Airline Emissions of Carbon Dioxide

The opportunity for voluntary agreement

Executive summary

1. Three milestones have led to the production of options for voluntary agreements to curb aviation emissions: the 1994 report of the Royal Commission on Environmental Pollution; the 1997 Kyoto Protocol; and the 1999 report of the Intergovernmental Panel on Climate Change (para 2).

2. The IPCC report acknowledged that "aircraft being produced today are now about 70% more fuel efficient per passenger kilometer than 40 years ago. A 20% improvement in fuel efficiency is projected by 2015 and 40 to 50% improvement by 2050 relative to aircraft produced today." It referred to the fact that "Internationally, substantial research programs are in progress, with goals to reduce Landing and Take-off cycle NOx emissions by up to 70% from today's regulatory standards, while also improving engine fuel consumption by 8 to 10%, over the most recent production engines, by about 2010." The report concluded that aviation accounts for about 2% of man-made CO2 emissions but that it could contribute 4-15% of man made global warming by 2050, although the higher end projections were regarded by IPCC as "less plausible". The report admitted that it is difficult to separate impact of aviation CO2 from other CO2 emissions; that uncertainty over the impact of water vapour emissions "is particularly large"; and that there was "no direct observational evidence that aircraft (NOx) emissions have altered ozone". Only one of the nine aviation-related factors listed as contributing to climate change can be assessed with a good level of scientific understanding, according to IPCC. "Hence", as IPCC notes, "at the present time it is not possible to directly observe any specific contribution to global climate change from aircraft." (2)

3. The main areas with potential for improvement are operational measures, technology; and improvements in Air Traffic Control and Air Traffic Management systems. In terms of operational and technological changes, today's fleets consume only about half as much fuel per passenger mile today as they did 20 years ago. An airliner with 70% of seats occupied is more fuel-efficient than a train or a car carrying two people. Examples of improvements are improved navigation and flight planning equipment, better monitoring of fuel burn, and changes to climb and descent procedures. New engines have also reduced NOx emissions significantly (4)

4. It is through reduction in consumption per passenger mile that airlines will be able to contribute to achievement of emission control targets (5).

5. There are a number of manufacturing research programmes aiming at environmental improvements such as more efficient engines and power management. (6). However, in the short term (to 2010) the most noticeable contribution to policy objectives will be made by airlines. (7)

6. Regulation and market based options should be investigated through the International Civil Aviation Organisation and implemented on a global basis. (8)

7. It is not realistic to base policy on the premise that demand should be reduced. Such an objective would be unpopular; it would favour those, such as business travellers, who could afford higher fares; and it would be anticompetitive. (9)

8. A tax on aviation fuel would be an incentive to tanker fuel. A recent study for the European Commission showed that that a tax would deliver little environmental benefit unless applied in ways that would significantly distort competition and that an EU-only tax would threaten 20,000 jobs, cost airlines 200m ECU and cut CO2 emissions by only 0.3%. It would be perceived as a "holiday tax", in particular if applied over and above Air Passenger Duty. (14)

9. It is unlikely that a workable emissions trading system could be agreed and put in place for several years. It is therefore likely that an approach based on a voluntary agreement would be most likely to deliver environmental benefits in the short to medium term. (22)

10. There appear to be two routes forward for the UK: a purely voluntary agreement, either on the basis proposed by the Association of European Airlines (a target improvement in efficiency of 22.4% between 1990-2012) or by combining AEA factors such as fleet replacement and operational improvement with action by Governments, primarily in the area of ATC, to generate greater efficiencies; or a system linked to APD or to other incentives such as capital allowances and operating in a similar way to the Climate Change Levy - a significant reduction in APD (say 50-80%) could be available to airlines which commit and show progress towards stretching targets. (23)

11. We hope that Governments will commit to a target-based regime, including environmental targets, for ATC across Europe. The current debate over the future of NATS provides an opportunity to require NATS to operate on this basis in future. (23)

12. Any target set by airlines is clearly different from that proposed by the European automobile industry. The latter starts from an inefficient base line and offers only potential performance. (24)

13. Most airlines already have fleet replacement plans and will ask if credits will be given for prior, as well as future investment. Some cost benefit analysis should be done on the potential of reducing APD against costs of investment in new aircraft and the level at which an incentive would be effective. Ultimately, the most attractive system could be an agreed cap as a stretching target and the potential to trade out if the target is beaten and trade in if not. Such a system in the UK could use APD rebates as an incentive. (27)

Introduction

1. This paper reviews some of the options for limiting emissions from aircraft engine exhausts. Its main purpose is, however, to investigate the possibility of a Government-airline partnership and to this end, the issues are reviewed along with a summary of the possible approaches that have been identified to date.

