SUSTAINABLE AVIATION

Progress Report 2011

Contents

Chair's Review

The past two years have been among the most challenging I can remember for the aviation industry.

It is testament to the seriousness with which the industry views its environmental responsibility that commitment to Sustainable Aviation (SA) among our membership has remained constant.

Our members have continued to safeguard resource for SA's pioneering work despite all the pressures on our costs. And we have had a very productive two years!

The work addressed in this Progress Report spans our industry. It has brought together recognised experts in their fields to help lead specialist work packages that can – and will – change the face of aviation in the UK.

We have helped generate new thinking on how to manage aircraft waste and airport emission levels; actively supported development of sustainable alternative fuels and sponsored in-service trials; carried out proving work on the fuel and CO_2 benefits of optimised Air Traffic Management (ATM) procedures and airport operations; and provided a realistic assessment of some difficult issues where an improvement in one area can create a setback in another.

The UK Government will publish updated growth forecasts on passenger demand and CO_2 later this year, and we have therefore delayed further work on our Roadmap until we can reflect that data since the ongoing trend in actual emissions will have been distorted, at least in the short term, by the economic recession and the volcanic eruption in Iceland in Spring last year.

Through all of this our members recognise that we can achieve more together through SA than we can individually. Sharing expertise and working collectively is SA's core strength – and has given us a credibility which has helped us secure independent scrutiny by a Stakeholder Panel of truly international standing and for which we are very grateful.

The next two years promise new challenges. We are really clear that while we will work to improve the environmental performance of the UK industry, emissions remain a global challenge. The CO_2 we may save won't create a halo over the UK. The importance of a global deal on aviation emissions remains paramount and we will continue to work with our colleagues worldwide, and to lobby for a global solution.

There will be new UK Government policy on aviation, with consultation this summer on a framework document. The Opposition, with a new leader, is also reviewing its aviation policy. There will continue to be huge pressure from groups concerned about both the global and local impacts of our industry.

Our work over the past two years has concentrated on environmental initiatives because it has never been more important for our industry to demonstrate we are serious in addressing our environmental impact. Equally, however, we must not allow policy makers to lose sight of the importance of aviation as a key driver of the UK economy. It is vital that we win support and recognition of aviation's role in the UK's economic growth, and it is vital that we put an end to any idea that aviation is just a luxury that can be replaced either by high speed rail or video conferencing.

Aviation is central not only to the UK's economy but to the global economy in a globalised world. It binds friends and families together in our multicultural world and helps bridge cultures. It has shaped the world we live in today.

SA's work programme over the next two years will therefore be crucial in further proving the credibility of our central proposition that aviation can grow sustainably and that we can minimise our environmental impact. We will be seeking to expand our existing evidence base to demonstrate the impact of initiatives under development and to ensure we can contribute maximum value to the political debate. Specifically, in addition to our ongoing environmental work, we will be undertaking a work package exploring the social and economic contribution that aviation makes to the UK's island economy.

Aviation remains unique in the UK transport sector as the only industry to establish a proactive coalition of airlines, airports, engine and airframe manufacturers and air traffic management set up specifically to address sustainability issues. We continue to be entirely focused on finding collaborative ways of improving our environmental performance. We will also continue to press for balance in the policy debate to safeguard the future development of our industry which is crucial to the health of the UK's island economy.

I am incredibly proud to have spearheaded for the past three years this unique initiative by the UK aviation industry to show real leadership in these challenging areas. We really are committed to making a difference.

Jill Brady
Chair, Sustainable Aviation

Stakeholder Panel Comment

The Stakeholder Panel is pleased to see the publication of this Progress Report. Convened immediately prior to the 2009 Progress Report, this offers the first real opportunity for us to comment publicly on the work and progress of the SA initiative. While we are supportive of, and encouraged by, the measures being developed, our role is not to endorse the work programme or its deliverables. Rather, we seek to engage and challenge the SA Council on its prioritisation and delivery, focusing attention on the issues that have most relevance to stakeholders.

The Report highlights the importance of SA signatories working together to achieve additional benefits. The Panel members believe this rationale defines the whole purpose of the initiative, and is the single most important factor in assessing the success of the work programme.

Measured against this objective, the Progress Report does set out some notable achievements. In particular, the work on "The Perfect Flight" illustrates how collaboration between signatories can deliver positive results, but it also demonstrates the potential for future operational improvements across the system.

Such information is helpful to both industry and stakeholders alike in understanding how changes to operations, technology and regulation may play a role in realising these benefits. Similarly, the Roadmap has been instrumental in aiding understanding and discussion of how aviation could develop in the UK in a low carbon society, while the ongoing work on a code of practice for departures has the potential to deliver tangible benefits.

Improving understanding and managing expectation is also a key output: the background papers on alternative fuels and trade-offs achieve this aim.

Producing a Progress Report is always good opportunity to take stock of what has been achieved and evaluate priorities and next steps against an evolving policy landscape. In addition to the specific areas of focus set out in this report for 2011/12, the Panel feels it is an opportune moment for the SA Council to review its commitments nearly six years after they were first published.

Many commitments remain relevant and have widespread support, but they can sometimes be regarded as aspirational especially where they are dependent on the actions of others. Delivering a global framework to address greenhouse gas emissions from the sector is a notable example of this. We recommend that SA should seek to refocus its commitments, specifically addressing the added benefits that can be achieved by working together to contribute to these high-level goals. This will provide a realistic alignment between ambition and delivery.

With the Government about to start work on the development of a new UK aviation policy, the next two years provide a timely opportunity to increase SA's engagement with all stakeholders and to set out the industry's vision for a sustainable policy framework. SA should reflect on its position and contribution to the wider national and international policy context, and where possible, seek to be proactive when delivering policy recommendations.

To inform this work, we have recommended that the SA Council takes forward work on scenario planning as a matter of urgency, so that the industry better understands and prepares for future challenges, disruptions and opportunities. We look forward to discussing and engaging with the Council on these issues.

Governance

The Sustainable Aviation Strategy and Work Programme is agreed by a Council comprised of representatives of the membership organisations. Signatories to SA have well established sustainability programmes. SA's terms of reference are to concentrate on issues that are most effectively addressed co-operatively. Additional information on signatories' programmes is available from their websites. A list of individual signatories of SA can be found here: http://www.sustainableaviation.co.uk/about-us/

Reporting to the Council is the SA Working Group, comprising Work Streams for the 2009/2010 period on:

- Climate change
- Operational improvements
- CO_2 reduction potential on the ground and at the airport
- Aircraft waste and recycling
- Sustainable alternative fuels
- Interdependencies

A Communications Group has been established during the last two year reporting period. This group reports to the Council and is responsible for publication of SA work findings on the SA website; wider engagement with SA member companies; and providing a voice for SA within the wider policy debate.

A Stakeholder Panel of recognised sustainability experts provides rigorous challenge to the Council and to the Work Programme. The Stakeholder Panel meets independently, and on a regular basis with the Council in order to track progress against the goals.

Goals and Future Programme

In the last two years, SA has reviewed its Goals, with input from the Stakeholder Panel. It was concluded they remained robust and relevant to drive forward our work programme. We combined two of the Goals, 'Social' and 'Economic', in a revised Goal 1. We simplified the 34 supporting commitments which had proved difficult to track and complicated to explain, replacing them with close tracking of the practical cooperative work being undertaken by SA signatories and a pragmatic specific programme for Sustainable Aviation under the Work Streams listed above.

Many individual SA companies have in place advanced systems for sustainability reporting; some of have received awards for their achievements in this area. However, collecting and collating information from a large number of different companies, which often use different reporting timescales and systems, is complicated and, while not ignoring this challenge, SA accepts that this is an area where more work will need to be done in future to ensure that our achievements can be properly recorded.

SA's Stakeholder Panel has taken a close interest in, and provided rigorous challenge to, the SA programme. SA will continue to take the Panel's advice into consideration in identifying areas for an effective cross-sectoral work programme. They have recommended that SA should focus on how it is taking forward work that would not otherwise have occurred through cross-sectoral cooperation and where, without SA, there would be little or no progress. With the Panel, SA has also concluded that, where appropriate regulatory requirements exist, SA commitment to further work is unnecessary, as it would not provide additional value.

Goal 1: Social and economic

A competitive aviation industry making a positive contribution to the UK economy, and meeting the needs of society for air transport, whilst maintaining constructive relationships with stakeholders.

