Response to Call for Evidence: Aviation and Climate Change

May 2013

Introduction

Sustainable Aviation welcomes this opportunity to respond to the Airports Commission's call for evidence concerning aviation and climate change, and is pleased to offer the comments below which are intended to address and/or provide additional context to some of the questions posed in chapter 7 of the Commission's Document "Discussion Paper 03: Aviation and Climate Change"

About Sustainable Aviation

Sustainable Aviation (SA) is a unique alliance of the UK's airlines, airports, aerospace manufacturers and air navigation service providers. Together, we drive a long term strategy to deliver cleaner, quieter, smarter flying. SA is the first alliance of its type in the world, and reports regularly on progress in reducing aviation's environmental impact. See www.sustainableaviation.co.uk for more details.

Sustainable Aviation is governed by a Council comprising a leading panel of aviation environment experts. External advice and guidance to the work of SA is provided by a Stakeholder Panel including representatives from Government, the CAA, NGO's and academics. This structure ensures SA's work remains relevant and robust. Our signatories cover a wide range of UK and global companies.

The SA strategy has established seven goals which cover the range of sustainability issues from social and economic aspects through to climate change and noise.

In the last two years alone Sustainable Aviation and our signatory members have delivered a diverse range of work to define and address the issue of carbon emissions from aircraft.

- *Developing and publishing a CO_2 Road-Map detailing how UK aviation can accommodate significant growth to 2050 without a substantial rise in absolute CO_2 emissions.*
- *Conducting a range of perfect and optimum flight trials to highlight the potential to reduce flight trip fuel through removing inefficiencies in infrastructure capacity at airports and airspace. These include a British Airways flight from Heathrow to Edinburgh which showed the potential to reduce flight trip fuel by 11%. Trials across the Atlantic and through European airspace are currently being conducted and we are awaiting the results with interest.*
- *Developing best practice guides to the industry. In June 2012 the industry launched 'Reducing the Environmental Impacts of Ground Operations and Departing Aircraft - An Industry Code of Practice'. This champions a series of operational techniques to reduce noise and emissions from departing aircraft. SA is now overseeing implementation and will report on progress.*
- *Engaging in policy discussions on how to address CO_2 emissions from international aviation with the Government through the Aviation Policy Framework consultation, the Committee on Climate Change, Dept. for Energy and Climate Change and the Parliamentary Energy and Climate Change Select Committee.*

- *SA members are also investing significant time and money to tackle aviation CO_2 emissions on the European and Global stage through the ICAO CAEP working groups, the EU ACARE Flightpath 2050 initiative and influencing the development of a global emissions trading scheme for aviation CO_2.*

Following the publication of the Road-Maps on CO_2 and noise, SA is now focussing on delivery. In 2013 we will be publishing our Progress Report covering full details of our work against our strategic goals in the last few years. Beyond this our working groups on climate change, operational improvements and communications will continue to focus on delivering the CO_2 Road-Map. Additionally we will explore how the aviation industry and academic research programmes can be improved.

CO_2 Emissions from UK Aviation

The Sustainable Aviation CO_2 Road-Map, published in 2012, resulted from several months of consultation and analysis involving all four corners of the UK aviation industry. It sets out SA's expectation of CO_2 emissions from UK aviation between 2010 and 2050, taking account of the latest evidence available at the time of publication, and comparing its results with aviation CO_2 forecasts from the Department for Transport and from the Committee on Climate Change.

The Road-Map combines an assessment of growth in demand - derived from UK government forecasts - with our own analysis and judgement concerning the available mitigation opportunities, and the extent to which they will deliver improvements in carbon efficiency. Our Road-Map shows that UK aviation can accommodate significant growth to 2050 without a substantial rise in absolute CO_2 emissions.

The mitigation opportunities assessed by the Road-Map include:

- reductions in fuel-burn enabled by improvements in air traffic management and in operational-practices;
- the impact of adopting the next generation of aircraft whose fuel-efficiency characteristics are already known, and whose impact on fleet fuel efficiency can therefore be estimated with some confidence;
- the potential impact on fleet-average fuel efficiency of future aircraft types whose fuel-efficiency characteristics are not yet known; and
- further reductions in CO_2 footprint made possible by the use of sustainable alternative fuels in place of fossil-based kerosene.