2. There are three milestones within the last few years that have developed and highlighted consideration of aviation-generated emissions:

- 1994 The 18th report of the Royal Commission on Environmental Pollution. This was a commendable first attempt to define the issues involved. It has, to a large extent been superseded by the IPCC report below.
- 1997 The Kyoto Protocol. Although aviation was left out of the targets for emissions reductions established under the Kyoto Protocol, Ministers have made reference to the need to address aviation emissions against the background of Kyoto commitments (eg Michael Meacher's support for

taxation of aviation fuel: Environment, Transport and the Regions Select Committee, 19 May 1999) and the role of the International Civil Aviation Organisation in developing a response was clearly identified. Work is already in hand to establish what mechanisms may be applied and both industry and government representatives from the UK are involved in this work.

- 1999 The Intergovernmental Panel on Climate Change report Aviation and the Global Atmosphere. The report concluded that aviation presently (1992) accounts for about 2% of man-made CO2 emissions (13% of global transport) but that it could contribute 4-15% of man made global warming by 2050, although the higher end projections were regarded by IPCC as "less plausible". There remain great uncertainties in the effects, in particular of NOx and water vapour. The report admitted that it is difficult to separate impact of aviation CO2 from other CO2 emissions; that uncertainty over the impact of water vapour emissions "is particularly large"; and that there was "no direct observational evidence that aircraft (NOx) emissions have altered ozone". Only one of the nine aviation-related factors listed as contributing to climate change can be assessed with a good level of scientific understanding, according to IPCC. "Hence", as IPCC notes, "at the present time it is not possible to directly observe any specific contribution to global climate change from aircraft."
- The IPCC report acknowledged that "aircraft being produced today are now about 70% more fuel efficient per passenger kilometer than 40 years ago. A 20% improvement in fuel efficiency is projected by 2015 and 40 to 50% improvement by 2050 relative to aircraft produced today." It referred to the fact that "Internationally, substantial research programs are in progress, with goals to reduce Landing and Take-off cycle NOx emissions by up to 70% from today's regulatory standards, while also improving engine fuel consumption by 8 to 10%, over the most recent production engines, by about 2010." The report also identified the long working life of aircraft and that it takes considerable time for improvements to work their way in to the overall aircraft fleet.