- SA provides a focus for addressing the social and economic contribution of the aviation industry to society, and to the economy in the UK and its regions, as well as understanding the economic cost of environmental measures. There has been no specific programme of work in this area over 2009 and 2010, however the work of SA signatories in other areas contributes to:
- Maintaining sustainable and commercially viable air links to improve the connectivity of the UK and its regions, and support economic development.
- Continuing development of UK civil aviation manufacturing as a world-class industry.
- Developing the skills, knowledge and motivation of all employees and an improved understanding of issues relating to a sustainable aviation industry.
- Meeting the needs of society from aviation, including access to goods and services from abroad, and links to friends and family.

Goal 2: Climate change

Aviation incorporated into a robust global policy framework that achieves stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous man-made interference with the climate system.

- SA will continue to review its CO_2 Roadmap in the light of actual trends in emissions and, when available, Government projections of future demand for UK aviation.
- SA is currently engaged, through Professor Piers Forster of the Stakeholder Panel, in identifying ways in which the industry can help develop fuller understanding of the non-CO_2 atmospheric effects of aviation.
- Exercises such as the "The Perfect Flight" trial and the study of emissions from ground operations at airports will lead to improvements in addressing the climate impacts of aviation through identifying and promoting operational best practice.
- SA members are leading improvements in technology which, together with operational improvements, help drive towards the relevant Advisory Council for Aeronautics Research in Europe (ACARE) 2020 targets and further, longer term, improvements.

Goal 3: Noise

Limit and, where possible, reduce the impact of aircraft noise.

- SA members are leading improvements in technology and operations towards the ACARE goal of 50% reduction in perceived external noise by 2020, based on new aircraft relative to equivalent new aircraft in 2000, and towards longer term improvements.
- Work involving SA and other partners contributed to two interim parts of the Departures Codes of Practice in late 2009, with a fuller version due to be published in 2011.
- A key aspect of our work is achieving a balance of noise with impacts on climate and local air quality requirements.
- Continued assessment of the contribution of Continuous Climb Departures, control of descent speed, displacement of runway thresholds and "tailoring" aircraft arrivals to reduce noise impact on communities around airports. These have positive implications for CO_2 and NO_x emissions, as well as noise.

Goal 4: Local air quality

Industry to play its full part in improving air quality around airports.

- Good progress has been made towards the ACARE target of 80% reduction in NO_x emissions by 2020 based on new aircraft of 2020 relative to equivalent new aircraft in 2000.
- SA work over the past two years has clearly identified the interdependencies between NO_x, noise and CO_2 emissions. We encourage regulators and policymakers to engage with industry to ensure that these interdependencies are understood and accounted for when setting future policy requirements.
- SA work with the Clinton Climate Initiative on reducing CO_2 emissions from aircraft on the ground should also lead to some reductions in NO_x emissions, which are related to overall fuel burn from the main engines.

Goal 5: Surface access

Industry playing its full part in an efficient, sustainable multi-modal UK transport system.

- SA signatories continue to make progress towards this goal on an individual basis. In particular, SA airports work with transport stakeholders and airlines to increase the share of public transport and other sustainable modes of transport.

Goal 6: Natural resources

Environmental footprint of UK aviation's ground-based non-aircraft activities is contained through effective management and reduction measures.

- SA has published an Aircraft Cabin Waste Recycling Guide which identifies new recycling opportunities - and barriers. Proposals for a systematic recycling programme will also draw in service partners.
- The Airport Carbon Management Group will look at energy management in particular with airlines and other partners.
- SA members have individually and collectively been proactive in testing and characterising a range of alternative fuels. Their collective experience has enabled SA to publish a briefing paper on the potential of sustainable alternative fuels.

Goal 7: Implementation

Full industry commitment to sustainable development and communicating fully the role of aviation in society in order to support a better understanding of its contributions.

- As indicated above, a thorough review of the Goals and how SA can drive towards them was carried out after publication of the last Progress Report in early 2009.
- Recent work on interdependencies between noise, NO_x and CO_2 will assist our efforts to engage with policymakers to develop pragmatic, effective and environmentally sound mechanisms for mitigating aviation's total environmental impact.
- SA is committed to report formally and publicly on the progress made at regular, approximately two yearly, intervals. We believe that the deeper engagement of our Stakeholder Panel has strengthened the SA Governance Framework and will facilitate progress.
- SA also provides a forum through which UK aviation companies can communicate, develop, implement and encourage best practice among industry partners across sustainable development issues.

Policy Framework for Aviation Emissions

While preparing for participation of air carriers in the European Emissions Trading Scheme (EU ETS), SA and its signatories are actively engaged in pressing for a global scheme to address CO_2 emissions from aviation. SA liaises with the UK's Committee on Climate Change (CCC) on future emissions from aviation in the UK and will continue to work on reviewing the SA Roadmap, published in 2008. Improving knowledge of the non-CO_2 impacts of aviation on the climate is also a priority. Measures to reduce some such impacts can lead to increases in other environmental impacts of aviation.

A global agreement on aviation emissions

Over the last two years, SA and its member signatories have continued to lobby heavily for a global agreement on aviation emissions.

Ahead of the Copenhagen Climate Change conference in December 2009, SA published a manifesto detailing our support for a global deal on aviation emissions (see box for details). We sent the manifesto to every Head of State attending the talks and secured major media coverage on the subject in the UK, significantly raising the profile of our industry coalition.

Although the Copenhagen summit did not secure a global agreement on aviation emissions, it did pave the way for further talks. At the International Civil Aviation Organisation (ICAO) talks in October 2010, the meeting successfully adopted a comprehensive resolution to reduce the impact of aviation emissions on climate change. The agreement provided an action plan through to 2050 for the 190 member states of ICAO.

The ICAO resolution formalised a goal of achieving a 2% annual fuel efficiency improvement up to the year 2050 and also sets a target of 2013 for a CO_2 standard for aircraft. It additionally seeks a collective medium-term aspirational goal of capping aviation's carbon emissions from 2020.

The International Air Transport Association (IATA) 2050 goal goes further, setting a target of a net 50% reduction in CO_2 emissions by 2050. Aviation is the first industry to have successfully agreed a sector-wide resolution to reduce its global emissions. This achievement should not be underestimated.

Ahead of Copenhagen, SA set out the position of the UK industry in supporting the principle of a global sectoral deal. Our manifesto document continues to be recognised as supporting a pragmatic approach to dealing with aviation at a global level and our support for ICAO's lead in this area was reinforced at the more successful Cancun summit in 2010.

SA Manifesto for Copenhagen

To support a global sectoral deal for aviation which must:

- be based on global targets for CO_2 emissions from aircraft, consistent with ICAO's recommendation
- be based on full and open emissions trading
- incentivise airlines to purchase sustainable low-carbon aviation fuels that offer net carbon reductions over their full life cycle
- look to establish an appropriate internationally-recognised life-cycle carbon model and sustainability standard for alternative fuels for aviation, as well as monitoring, reporting and verification procedures to be established to acknowledge the lower life-cycle carbon footprints of these fuels
- replace local, national and/or regional measures with a single, global framework, which will ensure that aviation emissions are accounted for only once, whether from domestic or international activities, with no duplicative measures
- require Governments to use the funds generated from a global cap and trade scheme to establish the right legal and fiscal frameworks to facilitate and increase investment in the research and development of new technology and designs for aircraft and aircraft engines, development of low carbon sustainable alternative fuels, and improvements in airspace management
- ensure that any revenues from economic measures are clearly earmarked for environmental purposes
- give ICAO a clear mandate and timetable for developing and implementing the detail of such an approach

Download the full manifesto here:
www.sustainableaviation.co.uk/information/sustainable-aviation-papers

UK target on aviation climate-related emissions

In December 2008, Sustainable Aviation published its first CO_2 Roadmap http://www.sustainableaviation.co.uk/sa-roadmap-2008/ setting out what the UK aviation industry believed was the future scenario of emissions from UK aviation to 2050. It showed that emissions were likely to start falling some time around 2020 and return to 2000 levels (or below) by 2050.

Following in-depth discussions with SA about the Roadmap, in January 2009 the UK Government set the UK aviation industry a target to reduce its emissions to 2005 levels by 2050. The CCC, an independent body of experts that advises the Government on making the transition to a low-carbon economy, was asked to assess whether the industry could meet the target.

Sustainable Aviation provided input to the CCC during the report's development. In December 2009, the CCC published its assessment suggesting that, based on "prudent" assumptions, air travel in the UK could grow by up to 60% while staying within the confines of the 2050 emissions target. You can download the full report at: www.theccc.org.uk

Sustainable Aviation welcomed the CCC's findings, while emphasising that the assumptions underpinning the CCC's report were more pessimistic than those used in our own Roadmap.

Aviation has a demonstrable and well-documented track record in improving its environmental performance and we are confident that the UK industry is at the forefront of developing solutions to ensure we can meet the 2050 target without the need for demand-growth to be artificially constrained.