The Road-Map also considers further potential reductions in UK aviation's net CO_2 emissions via market-based measures in which aviation can support CO_2 reductions in other sectors. Since CO_2 is a well-mixed gas, the geographical or sectoral distribution of its emission has little bearing on the resulting climate impact. Market based measures can therefore play a role in ensuring that the most cost-effective CO_2-reduction opportunities can be pursued, irrespective of sector or geography.

Being based on the DfT's own demand growth forecasts, our Road-Map implicitly accounts for the impact of the price of carbon upon demand for UK aviation.

UK aviation currently accounts for 5-6% of global aviation's CO_2 emissions. This proportion will fall over the next few decades due to a rapid growth in demand for aviation in the developing world. Looking to the future, significant UK influence over CO_2 emissions from aviation will be achieved not through restricting the scale of UK aviation activity, but through internationally focussed efforts. As a result, SA recommends that Government pursues an approach consisting of the following four elements:

1. intensifying R&D support to the UK's aerospace manufacturing sector, underpinning the development of fuel-saving technologies which will be deployed at scale on a world-wide basis;
2. encouraging the development and deployment of sustainable aviation fuels offering significant life-cycle CO_2 savings;
3. working with international partners to enable more efficient air traffic management, within the context of increased capacity requirements;
4. continuing to press for a global carbon-trading solution encompassing all of aviation, with a level playing field for all participants.

Interdependencies Between CO_2, NO_x and Noise

In 2010, Sustainable Aviation published a paper setting out some of the interdependencies between CO_2, NO_x and noise, and discussing their relevance for engine and aircraft design and operational choices. Trade-offs driven by airport capacity are also explored. Some of the key messages are:

- Inter-dependencies between noise, NO_X and CO_2 emissions are complex and require careful evaluation prior to regulatory, operational or design decisions. As regulations become more stringent, the relevant trade-offs become more difficult to address.
- Local noise regulations can in some cases result in increased fuel-burn and CO_2 emissions arising from operational choices necessary to achieve compliance. Limitations in airspace or airport capacity can increase noise and emissions through holding, or through non-optimal cruising speeds or flight altitude profiles.
- In general, it is not possible to express an inter-dependency in terms of a universally applicable metric, since its strength and character depend on the particular design point or operating point at which it is evaluated.
- Regular dialogue between regulators and industry stakeholders will be essential in ensuring that the complexities of the topic, and the delicate balances required, are adequately accounted for in the decision-making process.

Non-CO_2 Impacts

Sustainable Aviation notes the discussion of aviation's non-CO_2 climate impacts that appears within the Commission's Paper, and wishes to make the following observations:

- Whilst radiative forcing (RF) is commonly used as a metric for expressing the radiative imbalance at a particular date due to emissions that have taken place prior to that date, it does not provide an indication of the future radiative imbalance that will arise from emissions taking place today or in the future. In this respect it is not useful for informing policy decisions that will influence future emissions.
- Furthermore RF does not provide an indication of the manner in which the climate will respond to a particular level of radiative imbalance.
- In the specific case of aviation, there are (as highlighted in the Commission's paper) a number of climate-change impacts whose inherent timescales span a wide range, from minutes (non-persistent contrails) through to weeks (NOx-ozone), years (NOx-methane), and decades or more (CO_2). Radiative forcing tends to over-emphasise the importance of short-lived effects, while failing to represent the long-term future impact of emissions that have already taken place.
- More details on the shortcomings of RF as a metric can be found in Sustainable Aviation's position paper on aviation's non-CO_2 climate impacts, for which a reference may be found below.
- Irrespective of the choice of metric, there is still a great deal of uncertainty regarding the current impact of aviation's past non-CO_2 emissions. Research into this topic is on-going:
    a. The radiative imbalance arising from aviation-attributable stratospheric water vapour has recently been shown to be much smaller than previously reported[1].
    b. Estimates of the net radiative imbalance from the numerous effects triggered by aviation's NOx emissions have also been revised significantly downwards by recent papers[2],[3] which have taken into account a wider range of relevant effects.
    c. The impact of contrails and aviation-induced cirrus has yet to be quantified with certainty and is the subject of continued research in the academic community.
- Due to the very long atmospheric residence time of CO_2, from a climate change perspective it makes sense to prioritise the reduction of CO_2 over the reduction of non-CO_2 emissions, as a means of mitigating future risk. This position aligns well with the very strong commercial incentive to reduce fuel-burn.