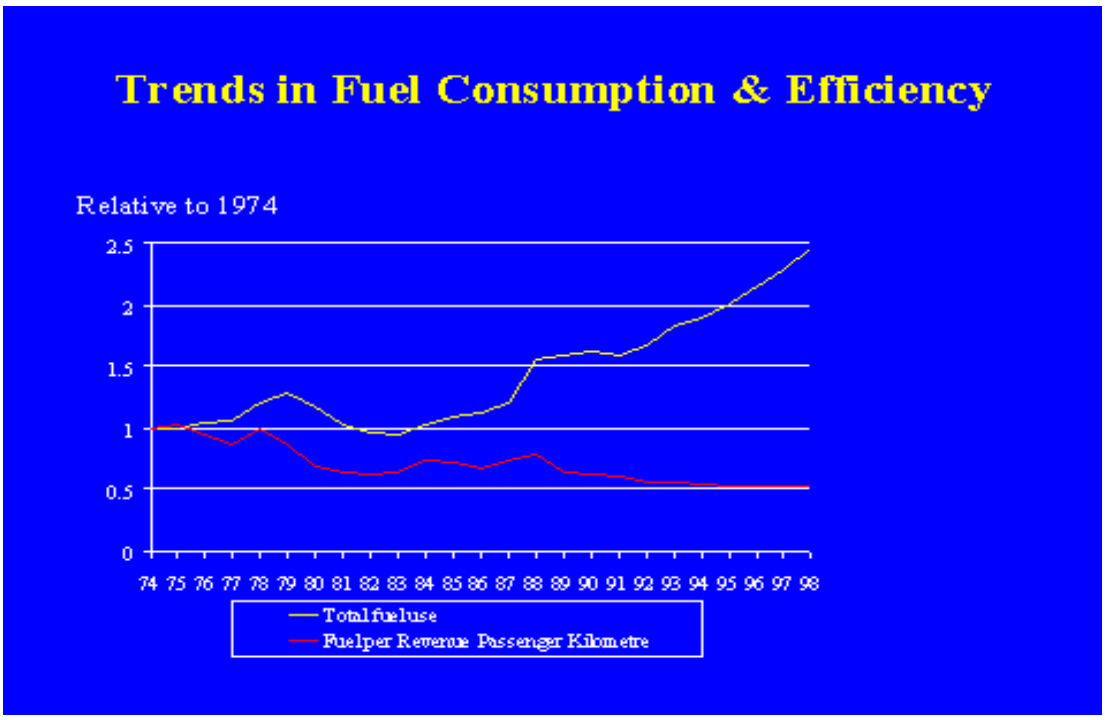
The airline sector's contribution

3. The main areas with potential for improvement are

- operational measures;
- technology;
- improvements in Air Traffic Control and Air Traffic Management systems.

The IPCC report acknowledges the improvements that have been made in aircraft fuel efficiency. Today's fleets consume only about half as much fuel per passenger mile today as they did 20 years ago. An airliner with 70% of seats occupied is more fuel-efficient than a train or a car carrying two people.

Figure 1



Source: British Airways

4. But the airlines have also contributed to improvements in environmental performance per flight:

- Improved navigation and flight planning equipment allows the shortest route and most fuel-efficient flying techniques to be followed
- New procedures reduce the time to top of climb, cutting fuel consumption and noise. New descent procedures, coupled with low power, low drag techniques, have also reduced consumption and noise
- Improved fuel burn monitoring
- Fuel-efficient aircraft have a higher residual value and airlines routinely specify that fleet purchase decisions will be influenced by consumption and the ability to meet anticipated environmental requirements. For example, the Rolls Royce engines specified on all British Airways 747-400 aircraft delivered after December 1998 deliver a reduction in NOx emissions of 40% during takeoff compared with the previous model. Most of the leading UK carriers already order state of the art airframes and engines in order to optimise efficiency.

5. Airlines have a commercial interest in reducing fuel burn through operational improvements and in working with manufacturers to optimise consumption. It is through a reduction in consumption per passenger mile that the airline sector will be able to contribute to achievement of the Government's and the IPCC's targets.

6. In the longer term, manufacturing improvements will play the greater part. As examples of work underway on environmental technology in this sector, we would cite

- DTI's CARAD (Civil Aircraft Research and Demonstration) Programme funding for the Advanced Low Pressure/Advanced Civil Core Demonstrator, which will enable Rolls-Royce to manufacture more fuel efficient and lower emission engines.

- The EC's Fifth Framework Programme has allocated Euro 700m to a Critical Technology Programme, one of the four elements of which is "Improving the Environmental Friendliness of Aircraft". Work will investigate low cost, lightweight primary structures; engine efficiency, and power optimised aircraft.
- Included within the £10m round of Foresight link awards announced in December 1998 was "Combustion Control for Aero Gas Turbines (CCAGT), a £1.5m joint activity between Rolls-Royce, Lucas Aerospace, Sheffield University and Cranfield University with the aim of developing fuel-control sensors to help reduce aircraft pollution.
- The Institution of Mechanical Engineers (2020 Vision, 1998) estimates that attainable manufacturing improvements included reductions of 10% and 14% in airframe weight and drag respectively which, combined with operational improvements, could cut the projected increase in energy demand over the next by 20 years by 40%.

7. However, it is realistic to assume that in the short term (to 2010) the most noticeable contribution to policy objectives will be made by airlines.

Options for limiting aviation emissions of carbon dioxide

8. It is a fundamental position of airlines that regulations and market based options should be investigated through ICAO and implemented on a global basis. In this paper these options are considered as background to the possible opportunity for an agreement on CO2 emissions between UK airlines and the UK Government.

9. People need to travel; and that need is unlikely to diminish. Given the very limited scope for substitution between air and surface transport modes, it is not realistic to base policy on the premise that demand should be reduced. Such an objective would be unpopular; it would favour those, such as business travellers, who could afford higher fares; and it would be anticompetitive. The central issue, as IPCC proposes, is whether there is a means of improving fuel burn technology and increasing operational efficiency over and above the substantial progress anticipated by IPCC.

10. Any proposal for a voluntary agreement has to be considered alongside other options, including the following:

- regulation;
- taxes;
- negotiated agreements;
- voluntary action;
- emissions trading.