The CCC has indicated its recommendations will be regularly reviewed against technological progress; and SA will continue to liaise with the CCC. The SA Roadmap is designed to evolve according to the latest data and forecasts available and we are confident it will continue to be fundamentally robust. We understand the Department for Transport will issue revised demand and CO_2 forecasts for air transport in 2011. We will review our Roadmap in light of the Government's forecasts.

Non-CO_2 impacts

Aviation produces several different emissions that have an impact on the climate, the most notable being carbon dioxide (CO_2). The main non-CO_2 impacts associated with aviation are related to oxides of nitrogen (NO_x), and condensation trails (contrails) leading to cirrus cloud formation. These impacts have been reviewed by SA. http://www.sustainableaviation.co.uk/nonco2paper/

There is a less mature understanding of the chemical and physical processes (and hence the resulting effect on climate) involved in these non-CO_2 impacts and there is currently no consensus on a metric that accounts for their very different lifetimes. As a result, there is still considerable uncertainty within the scientific community on how to account for their climate change effect.

Given this uncertainty around non-CO_2 emissions, SA believes that the impacts of non-CO_2 emissions should be addressed separately from CO_2 and on an individual basis, rather than being expressed and treated as equivalent CO_2 emissions.

Interdependencies

While the national and international environmental agenda is focused primarily on climate change, the local environment agenda for aviation is driven largely by noise and local air quality impacts.

SA has published a paper detailing interdependencies between aviation's emissions of CO_2, NO_x and noise, focussing on technological, operational and regulatory issues. The paper presented a largely qualitative view in order to raise awareness of these interdependencies and their implications for regulatory decisions. For example, the overall noise, carbon dioxide and NO_x footprint of arrivals depends on routes taken to approach airports, which are of concern to stakeholders, such as local communities, as well as SA sectors.

The report describes situations in which measures to reduce noise can increase fuel-burn, and circumstances in which measures to reduce fuel-burn may present challenges to meeting noise and NO_x regulations. We also identify several operational techniques with the potential to reduce noise, NO_x and/or CO_2 emissions with no trade-offs, and describe progress made so far towards their characterisation or implementation.

Source: NATS

Acknowledging the complex nature of these interdependencies, the paper calls upon policymakers and regulators to engage with the industry to ensure adequate quantitative understanding of the interdependencies applying to specific policy proposals, in order to avoid policy decisions that lead to unintended environmental outcomes. We acknowledge support from the UK Government representative at ICAO for the need to consider fuel burn implications which would result from a new noise standard. You can download the paper here: http://www.sustainableaviation.co.uk/wp-content/uploads/sa-inter-dependencies-sep-2010.pdf

Reducing Carbon Emissions

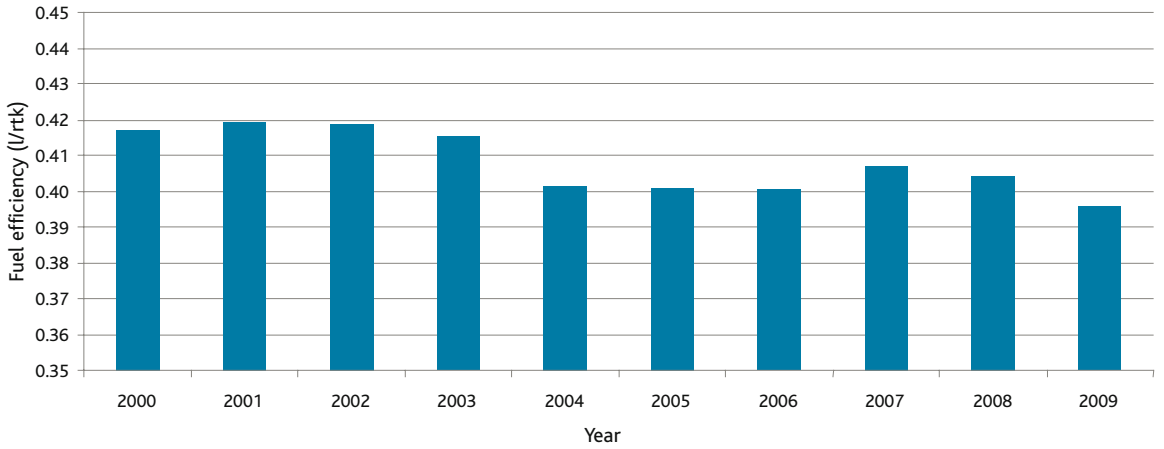
Aviation is one of the leading UK industries and SA provides a focus for co-operation between sectors on efforts to reduce carbon emissions including technology, sustainable alternative fuels, and improvements in operations and procedures. Our work in these areas is directed towards supporting the conclusion of our 2008 Roadmap that CO_2 emissions from UK aviation can return to their 2000 levels by 2050.

Sustainable Aviation believes that the aviation industry should aim to reduce its actual carbon emissions through:

- technology
- sustainable alternative fuels
- operational improvements including air traffic management with additional policy measures to further incentivise these developments only if necessary

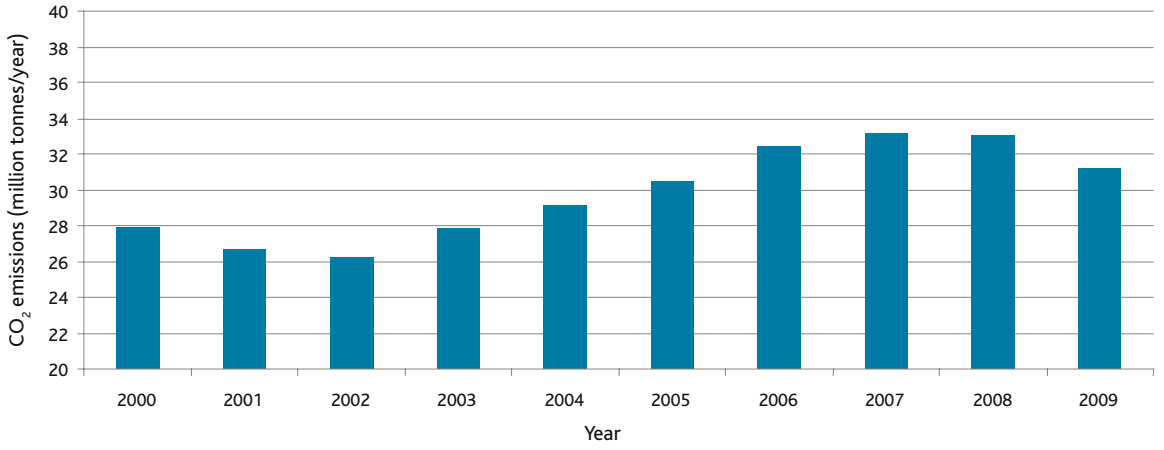
This three-way approach to reducing carbon emissions from aviation is having a direct impact on UK aviation. Overall, 2009 showed almost a 3% improvement in fuel efficiency compared to 2007 and around 5% since 2000. While overall emissions of CO_2 have grown since 2000, there has been a reduction of about 6% in aggregated SA airline CO_2 emissions over the 2007-2009 period.

SA airlines' aggregate fuel efficiency



Source: BATA

SA airlines' aggregate CO_2 emissions



Source: BATA

The improvement in fuel efficiency has been achieved through a combination of factors, including the retirement of older aircraft from the UK fleet. One notable contribution has been the success achieved by airlines in filling their aircraft. Load factors have been consistently high for many years, but in 2009, for the first time, UK airlines reached an aggregate load factor of over 80% (averaged across all flights). A significant part of the reduction in total emissions was due to the impact of the recession, which is difficult to separate from other factors.

Technology

UK aerospace companies are committed to achieving the challenging targets set for the industry by ACARE, which has a 2020 target for a 50% cut in CO_2 emissions per passenger kilometre, compared with equivalent new aircraft entering service in 2000.

