



REPORT

ON

VOLUNTARY EMISSIONS TRADING FOR AVIATION

(VETS Report)

*Approved by the Secretary General
and published under his authority*

PRELIMINARY EDITION – 2007

International Civil Aviation Organization

Disclaimer

This report has been posted to the ICAO Website as a final draft. However, the contents shown are subject to change, pending editorial revision and further technical input. The Organization accepts no responsibility or liability, in whole or in part, as to currency, accuracy or quality of the information in the report nor any consequence of its use.

TABLE OF CONTENTS

CHAPTER 1 VOLUNTARY EMISSIONS TRADING CONCEPTS.....	5 -
1.1 INTRODUCTION.....	5 -
1.1.1 Discussions in ICAO CAEP.....	5 -
1.1.2 Aviation’s role in the global economy.....	5 -
1.1.3 Climate impact.....	6 -
1.1.4 International regulatory framework.....	6 -
1.2 VOLUNTARY EMISSIONS TRADING EXPLAINED.....	7 -
1.2.1 Rationale behind emissions trading.....	7 -
1.2.2 Description of voluntary emissions trading.....	7 -
1.2.3 Key considerations	8 -
1.2.4 Opportunities for airlines created by voluntary emissions trading.....	9 -
CHAPTER 2 EXISTING VOLUNTARY EMISSIONS TRADING SCHEMES.....	11 -
2.1 UK EMISSIONS TRADING SCHEME (UK ETS)	11 -
2.1.1 Overview	11 -
2.1.2 Participants and incentives	11 -
2.1.3 Identifying emissions sources and calculating a Baseline.....	12 -
2.1.4 Allocation of allowances	12 -
2.1.5 Trading of allowances	13 -
2.1.6 Reporting, verification and compliance.....	13 -
2.1.7 Results	13 -
2.2 JAPAN’S VOLUNTARY EMISSIONS TRADING SCHEME.....	14 -
2.2.1 Overview	14 -
2.2.2 Participants and incentives	14 -
2.2.3 Calculating baseline emissions and emission reductions	14 -
2.2.4 Allocation of allowances	15 -
2.2.5 Trading allowances.....	15 -
2.2.6 Reporting, verification and compliance.....	15 -
2.2.7 Results	15 -
2.2.8 Remarks.....	15 -
2.3 CHICAGO CLIMATE EXCHANGE (CCX).....	15 -
2.3.1 Overview	15 -
2.3.2 Participants and incentives	16 -
2.3.3 Identifying emissions sources, calculating baselines and setting emission reduction targets	17 -
2.3.4 Emission offsets.....	18 -
2.3.5 Allocation of allowances and offsets.....	18 -
2.3.6 Trading of allowances and offsets.....	18 -
2.3.7 Reporting, verification and compliance.....	19 -
2.3.8 Results	19 -
2.4 EUROPEAN CLIMATE EXCHANGE (ECX).....	19 -
2.4.1 Overview	19 -
2.5 MONTREAL CLIMATE EXCHANGE (MCEX).....	19 -
2.5.1 Overview	19 -
2.6 ASIA CARBON EXCHANGE (ACX-CHANGE).....	20 -
2.6.1 Overview	20 -
2.7 VOLUNTARY CARBON OFFSET SCHEMES	20 -
2.7.1 Context	20 -
2.7.2 British Airways’ offset scheme	20 -

CHAPTER 3 FUTURE DEVELOPMENT OF VOLUNTARY EMISSIONS TRADING SCHEMES INVOLVING AVIATION.....	- 22 -
3.1 INTRODUCTION	- 22 -
3.2 PARTICIPATION IN AN EXISTING VOLUNTARY EMISSIONS TRADING SCHEME.....	- 22 -
3.3 DEVELOPMENT OF CARBON OFFSETS.....	- 23 -
3.4 DEVELOPMENT OF VOLUNTARY AGREEMENTS AS A PRECURSOR TO AN EMISSIONS TRADING SYSTEM	- 23 -
3.5 ESTABLISHMENT OF A VOLUNTARY EMISSIONS TRADING SCHEME FOR AVIATION ...	- 24 -
3.5.1 Commonalities between voluntary and mandatory emissions trading schemes	- 24 -
3.5.2 Differences between voluntary and mandatory emissions trading schemes.....	- 25 -
3.6 HOW VOLUNTARY EMISSIONS TRADING FOR AVIATION COULD DEVELOP	- 26 -
3.7 ROLE OF ICAO	- 27 -
3.8 FURTHER INFORMATION	- 27 -
GLOSSARY	- 28 -
APPENDIX A	- 33 -

CHAPTER 1 VOLUNTARY EMISSIONS TRADING CONCEPTS

1.1 Introduction

1.1.1 Discussions in ICAO CAEP

In evaluating alternative approaches to addressing aviation's impact on the global climate, ICAO's Committee on Aviation Environmental Protection (CAEP) concluded that, relative to other market-based measures, an emissions-trading system would be a cost-effective measure to limit or reduce CO₂ emitted by civil aviation in the long term, provided that the system is an open one across economic sectors.¹

The 33rd ICAO Assembly (2001) endorsed the "development of an open emissions trading system for international aviation" and "requested the Council to develop as a matter of priority the guidelines for open emissions trading for international aviation, focusing on establishing the structural and legal basis for aviation's participation in an open trading system, and including key elements such as reporting, monitoring, and compliance, while providing flexibility to the maximum extent possible consistent with the UNFCCC process."