11. To be effective such measures must:

- demonstrate clear environmental benefit;
- not distort competition;
- be based on scientific need and technological feasibility;
- use levies (taxes or charges) to mitigate the effect at which the levy is aimed.

Regulation

12. There is no indication of any current intention to regulate CO2 or other greenhouse gases from aviation by any direct means. For example, the possibility of setting standards for CO2 emissions has been discussed and rejected by ICAO, at least for the time being.

Taxes

13. Taxation options have been widely promoted by governments and NGOs as the primary means to control aviation emissions of greenhouse gases, in particular CO2. Aviation fuel taxes already exist in Japan at a significant level and in the USA at a lower level. Air Passenger Duty (APD) was introduced in the UK as a surrogate fuel tax, although it is poorly designed to achieve its environmental objective. It is current UK government policy to advocate a kerosene tax, but not at the domestic level. It is not current EU policy to advocate implementation of a European kerosene tax, although such a tax has not been ruled out in the future (and the recent Communication Air Transport and the Environment advocates a Eurocontrol-imposed Fuel Charge - effectively a tax). Local airlines in Norway have successfully challenged their government's tax on aviation fuel.

14. There are a number of reasons why a tax should not be implemented at the UK level. The arguments also apply to Europe and include the following:

- It would be an incentive to tanker fuel, in particular for aircraft scheduled to fly to UK/EU airports. This is not such an important factor in Japan or the USA.
- The recent Resources Analysis study for the European Commission (Analysis of the taxation of aircraft fuel, VII/C/4-33/97) indicated that a tax, effectively doubling the cost of fuel, would deliver little environmental benefit unless applied in ways that would significantly distort competition. The study concluded that for a 2005 scenario designed to minimise distortion of competition an intra-European tax doubling the price of aviation fuel would threaten 20,000 jobs, cost airlines 200m ECU and cut CO2 emissions by only 0.3%. Other studies with levies at similar levels have suggested larger effects on supply and cuts in emissions of around 25%.
- A purely UK tax would affect the ability of UK carriers to feed transfer traffic through hubs such as Heathrow and Gatwick, in the absence of equivalent domestic taxes in other countries. This would inevitably put airlines operating to the UK from nearby hubs such as Schiphol and Paris at a competitive advantage.
- It would increase pressure to divert traffic to other transport modes. While we accept that rail has a role to play, the capacity of the UK's road and rail systems is limited and the environmental impact of any increase in use and/or capacity could be more damaging than the use of air transport.
- It would be perceived as a "holiday tax", in particular if applied over and above Air Passenger Duty. The current level of APD is £10 for travel to and from UK and the European Economic Area, and £20 for elsewhere. This already raises a sum sufficient to alleviate CO2-related impacts. The tax was imposed initially in 1994 on the basis of the absence of a kerosene tax.
- Aviation already pays for its own infrastructure. Thus, taking infrastructure costs with APD, it could be argued that the industry is already well placed with respect to internalisation of external costs.

"Air travel has been undertaxed because it has proved difficult to get international agreement to tax its fuel. The rates of Air Passenger Duty are to be increased...."

Statement by the Chancellor of the Exchequer when announcing doubling of the tax in the 1996 Budget.

The Chancellor also stated that at the initial lower rate APD has had little or no effect on the overall rate of growth at UK airports. However, it is very difficult to disentangle the effects of this tax on growth, particularly against a background of significant airline liberalisation, which is stimulating growth.

- There is no guarantee that it would accelerate development of relevant new technology - the incentive is already there as fuel represents a significant proportion of airline operating costs.
- If the objective of a tax is to reduce demand for air travel it should be realised that alternatives only exist for short distances and that these routes constitute a very small percentage of the total Revenue Passenger Kilometres flown on a regular basis. In order to cut the number of flights in the very short haul sector, prices would have to rise very significantly. Even if they did, this sector represents only a small proportion of overall air travel and emissions would therefore only be reduced by a fraction of a fraction of the current small element of global emissions accounted for by aircraft. Fewer short haul flights would also mean less price competition between modes of transport. Furthermore, in order to reduce fuel consumption by cutting the number of services, airlines would have to experience a reduction in passenger numbers such that the flight was no longer economically viable and the only sensible course would be to amalgamate or drop services. This may have implications for the UK economy since, as mentioned above, the nature of interlining would call into question major services via London if short haul services feeding into them were restricted. Furthermore, rail and road transport have significant environmental impacts of their own and are subject to severe capacity constraints. Substitution for air on any significant scale is therefore unlikely.