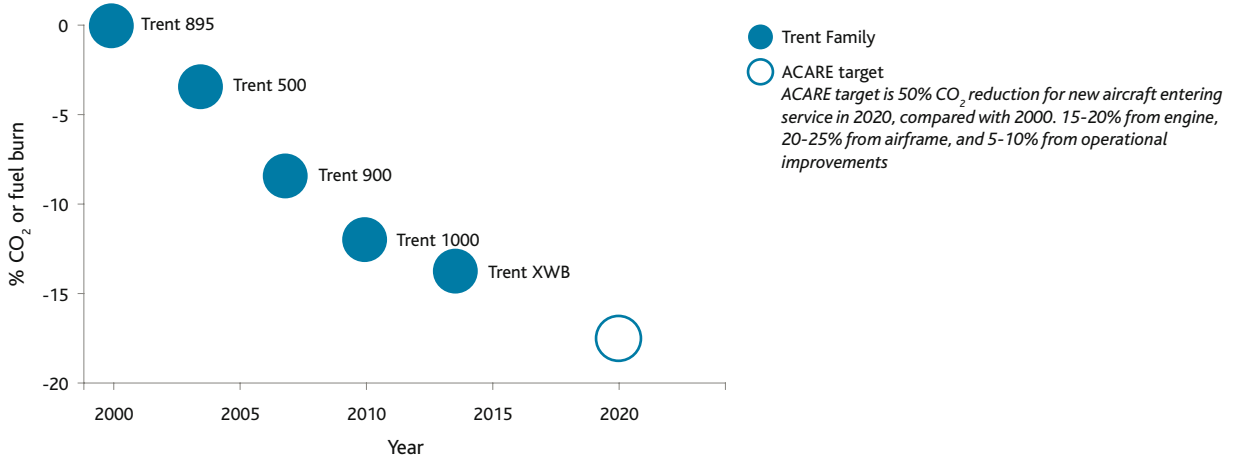
As well as the improvements being shown by the latest aircraft and engines to enter service (see below), the UK aerospace manufacturing industry has invested heavily in major research programmes, such as the National Composites Centre set up with additional financial help from the UK Government. These will be crucial in pushing onwards to meet and exceed the current ACARE targets. Several ongoing programmes are supported and/or managed through the UK Technology Strategy Board (see for example, http://www.rolls-royce.com/technology_innovation/research_programmes/gas_turbine_programmes/siloet.jsp).

The UK based Industry also plays a major role in several European Union "Framework" research programmes. One substantial programme "Clean Sky" http://www.cleansky.eu/ has become operational in the past year with the objective of developing demonstrators for advanced engine, airframe and system technologies all aimed at step change improvement in the environmental impact of civil transport aircraft. This of course is where the UK industry can have a major impact on global emissions as well as improving the competitiveness of its products and its contribution to the UK economy. The continuing partnership between industry and the European and UK Governments is absolutely crucial in ensuring acceptable affordability of these and future major programmes.

Engines. Steady progress continues to be made in improving the efficiency of successive generations of engines:

- The Rolls-Royce Trent 1000 engine, due to enter service in 2011 on the Boeing 787, will be some 12 per cent more fuel efficient than the Trent 895. British Airways (BA) and Virgin Atlantic have ordered a number of these aircraft. The Trent XWB engine, due to enter service in 2013 on the Airbus A350 XWB, will be more than 15% more efficient than the first member of the Trent family, which entered service in 1995.
- Rolls-Royce continues to make progress in developing its open-rotor concept, which is expected to offer an improvement in fuel burn of up to 30% compared with equivalent aircraft flying today, whilst offering a reduction in NO_x emissions and noise.

Reducing carbon emissions through improvements in engine fuel-efficiency



Source: Rolls-Royce

Airframes. The UK is an acknowledged "Centre of Excellence" for wing design and manufacture and thus makes a substantial contribution to the continuing improvement in the environmental performance of all Airbus aircraft. As a major supplier to both Boeing and Airbus, in the last two years GKN (a global aerospace company) has made substantial investment in new plant and technologies for the production of light weight carbon fibre major components and subassemblies. The new Bombardier CSeries aircraft is to be produced from 2011 in Belfast using an innovative composites process. At £520 million, this is the largest ever single investment in Northern Ireland and will cement the wider industry interests in aircraft wing technology in the UK.

Composite materials, used relatively little 40 years ago, are now widespread. Modern airframes benefit from a high-level of manufacturing expertise in incorporating composite material into aircraft; expertise that has been built up over many years. Some 25% of the A380, of which a number have been ordered by BA, is built using advanced lightweight composite materials; this, plus many other innovative technologies, results in the A380 having a very low fuel-burn of less than 3 litres per passenger per 100 kilometres.

Innovations such as advanced wingtip devices build on existing technology to help reduce emissions further. Airbus' next step is the large Sharklets™ wingtip devices, representing the latest element in an ongoing continuous improvement programme for its A320 Family, which will be flown by Thomas Cook Airlines. Sharklets are expected to reduce fuel burn over long sectors by at least 3.5 per cent, representing an annual CO_2 reduction of approximately 700 tonnes per aircraft.

Cabin. Airlines are working with manufacturers to minimise cabin weight, to help reduce fuel burn and carbon emissions. A new galley concept, SPICE (SPace Innovative Catering Equipment), developed by Airbus, allows airlines to save up to one tonne of weight on a single wide-bodied aircraft. Tests have shown SPICE is a viable concept, likely to lead to the first new galley standard in over 40 years.

Sustainable alternative fuels

SA published a report in the summer of 2010 setting out the progress made in the field of sustainable alternative fuels http://www.sustainableaviation.co.uk/sa-fuels-progress-report-2010/

In the past four years, there have been several successful demonstration flights using blended fuels and it has been shown that certification standards can be achieved. However, the extent to which the full potential of these alternative fuels can be realised is still unclear. Key issues include sustainability criteria and availability of adequate land and/or marine space (see box for further details). For the time being, SA holds to its view that such fuel blends will reach the SA fleet starting in 2020 leading to full deployment in 2030, at which point a 10% life-cycle carbon-saving, relative to 100% kerosene, will be realised. We will evaluate this position as we update our Roadmap over the next reporting period.

The CCC has concluded that, subject to further assessment, "likely" penetration of alternative fuels, allowing for life-cycle aspects in the same way as in the SA Roadmap assumptions, would be below 2% by 2030 and 10% by 2050. They noted that, as the result of limited information, they had to assume a pessimistic view of the penetration of alternative fuels. This is an exciting and rapidly developing area and SA members are involved in a number of current initiatives including the potential generation of fuel from household waste.

SA signatories continue to work at the international level to inform the safety certification, sustainability benchmarking and commercialisation of alternative fuels for aviation. The Sustainable Use of Renewable Fuels (SURF) consortium was formed in Autumn 2010 by a group of SA signatories and Cranfield University. Its purpose is to address major considerations for the successful use of fuels from a renewable source like microalgae.

Sustainability standards for alternative fuels

SA has made it clear that sustainable fuels must meet at least the following requirements:

1. Meet or exceed existing international jet fuel standard specifications
2. Have a significantly lower life-cycle carbon footprint than conventional jet fuel
3. Do not cause deforestation or the loss of high-value ecosystems
4. Do not compete with food production for land or freshwater
5. Retain social and economic benefits in the communities in which they are produced
6. Have the potential to be produced at a sufficient scale to generate a material reduction in global and UK aviation's life-cycle greenhouse gas emissions on a carbon-equivalent basis (i.e. taking into account emissions of other Kyoto gases)

Operational improvements

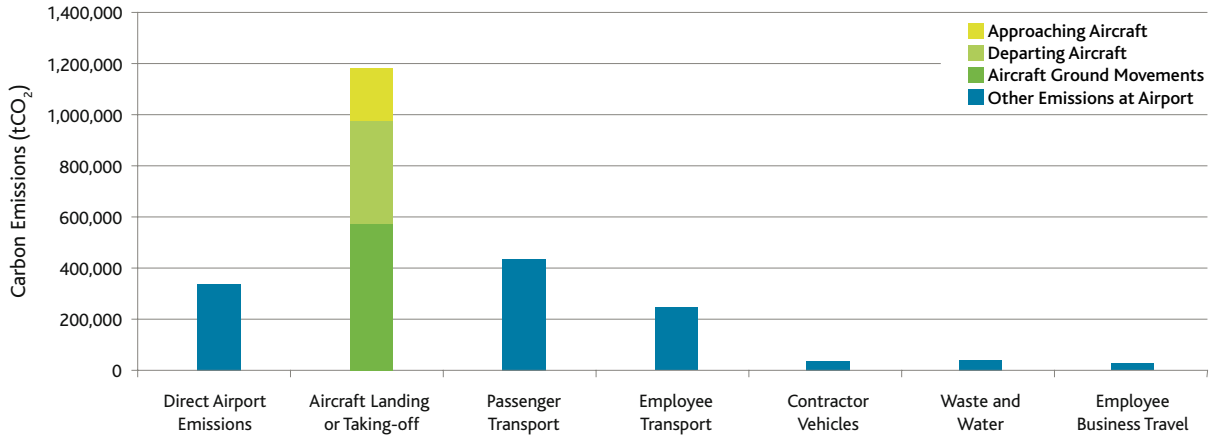
Following feedback from the Stakeholder Panel, SA set up an Operational Improvements Group to deliver more tangible environmental benefits from SA activity.

