any policy mechanisms that could reduce our reliance on shipping?*

*What further action is needed by the International Civil Aviation Organization and International Maritime Organization to drive emissions reductions?*

The successful implementation of the CORSIA scheme is the most significant action that can be taken by ICAO. This requires a considerable level of effort during the pilot and full implementation stages up to 2035.

*What can the UK Government do to drive international action on emissions?*

*How effective will the global offsetting scheme for international airlines (ICAO's CORSIA) and the UK and EU ETS be at stimulating technology improvement and/ or behaviour change to reduce emissions from aviation / shipping?*

*How should the UK define its ownership of international aviation and shipping emissions (i.e. arrivals, departures or both) in order to include them in legislative targets?*

For aviation, it may be simpler to consider the fuel uplifted in the UK only for inclusion in legislative targets. This will need to be agreed internationally however, to avoid double accounting.

*September 2021*