Emissions trading

15. Emissions trading has attractions in that, according to the permits issued, a cap is fixed on the production of CO2 allowed. This would not necessarily be a fixed cap: it could increase, or decrease, by issue or withdrawal of permits. For aviation it is clear that this would have to be global by nature. Issues arise with closed or open options, and how to issue and manage permits, for example grandfather rights as opposed to auctioning. Problems could arise with administration One possibility for aviation that has been put forward for discussion by British Airways would be to tie CO2 emissions to aircraft with a limited number of permits controlled at the manufacturing level. In this proposal, which is not official BA or BATA policy, each aircraft would be allowed to emit a determined level of CO2 per year or per operating cycle. New aircraft could only enter service by growth of the total amount allowed to be emitted, by acquiring permits through removal of existing aircraft from service; or by buying permits outside aviation, should that be allowed. As this proposal is aimed at a global system it is not discussed in detail here.

16. In the UK, the CBI and ACBE are currently developing a scheme for trading of ground based emissions. At this stage this scheme is not related to aircraft emissions.

Voluntary agreements

17. There are currently over 30 companies or sectors seeking to develop agreements with the UK government. Some have been put in place or are close to being so. At present any installation covered by Integrated Pollution Prevention Control will be able to negotiate with government an 80% reduction in CCL. Agreements must be signed by individual companies as trade associations are not appropriate legal entities. Agreements for sectors could take two forms - a collective agreement where all have the same target. For example, airlines could agree to have the same target or the agreement would be a collective one where different contributions are made by different airlines. Most sectors appear to be opting for CO2 efficiency (or more simply but not strictly correctly, carbon efficiency) per unit of output although total CO2 is an option for airlines. All of these aspects lead to administrative complexity. The current proposal is for agreements to be reviewed every two years, with milestones every two years to monitor compliance. Failure to reach each milestone would result in reversion to the full rate of the climate change levy. Such agreements involving the CCL could apply to aviation ground energy consumption but it is debatable at this stage as to whether they would be administered through generators or consumers, or, indeed, at all. Most organisations seeking such agreements are likely to wish to be able to translate efficiency improvements into tradable entities. The mechanisms for this are not clear and add an additional layer of administrative complexity. Nonetheless this is the most attractive short term route for influencing climate.

18. For transport there is an additional difficulty. Government is asking companies to report on CO2 emissions, including transport, using the figures in Table 1. This could lead to erroneous accounting and such a reporting system is not well designed to run alongside initiatives that are designed to raise efficiency. Airlines should be encouraged to report on emissions using actual efficiencies achieved.

Figure 2 Carbon efficiencies of transport modes. (source, IPCC)

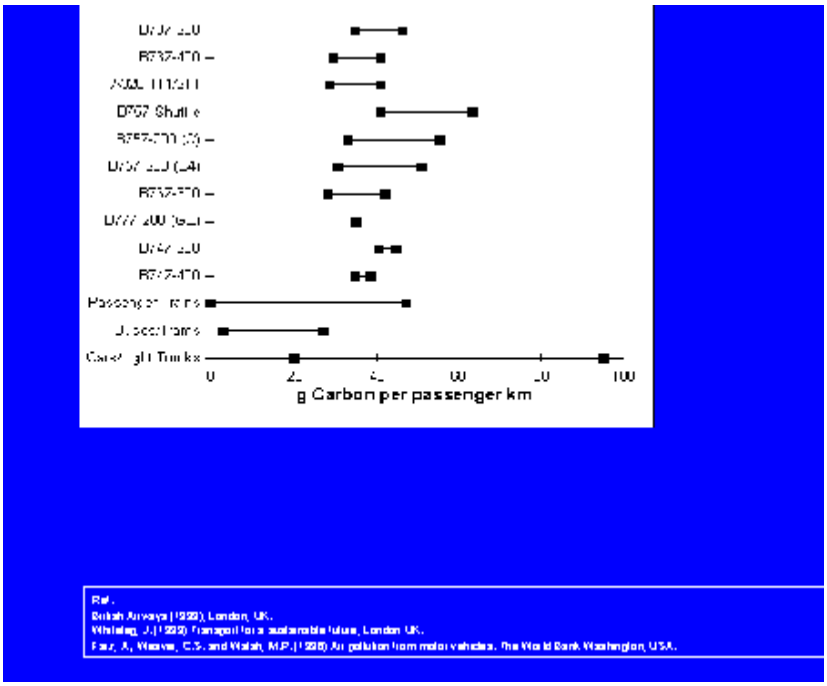


Table 1 - Factors for reporting on business travel

Transport mode	CO2/person (tonne)km
air short haul (av 500km)	0.18
air long haul (av 6495km)	0.11
Train	0.06
air freight short haul (av 457 km)	1.58
air freight long haul (av 6342 km)	0.57
rail freight	0.03
Shipping	0.003-0.06

Source DETR

The figures in Table 1 probably do not address adequately the relative efficiencies of different types of rail transport, in particular for high speed rail, which overlaps with aviation (see Figure 2). Such moves could be interpreted as a form of indirect demand control.