Two years on, significant progress has been made. Information sharing, co-operation and partnership have delivered several high-profile initiatives, some with demonstrable environmental benefits and others raising awareness and setting the platform for future improvements in environmental efficiency.

Aircraft on the Ground CO_2 Reduction Programme. The Aircraft on the Ground CO_2 Reduction (AGR) Programme was launched in June 2010, following two years of collaborative work between SA signatories led by Heathrow Airport with the input of the Clinton Climate Initiative http://www.aoa.org.uk/documents/Aircraft%20on%20the%20Ground%20.pdf

The programme offers practical guidelines to airports working with partners to cut aircraft ground movement CO_2 emissions and improve local air quality. It captures best practice across the industry today with potential for greater efficiency improvements in the future.

Overall airport CO_2 emissions compared with emissions from aircraft at an airport (Heathrow, 2009)



Source: AOA

Member airports that have signed up to the programme include BAA (Heathrow, Stansted, Edinburgh, Glasgow, Aberdeen, Southampton), Gatwick, Manchester Airports Group (MAG - Manchester, Bournemouth, East Midlands, Humberside), Luton, Birmingham, Bristol, Newcastle, Belfast City, Infratil (Glasgow Prestwick and Kent International) and Blackpool.

Among the initiatives outlined are reduced engine taxiing, and the use of fixed electrical ground power and pre-conditioned air rather than running auxiliary power units on stationary aircraft. It is estimated that the overall current savings for ground based aircraft activity at Heathrow are of the order of 100,000 tonnes of CO_2 per year against a notional "do-nothing" scenario. SA airports are working with their aviation partners including SA airlines to reduce CO_2 emissions at airports.

So far 23 airports across the country have joined the programme, representing 70% of all passenger traffic in the UK. Participating airports will work together with industry partners, including SA members to monitor and report on progress to the Airport Operators Association (AOA). The results from these airport progress reports will be compiled and presented by the AOA within the Sustainable Aviation progress report every two years.

Some SA airports have achieved accreditation to the Airports Council International Carbon Management Programme. A number of SA signatory airports have achieved the Carbon Trust Standard for carbon management. For example, Gatwick airport is working with SA partners NATS, Virgin, BA, TUI, and easyJet to achieve the related carbon reduction target.

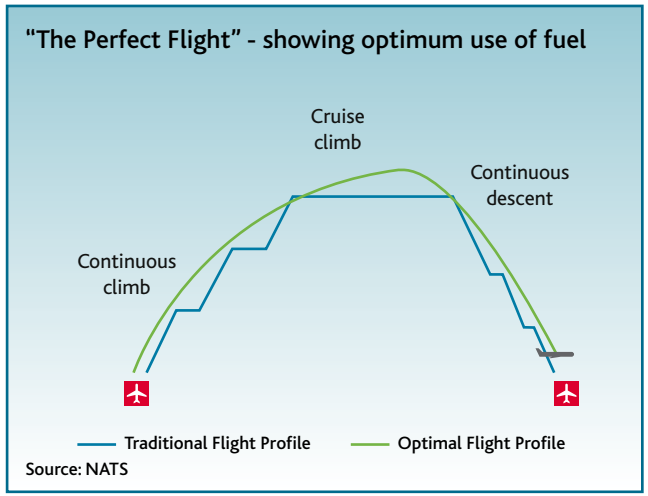
The Controller-Pilot Environment Forum. In October 2009, NATS hosted a Controller-Pilot Environment Forum drawing heavily on the contacts and relationships built through SA to engage nine UK airlines, three airports, the military and Air Traffic Management (ATM). The aim was to bring controllers and pilots together to:

- Discuss environmental efficiency and improve understanding
- Share examples of current best practice and future opportunities
- Establish environmentally-efficient operating principles

As a result of the event, immediate guidance was issued to Air Traffic Controllers advising of the potential fuel and emissions saving benefits of slower speeds (up to 100kg fuel, 320 kg CO_2, per aircraft by flying economic descent speeds). This has informed operational practice and led to better ATM/pilot interaction to manage descent speeds, saving fuel and reducing emissions.

NATS has also launched a study to explore opportunities for more formalised speed control, working through the SA Operational Improvements Group, which includes Thomas Cook and others.

Towards "The Perfect Flight". The principles discussed at the Controller-Pilot Workshop also gave rise to the "Perfect Flight" initiative captured in a DVD: http://www.youtube.com/watch?v=UbuBtSY3MUs&feature=player_embedded which promotes environmental best practice in UK aviation. Produced by NATS for SA, the film is designed to help those involved in aircraft operations understand how a fuel-optimum flight profile can be achieved.



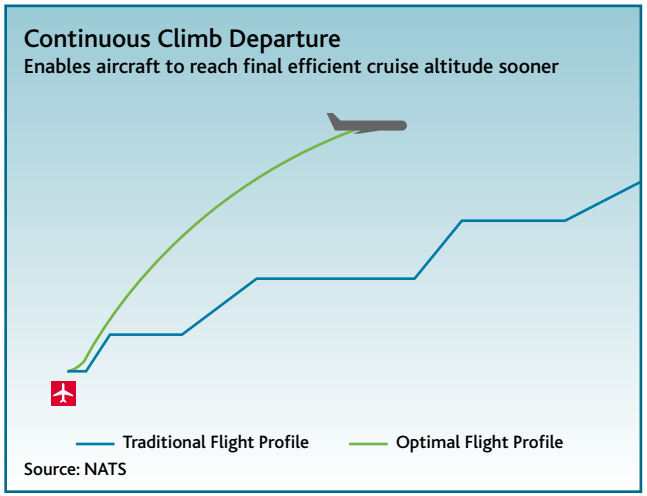
It sets out a three-stage plan:

- From today – improve flight planning and route availability to favour the most fuel-efficient routes and altitudes, and economic flying speeds.
- By 2015 – improved air traffic control procedures, such as arrivals management, and new tools, such as Collaborative Decision Making, will see airborne holding reduced, better management of airport ground operations and airlines gaining more access to preferred routes and optimum flight levels.
- By 2020 – airspace changes will enable Continuous Climb Departures and Continuous Descent Approaches, or tailored arrivals, delivering aircraft closer to their fuel optimum profile or "The Perfect Flight".

The film has been distributed and viewed widely across SA airlines, airports and in NATS, prompting discussion on how we deliver the principles of the "The Perfect Flight" in day to day operations.

"The Perfect Flight" live trial. The concept of "The Perfect Flight" was tested in July 2010 when NATS, BA and BAA collaborated to deliver a fuel optimum flight profile on a live flight from Heathrow to Edinburgh. Every factor within the journey – from pushback from the stand and taxiing to an optimised flight profile and Continuous Descent Approach – was calibrated to achieve minimal emissions and delay. Data from the flight demonstrated that fuel savings of around 350kg and one tonne of CO_2 (about 11%) were achieved compared to the average for flights of the aircraft type involved between these two airports.

The Sustainable Aviation Operational Improvements Group is learning from the results of the first "Perfect Flight" and looking at opportunities to develop the concept further. Involvement of other SA signatory airlines on European and Transatlantic routes are likely to be the next steps.



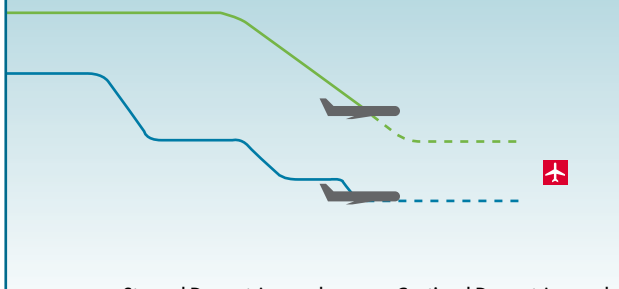
Continuous Climb Departure (CCD). BA flight data from a Boeing 747 showed that on the same departure route from Heathrow, the best climb profile used 1.5 tonnes more fuel than the worst climb profile. A continuous climb departure for a long-haul B747 can therefore save up to 1.5 tonnes of fuel (the difference between the best and worst cases above) and up to 4.5 tonnes CO_2.

NATS has built on the BA data and its own emissions model to estimate the potential savings for improving climb profiles in the London and Manchester terminal areas and demonstrated that, potentially, very large fuel and emissions savings can be made.

The challenge is that complex, costly and lengthy airspace changes are normally required to achieve improvements in climb profiles so there is no quick fix. Further requirements for airspace developments such as ensuring safe separation of aircraft and maintaining or increasing capacity can make the delivery of continuous climb and descent profiles more challenging.