Sustainable Aviation plans to update its position paper on aviation's non-CO_2 emissions referred to above during 2013, so as to take account of recent developments in the understanding of aviation's non-CO_2 climate impact, and mechanisms for expressing that impact.

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1 LJ Wilcox et al, "Radiative forcing due to aviation water vapour emissions", Atmospheric Environment, Vol. 63, 2012

2 CD Holmes et al, "Uncertainties in climate assessment for the case of aviation NO", PNAS, vol. 108, no. 27

3 K Gottshaldt et al, "Global sensitivity of aviation NO_x effects to the HNO_3-forming channel of the HO_2+NO reaction", Atmospheric Chemistry and Physics, 12, 2012

Sustainable Alternative Fuels

Sustainable Aviation supports and encourages the development of sustainable alternative fuels that are derived from biomass and/or waste streams, and mixed with kerosene, and which have considerable long-term potential to reduce CO_2 emissions from the airline sector in the UK.

To be acceptable to the industry, such fuels must be technically suitable for use in existing engines and aircraft. They must also be environmentally sustainable, including not competing with food crops for land or fresh water supplies. Finally, they must be capable of deployment on a sufficient scale to enable a material reduction in CO_2 emissions from aviation.

SA supports robust standards for sustainability and for supply chain regulation and control in order to ensure full quality assurance for fuels delivered to aircraft. SA also welcomes the recent discussion about Indirect Land Use Change (ILUC) associated with biofuels. SA acknowledges that all effects should be considered, both direct and indirect. SA is committed to endorsing sustainable practices throughout the lifecycle of sustainable aviation fuel, and supports and endorses standards that include "The Roundtable for Sustainable Biomaterials" (RSB) – a non-profit, international, independent, multi-stakeholder certification standard, widely accepted to be the most robust standard available in this field.

SA recognises that sustainable fuels do not represent a 'silver bullet' for our sector's contribution to carbon reduction. However, in combination with a continued emphasis on greater efficiencies and market based mechanisms, sustainable fuels can offer an opportunity to reduce the carbon intensity of air travel.

Carbon Emission Targets and Trading

Sustainable Aviation supports the inclusion of international aviation emissions in UK carbon budgets, based on the UK share of the EU Emissions Trading Scheme (ETS) cap, providing that delivery against the carbon budget is met through internationally agreed carbon trading.

We support an appropriately implemented EU ETS as a good starting point towards this and call on the Government to continue pressing for an agreement on and support implementation of a global carbon-trading solution encompassing all of aviation, ensuring a level playing field for all participants.

We do not support unilateral UK targets however as we believe this will lead to carbon leakage.

Summary

The Sustainable Aviation CO2 Road-Map envisages increasing efficiency of aircraft and the way in which they are operated over the next 40 years which, when combined with the introduction of sustainable alternative fuels means that significant growth in UK aviation can be accommodated without a substantial rise in absolute CO2 emissions.

To avoid the issue of aviation carbon leakage to countries outside the UK, Sustainable Aviation believes any policy measures to manage aviation carbon emissions should be implemented on an international level. We do not support unilateral UK aviation carbon targets.

Regarding the latest DfT forecasts of aviation carbon emissions levels Sustainable Aviation believes their model fails to take proper account of the potential of improved airspace and aircraft operational techniques and is too pessimistic in its assumptions concerning the efficiency of future aircraft[4].

References

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http://www.sustainableaviation.co.uk/wp-content/uploads/sa-inter-dependencies-sep-2010.pdf

Non-CO_2 climate change effects of aviation emissions
Sustainable Aviation, 2008
http://www.sustainableaviation.co.uk/wp-content/uploads/nonco2papernov08.pdf

Reducing the Environmental Impacts of Ground Operations and Departing Aircraft - An Industry Code of Practice
Departures and Ground Operations Code of Practice Working Group, 2012
http://www.sustainableaviation.co.uk/wp-content/uploads/DCOPractice2012approvedhi-res.pdf

[4] See SA CO_2 Road-Map Section 9.3 Comparison of SA's Projections with DfT's CO_2 Forecasts, p.44