Voluntary action - offsets

19. It is not clear at this stage where voluntary actions such as those covered by Clean Development Mechanisms and Joint Implementation would fall. CDM and JI are mechanisms primarily aimed at international flexibility. However, it might be possible for airlines to invest in carbon offsets and obtain credits, for example against APD or towards agreed targets, from the UK government. Buying of external credits to achieve domestic targets is not generally approved by governments, with the possible exception of the USA, or by NGOs. However, perhaps the simplest illustration is through carbon sequestration, as proposed by groups such as Future Forests and the Carbon Storage Trust. Costs of sequestration or carbon offsets have been estimated at 60p per passenger hour based on sequestration costs per tonne of carbon. Thus a short haul flight of one hour duration would cost some 80p for total carbon offset and an average long haul flight of say eight hours would cost almost £5.00 to offset. These costs are within the current level of APD imposed for domestic and international flights (£10 and £20 respectively), even assuming that airlines should bear the total responsibility for carbon dioxide emissions. One advantage of sequestration or offsets is that were they could help to set the price if open to trading with permits.

Table 2- Cost of carbon offsets

Commodity	Cost of carbon offset
gas	0.12p/kWh
electricity	0.24 p/kWh
petrol	1.3p/litre

air ticket	80p/seat hr

Source: Carbon Storage Trust

Package approaches - mixed regimes

The UK is currently examining four ways of reducing CO2 emissions:

- IPPC - led by the Environment Agency
- CCL - led by the Treasury - implemented
- negotiated agreements - led by DETR
- trading - led by industry

It is clearly not possible to say to what extent options other than CCL will be implemented and what the relative roles of each will be. However, it is clear that much has happened since Kyoto and that the field of control of carbon dioxide emissions is developing rapidly. The UK is one of only a handful of countries that is on track to achieve its Kyoto objective (others are Germany, Switzerland and Luxembourg) and the pace is as fast in the UK as anywhere. The drivers are not only emissions reduction; there is also the question of which financial centre will be dominant in carbon trading, which could turn out to be a very large global business.

21. Voluntary agreements are currently being considered within Working Group 5 of ICAO's Committee for Aviation Environmental Protection. While work is still in progress, the sub-group on this topic has recognised:

- that voluntary agreements are unlikely to be used to achieve particularly onerous emissions reduction targets;
- that a regional or national agreement is unlikely to provide a workable model for a wider target-based regime;
- and the need to maintain comparability with work on levies and trading.

UK airlines and possible voluntary agreements

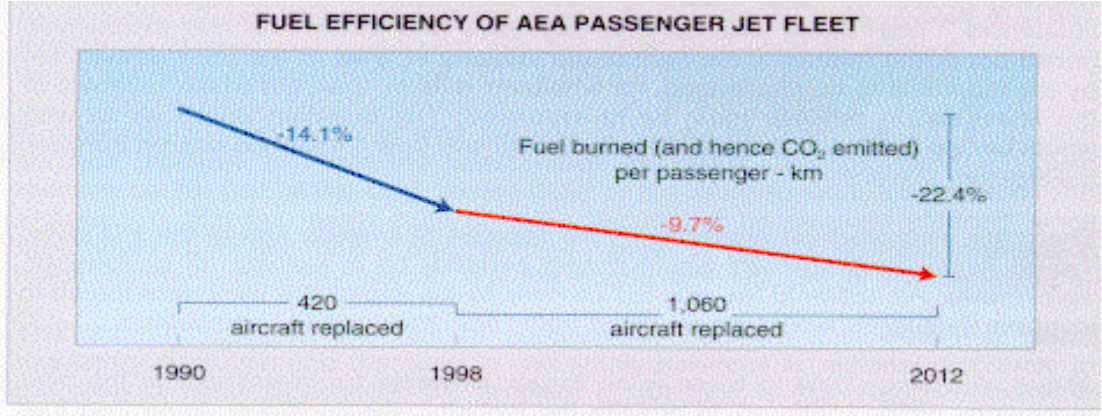
22. It is unlikely that a workable trading system could be agreed and put in place for several years. Thus, for UK airlines it is likely that an approach based on a voluntary agreement would be most likely to deliver environmental benefits in the short to medium term. However, UK airlines operate in a very competitive European and global market. Any system of voluntary targets should not put UK airlines at a competitive disadvantage by creating large compliance costs not borne by competitors. This requirement reinforces the argument that any significant action is likely to require action at a multinational level.