The learning from this work has already been built into NATS' future airspace design objectives where the principle of Continuous Climb Departures is now well established. NATS and the SA Operational Improvements Group are, however, also looking for opportunities to increase the opportunities for Continuous Climb Departures in the short term.

Reducing noise using Continuous Descent Approach

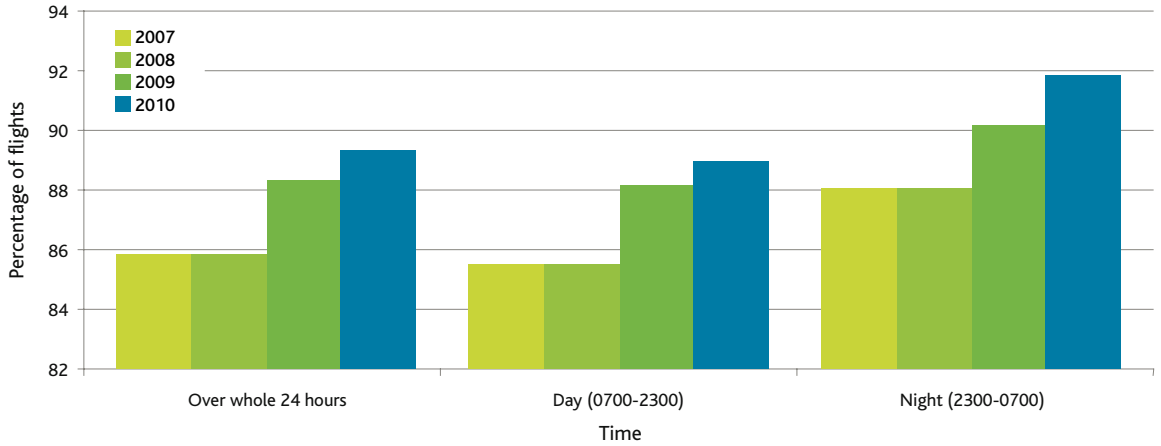


Source: NATS

Continuous Descent Approach (CDA). CDA brings aircraft in to land more quietly by removing stepped descent and the engine noise associated with the increased thrust required for level flight. The use of CDA by airlines using London airports increased following the issue in 2006 of the Arrivals Code of Practice, developed by SA members and compliance for H24 (the 24 hour operational period) now sits at 89% (see chart). CDAs are also being achieved at other UK airports, many with equally good success rates. Aircraft arriving into East Midlands Airport, for example, achieve 87% CDA compliance for H24. Air navigation service providers such as NATS, airlines, and airports are also targeting improvements to current performance at other airports.

Steeper approaches. The SA Operational Improvements Group is supporting work to help determine the theoretical noise benefits of steeper approaches. BA is leading this work, planning simulator trials to assess the potential noise benefits on gradients between 3.0 and 3.5 degrees at 0.1 degree increments. Aircraft handling and energy management issues will also be assessed. The output from the trials will be analysed by Airbus to determine the effect on noise including consideration of the impact on delayed landing gear or reduced landing flap options as this may dilute or negate any benefits of the steeper approach.

Aircraft meeting targets to descend continuously when landing at Heathrow, Gatwick and Stansted (%)

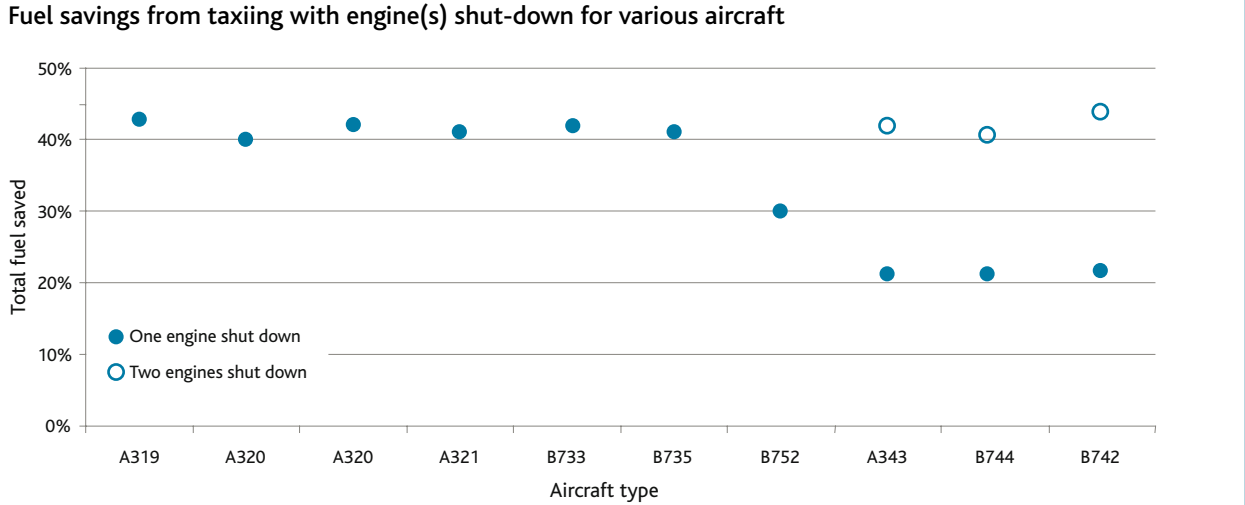


Source: NATS

Steeper approaches remain a complex issue with many safety and regulatory, as well as environmental, considerations to be properly investigated. Following the BA and Airbus simulator trials, SA will review the results with a view to adopting a position on whether we believe there are noise benefits in steeper approaches. Further research in other areas will need to be picked up by relevant bodies outwith SA.

Departures Code of Practice. The existing Arrivals Code of Practice was published by the Department for Transport in 2006, and developed by SA members. It is now an internationally regarded reference text on Continuous Descent Approaches.

Building on this work, the SA Operational Improvement Group has participated in developing a Code of Practice for Departures, due to be published in 2011. It is designed to highlight best practice to airports, airlines, ATM and ground operations, and will bring benefits in terms of noise, CO_2 and NO_x reductions.



Significant fuel reductions have been demonstrated for aircraft taxiing with one, or two, engines shut down. Data for different aircraft types A, Airbus; B, Boeing.

The final Departures Code of Practice will have four areas of focus:

1. Taxiing
2. Continuous Climb Departure
3. Fixed Electrical Ground Power / Pre Conditioned Air (Ground Operations)
4. Collaborative Decision Making

Interim papers have already been published, including Reduced Engine Taxiing in September 2009 and Ground Operations in December 2009.
http://www.sustainableaviation.co.uk/interim-ground-operations/

http://www.sustainableaviation.co.uk/interim-ground-operations-final/

Noise

Aircraft noise is inevitably an issue for people living close to airports. Good progress is being made towards the ACARE target of reducing perceived external noise by 50% by 2020. This is complemented by work at individual airports on Noise Action Plans.

Noise action plans. While SA itself is not looking at noise mitigation schemes as a specific workstream, airport SA signatories have each developed a Noise Action Plan (NAP), in response to the regulatory requirements of the Environmental Noise Directive (END). NAPs look at the noise environment around each airport and set out how the airport operator will work with stakeholders to help manage noise impacts. Where appropriate, the NAP will include mitigation measures such as noise insulation or double-glazing schemes, and apply in the most directly affected areas around the airports.

Draft NAPs have now been submitted to the Department for Transport, and the Department for Environment, Food and Rural Affairs (DEFRA) for approval and once adopted will be reviewed every five years.

SA continues to support ICAO's balanced approach to aircraft noise management. In years to come, strategy on noise mitigation in the UK will be shaped by revisions to the END that shapes much of Europe's and the UK's broader approach to airport noise mitigation.

The European Commission has confirmed that revisions will be made in 2011.

Technology

The ACARE target is to reduce perceived external noise by 50% by 2020 compared to the equivalent new aircraft in 2000 through a combination of new technology and improvements in operational procedures.

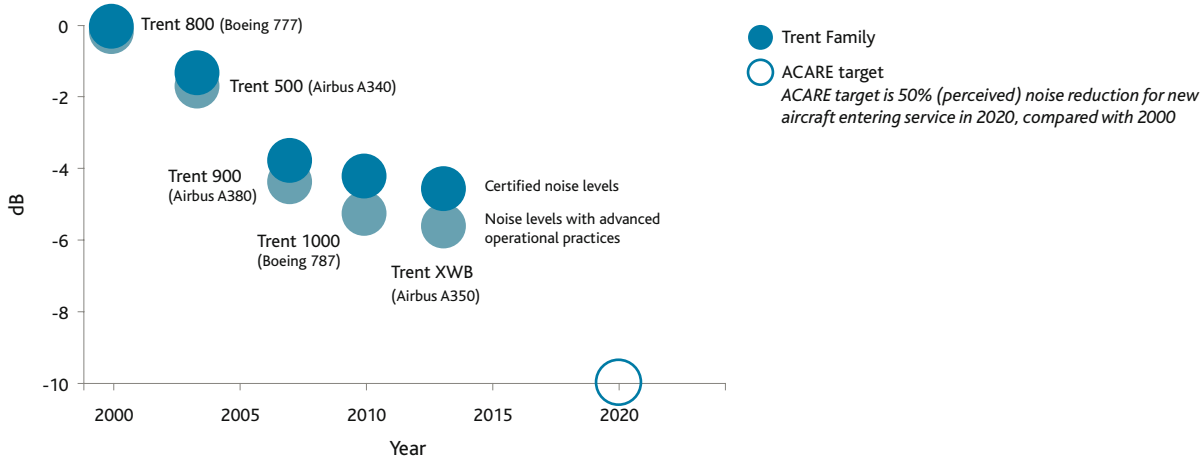
Aircraft and engine manufacturers are continuing to research and deliver new quieter designs. Examples include:

- The introduction of new innovations on wing devices (flaps, slats and spoilers).
- The new Bombardier CSeries aircraft (due to enter service in 2013) will fly considerably more quietly than current in-production aircraft of a similar size.
- Rolls-Royce continues to invest heavily in collaborative noise research research programmes in the UK, Germany, the US and the EU, which have demonstrated that the noise of Open Rotors can be significantly reduced.

Operational improvements

Much of the work undertaken by the Operational Improvements work stream delivers benefits in terms of noise mitigation as well as emissions. See the section on "Reducing Carbon Emissions" for details.

Reducing aircraft noise through engine technology and operational practices



Source: Rolls-Royce

Air Quality

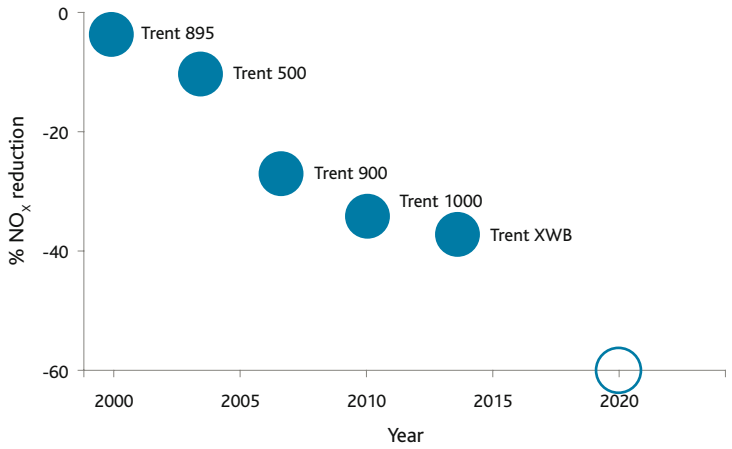
Air quality, largely related to concentrations of nitrogen dioxide (NO_2- a component of NO_x), is a matter of concern at some UK airports. While road traffic is generally the major source, progress is being made in reducing emissions from aircraft and in understanding the relative contributions from other airport sources as well as those from road traffic close to airports.

Technology

ACARE has set a target of an 80% reduction in NO_x emissions by 2020, based on new aircraft of 2020 relative to equivalent new aircraft in 2000. Good progress continues to be made towards the ACARE target. For example, the new Bombardier CSeries aircraft (due to enter service in 2013) will emit up to 50% less NO_x than current in-production aircraft of similar size.

Through detailed design optimisation, NO_x emissions have been steadily reduced on successive generations of Rolls-Royce Trent engines. The Trent 900 has the lowest certificated NO_x level of any large engine in-service and the Trent 1000 NO_x level will be even lower. Ultra-low NO_x 'lean burn' combustion system technology has been carefully developed and matured over a number of years. Lean burn combustion technology will be made available for the next generation of Rolls-Royce gas turbines. With these innovations, we are on track to meet the ACARE 2020 goal.

Reducing NO_x emissions through engine technology and operational improvements



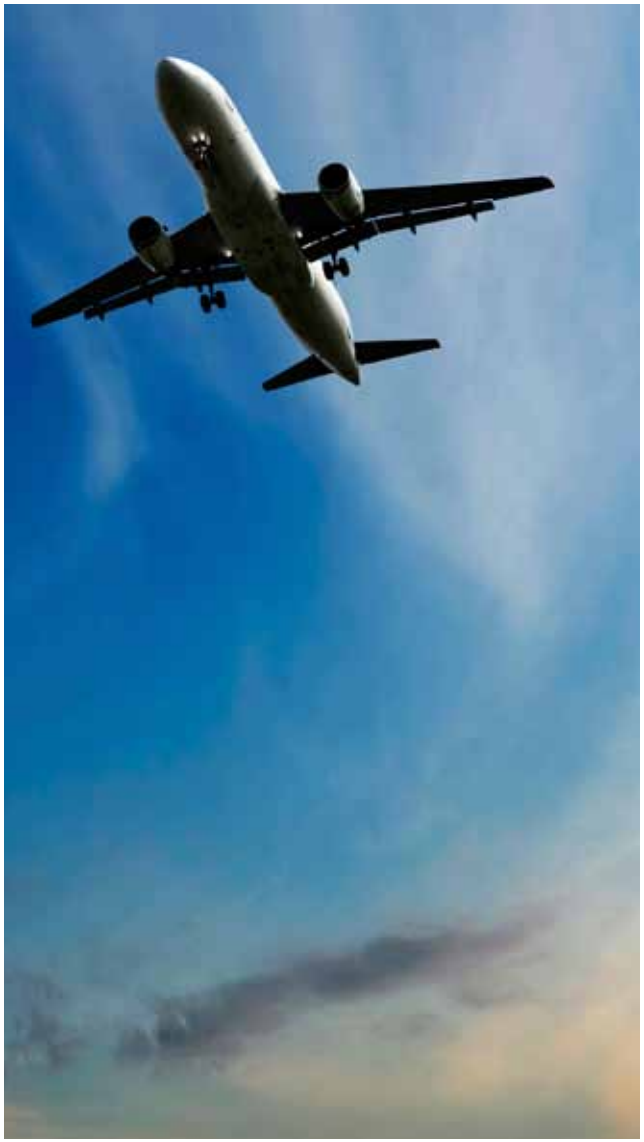
Source: Rolls-Royce

Operational improvements

In our 2009 progress report, SA committed to assessing the opportunities for NO_x reductions through airside operational efficiencies. Many of the operational improvements outlined in the carbon and noise sections also result in improvements in air quality, although trade-offs do exist as noted in the SA "Interdependencies" paper. Individual airports report on NO_2 issues in their local areas http://www.sustainableaviation.co.uk/wp-content/uploads/sa-inter-dependencies-sep-2010.pdf

The impact on UK, as well as much of European, airspace of the eruption of the Eyjafjallajokull volcano in Iceland in May 2010, provided a rare opportunity to assess the air quality around airports when there were no aircraft flying.

The area around Heathrow airport was well placed for this study as there is already a large concentration of air quality monitors measuring NO_x and NO_2 in the vicinity. Interestingly, initial analysis suggests that while there were some reductions in levels at some monitors, these were not significant; especially as measurements were further complicated by changing wind directions and other sources.



A number of groups are carrying out European-wide analyses of the effects of the absence of air traffic, to investigate how air quality around airports changed. SA is keeping abreast of these and intends to use them to inform our own air quality work over the coming years.

In addition, SA members have been working with academia to investigate the impacts of ultra-fine particulate matter below 10µm (10 micrometers) in diameter, arising from sources other than aircraft engines such as tyres, brakes and runway erosion. Results will be reported as they become available.

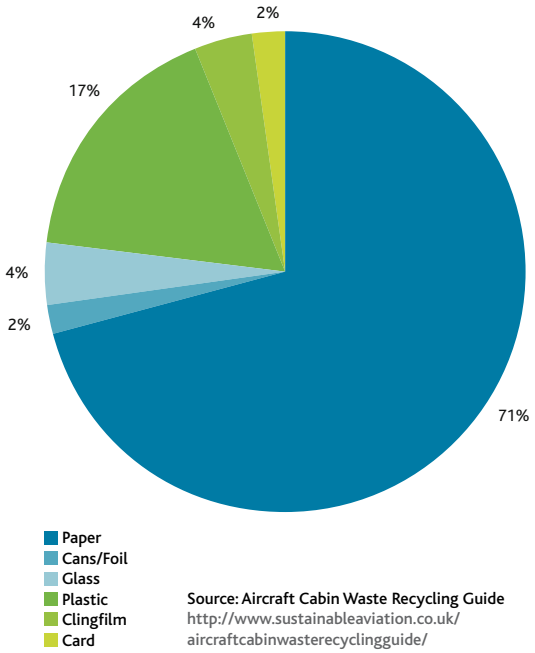
Waste

Work by SA signatories and service partners has indicated opportunities for improving waste management. This will require co-operation from a range of stakeholders, including Government for some waste streams.