23. There appear to be two routes forward for the UK:

- A purely voluntary agreement, which could follow two models

The basis proposed by the Association of European Airlines (which has secured agreement from its members to a target improvement in efficiency of 22.4% compared with a Business As Usual case over the 1990-2012 period). AEA's targets take account of improvements already achieved, fleet and engine replacement, seating configuration/load factor, RVSM (reduced vertical separation minima), operational improvements, drag and weight reduction.

Figure 2 - Fuel efficiency of the AEA fleet

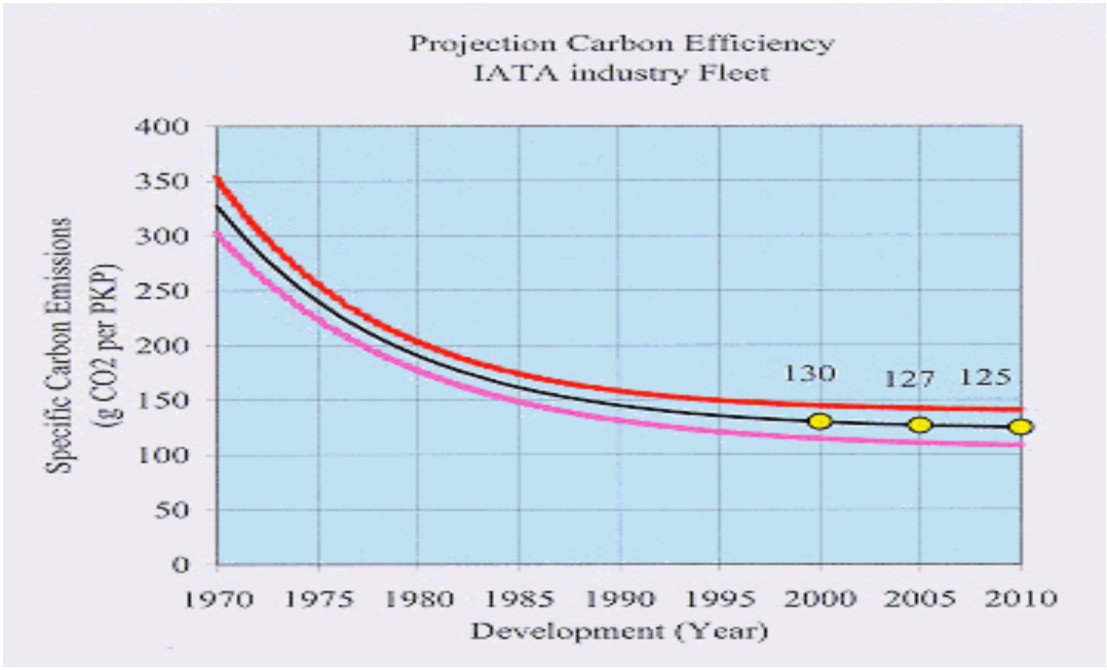


Source: AEA

The AEA figure of 22.4% improvement per RPK is made up of 14.1% already achieved from 1990-1998 as a result of fleet renewal and an improvement in load factor. The remaining improvement (9.7% from 1998-2012) is projected largely on the basis of fleet replacement.

or an approach that combines the above factors with action by Governments. BA, for example, has set a target of a 30% improvement in fuel efficiency from 1990-2010, but its achievement will depend on improvements in ATC/ATM as well as load factor and fleet replacement. Thus significant improvement depends on measures beyond direct control of airlines. This provides the opportunity for the UK Government to consider contributing to the performance of the industry by working with the relevant bodies to set and achieve a target for improvements in fuel efficiency through upgrading of the ATC/ATM systems. We hope that the UK and other European Governments will commit to a target-based regime, including environmental targets, for ATC/ATM in the UK and across Europe. The current debate over the future of NATS provides an opportunity to require NATS to operate on this basis in future.

Figure 3. Extrapolation of historical data.



Source: IATA (Swissair), top - USA, bottom - IATA fleets

It may be possible for UK airlines to adopt an AEA-related improvement as the efficiency "norm" without carrying out the calculations that have been done by BA. Such commitment by airlines would be seen as a "Good Neighbour" badge pending the development of international agreements to control aviation emissions. Motivating factors could be introduced. For example, where competition arose in allocation of route licenses under bilateral air service agreements, performance against the target could be used as one of a number of "public interest" criteria.

- A system linked to APD or to other incentives such as capital allowances. Such a system would have to be open to all airlines using UK airspace in order to avoid allegations of anticompetitive behaviour. It might be that it would only make sense for heavy payers of APD to get involved. The system could operate in a similar way to the Climate Change Levy. A significant reduction in APD (say 50-80%) would be available to airlines which commit and show progress towards stretching targets. This would need to be voluntary and it would be for airlines to decide whether or not to participate. The scheme should not distort competition as the APD reduction would be in lieu of compliance costs of meeting stretching fuel efficiency targets. This system would require a rigorous reporting and measurement system and thus could attract significant administrative costs, as discussed above.

24. Any voluntary target involves assessment of a large number of factors that influence fuel efficiency and emissions. For different airlines, different challenges would be presented. Consideration would have to be given to the baseline and fleet composition at that time, as well as to the nature of the current and planned operations. Any target set by airlines is clearly different from that proposed by the European automobile industry. The latter starts from an inefficient base line and offers only potential performance. On the other hand, it has been acknowledged (see 2. above) that airline fuel consumption and efficiency has improved consistently through technology and operational measures.

Setting targets

25. One of the key issues is the interface between agreements and trading. It is important that benefits accrued through agreements have at least the potential of being banked for use in any trading schemes. This is simpler where the agreement is in the form of a cap but rather more difficult where the agreement is in the form of efficiency and a formula has to be agreed for translation to an absolute tradable entity. For aviation, if efficiency is to be the basis of any agreement, what is the unit to be used - ATKs, ASKs, RTKs or RPKs? The best approach may well be to use the agreement as a precursor to trading.

26. For aviation the problems of agreements are not only what units to choose but which aspects to consider within the negotiation. For example, demand is an important element of load factor and capacity control is complex; governments are critical to delivery of improvements in the ATC/ATM systems. Improvements in ATC/ATM could lead to an imbalance of benefits to airlines with some whose routes are currently most inefficient receiving greater benefits than others, for example those flying along close to “great circle” routes between non congested airports. Different airlines have different fleet histories; indeed several airlines are new since 1990. Thus there would be a considerable challenge to BATA and the Government to develop both accurate individual and overall predictions and an equitable administrative system. It is possible that some airlines would have to fly a greater proportion of passenger kilometres at heights where fuel efficiency is lower. A UK-only system would probably take no account of efficiencies in flights external to the UK. Those elements totally within the control of airlines have a limited capacity for impact on efficiency. These would include some operational aspects and investment in new aircraft. Thus predictions such as the 22.4% (AEA) and 30% (BA) targets can be misleading as they depend on external as well as internal efficiency improvements. As an example, Swissair has predicted a much lower improvement by extrapolation of historical data. The contributions of the various factors contributing to efficiency targets will, of course, vary from airline to airline.

27. Most airlines already have fleet replacement plans and will legitimately ask if credits will be given for prior, as well as future investment. Some cost benefit analysis should be done on the potential of reducing APD against costs of investment in new aircraft and the level at which an incentive would be effective. Ultimately, the most attractive system to all parties could be an agreed cap as a stretching target and the potential to trade out if the target is beaten and trade in if not. Such a system in the UK could use APD rebates as an incentive.

28. Finally, one broadly accepted general point should be mentioned. That is the question of trade-offs in performance, in particular that of noise performance against operating range and fuel efficiency.

Summary

- There is much current work and discussion on development of mechanisms to control emissions of greenhouse gases. This includes aviation, where there is wide agreement that controls should be developed at the global level.
- Improvements in aviation performance depend on many factors, some of which are outwith the direct control of the industry.
- Nonetheless, in the UK there may be room for a voluntary agreement with efficiency improvements driven by incentives, for example by rebates on APD. The achievement of such performance targets could involve

Government making a direct commitment to improvements in ATC/ATM and/or contributing by means of incentives.