Cabin waste recycling

Audits of on-board waste have shown a high proportion of recyclable material, in particular newspapers and magazines. Over half of all aircraft cabin cleaning waste could potentially be recycled. Recycling is increasingly part of many airlines' and airports' company policy and is expected by passengers.

Typical composition of recyclable aircraft cabin waste (% content by weight)



Source: Aircraft Cabin Waste Recycling Guide
http://www.sustainableaviation.co.uk/aircraftcabinwasterecyclingguide/

The 'Aircraft Cabin Waste Recycling Guide' was published in January 2010 with input from SA airports and airlines, as well as some service partners, and on-board recycling has now been implemented by several SA member airlines.

The SA Waste Working Group is continuing to address issues such as inclusion of environmental considerations in product specification, cleaning contracts, issues around disposal of food waste and sharing best practice on recycling. The group also aims to introduce data collection on disposal of different waste types.

During 2011 discussions will take place with DEFRA on ways in which to optimise recovery and recycling of aircraft Category 1 waste (essentially food waste arising from international flights), much of which is currently sent to landfill or incinerated in order to comply with existing regulations.

SA work in this area is complemented by the work of airports with airlines to reduce water use at airports and by the separate initiative on converting household waste to aircraft fuel, outlined above. SA member airports have also been looking, with industry partners, at ways to reduce the amounts of waste they generate through development and operational activity.

Next Steps

The SA Council accepts that sustainability is a long-term issue. Our goals are set with this in mind and full achievement is likely to take a significant period, probably measured in decades rather than years. This is in line with the time scale of the objectives set by the ICAO, IATA and ACARE. Thus our two-yearly work programme concentrates on areas where SA believes there is a priority and that, through working together, SA can make a difference.

We anticipate that we will update our briefing paper on alternative fuels and continue to investigate the potential of technology, operations, market mechanisms and alternative fuels to reduce our net CO_2 emissions. Work in these areas and on others including noise and local air quality, will also continue in the programmes of relevant SA signatories. We will take account of the updated ACARE vision, due to be published around the same time as this report, as well as work in ICAO, including progress towards a CO_2 standard for aircraft and the CCC work on carbon budgets.

SA will continue, in conjunction with the Stakeholder Panel, to identify areas where improvements can be made and to construct relevant future work plans.

Specific areas on which we will focus for 2011/12 include:

Climate change – Roadmap. The Roadmap reflects the SA view of UK aviation's CO_2 emissions trajectory, given the Government's predictions of growth in demand. Our first Roadmap was published in 2008. Revised demand-growth projections will be published by the Government later in 2011, enabling SA to review the contributions to medium and long term reductions in CO_2 emissions from UK aviation.

Non-CO_2 impacts of aviation on the climate. SA will work with other stakeholders to establish: agreement between academia, Government and industry on current gaps in understanding; priorities on how to address these; and a broad framework for progression. SA will participate, in June, in a workshop hosted by Professor Piers Forster, a member of our Stakeholder Panel, which will provide an impetus for this work.

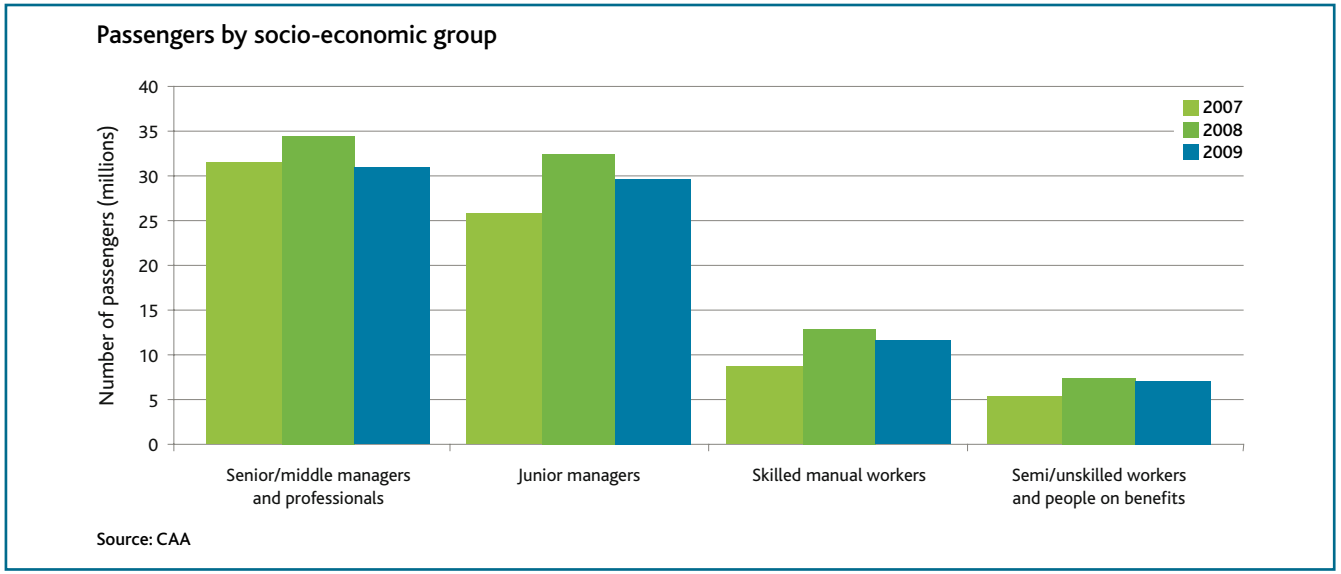
Operational improvements. The programme over the coming year will include:

- Opportunities for a follow-up to the "The Perfect Flight" live trial, to include other airlines, airports and neighbouring air traffic authorities.
- Promoting the fuel and emissions saving benefits of reduced engine taxiing and encouraging wider uptake where possible.
- Building more understanding of the benefits of Continuous Climb Departures and looking for opportunities for short term improvements.
- Conducting simulator trials to determine potential noise effects of steeper approaches and understand impacts on aircraft stability and energy management options.
- Contributing the SA element to the Departures Code of Practice.
- Investigating options to promote wider use of economic descent speeds.

Waste. The drive will continue to improve participation of airlines (in particular those not based in the UK) and service partners. Difficulties in recovery and recycling of relevant waste include the number of steps and groups involved. One key area is Category 1 international waste, contamination of which with food leads to a regulatory requirement to incinerate or bury in sealed landfill. SA will continue to investigate possible ways by which to resolve these difficulties. Relevant contacts have been made with DEFRA and discussions will take place on possible ways forward during 2011.

Social and economic value of the industry. At the end of 2010, Council agreed to initiate work on the social and economic impacts of the industry during 2011. An initial survey of expertise within SA signatories will be carried out leading to a programme which could include: impact on local communities around airports and other workplaces; economic research; social impacts relating to travel by different categories of passenger and of non-passenger traffic. Data collected by the CAA for passengers terminating their journey in the UK indicates a small broadening in the access of different social groups to aviation.

Sustainable Aviation has made a significant, evidence based contribution to improving the environmental performance of our industry and will continue to seek ways in which the industry, by working together, can encourage this improving trend. We will also maintain efforts to seek wider consensus on ways to address the challenges which face the sustainable growth of our industry to ensure that policy decisions acknowledge the need for a strong and successful UK aviation industry.



Aggregate data for all passengers arriving at Aberdeen, Durham Tees Valley, Edinburgh, Gatwick, Glasgow, Heathrow, Inverness, Luton, Manchester, Newcastle, Prestwick and Stansted.

Selected Glossary

ACARE	Advisory Council for Aeronautics Research in Europe
AOA	Airport Operators Association
ATM	Air Traffic Management
BATA	British Air Transport Association
CCC	Committee on Climate Change
CCD	Continuous Climb Departure
CDA	Continuous Descent Approach
Contrail	Condensation Trail
CO_2	Carbon Dioxide
EU ETS	European Emissions Trading Scheme
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
rtk	Revenue Tonne Kilometre (a unit of aircraft load)
SA	Sustainable Aviation