Subsequently, at its 35th Assembly (2004), ICAO endorsed the "further development of an open emissions trading system for international aviation" and requested the Council, in its further work on this subject, to focus on two approaches, namely to "support the development of a voluntary trading system that interested Contracting States and international organizations might propose" and to "provide guidance for use by Contracting States, as appropriate, to incorporate emissions from international aviation into Contracting States' emissions trading schemes consistent with the UNFCCC process".

Under both approaches, the Council was instructed to ensure that the guidelines for an open emissions trading system address the structural and legal basis for aviation's participation in an open emissions trading system, including for example key elements such as reporting, monitoring and compliance.

This report has been developed for CAEP by its Emissions Trading Task Force in response to the request to the Council to support the development of a voluntary trading system that interested Contracting States and international organizations might propose.

1.1.2 Aviation's role in the global economy

Aviation plays a vital role in facilitating economic growth, particularly in developing countries. It provides the only worldwide transportation network, and transports about 2 billion passengers annually, as well as 40% of interregional exports of goods (by value). According to industry sources², its global economic impact is estimated at US\$ 2,960 billion (equivalent to 8% of world Gross Domestic Product (GDP)) while generating a total of 29 million jobs globally.

The demand for air transport has increased steadily over the years. Passenger numbers have grown by 45% over the last decade and have more than doubled since the mid-1980s. Freight traffic has increased even more rapidly, by over 80% on a tonne-kilometre performed basis over the last decade and almost three-fold since the mid-1980s.

¹ "Market-Based Measures:" Report from Working Group 5 to the fifth meeting of the Committee on Aviation Environmental Protection. CAEP/5-IP/22. 5/01/01.

² ATAG (2005) Economic Benefits of Air Transport

1.1.3 Climate impact

Inclusion of aviation in an emissions trading system would require a decision regarding aviation emissions to be covered by the scheme.

The primary direct greenhouse gas emissions of aircraft are carbon dioxide (CO₂) and water vapour (H₂O). Other emissions are oxides of nitrogen (NO_x), particles containing sulphur oxides (SO_x) and soot. The total amount of aviation fuel burned, as well as the total emissions of carbon dioxide, NO_x, and water vapour by aircraft, are well known relative to other parameters such as aerosols. These gases and particles alter the concentration of ozone (O₃) and methane (CH₄), may trigger formation of condensation trails (contrails), and may increase cirrus cloudiness – all of which may contribute to climate change.

According to estimates produced in the IPCC aviation report (1999), the overall radiative forcing from aircraft effects (excluding that from changes in cirrus clouds) in 1992 was a factor of 2.7 larger than the forcing by aircraft carbon dioxide alone.³ The IPCC concluded that there were varying levels of scientific understanding (e.g. ranging from “very poor” in the case of cirrus to “good” for CO₂⁴) associated with these effects. Further research into such non-CO₂ effects is ongoing, and IPCC is expected to provide an update in its fourth assessment report due in 2007. These radiative forcings represent the best estimate of the effects of aviation on climate for the reported year, i.e. 1992. However, for aviation’s past, present or future emissions, the radiative forcing index should not be used to derive relationships between emissions and marginal changes in climate, as the Global Warming Potential (GWP) is intended to do.

The Global Warming Potential (GWP) metric was developed by the IPCC, to compare the climate impacts of changes on emissions of long lived well mixed gases to that of CO₂ over a specific time horizon. It is used by the UNFCCC process in establishing emissions equivalencies for emissions reduction targets and activities. CO₂ impacts from aviation are the longest lived and most well defined and are readily defined in terms of GWP. Formulating GWPs from non-CO₂ effects from aviation has conceptual difficulties and the IPCC (1999) stated that such GWPs were not adequate to describe the climate impacts of aviation (see IPCC, 1999 Chapter 6 section 6.2.2).

For further information on emissions from the aviation sector please refer to the most current IPCC Assessment Report and the IPCC Special Report on Aviation and the Global Atmosphere.

1.1.4 International regulatory framework

The United Nations Framework Convention on Climate Change (UNFCCC), adopted at the Rio Earth Summit in 1992, aims to stabilize greenhouse gas concentrations in the global atmosphere. Under the UNFCCC, industrialized countries (named “Annex I Parties”) shall adopt national policies and take corresponding measures on the mitigation of climate change by limiting its greenhouse gas emissions.

The UNFCCC is supplemented by the Kyoto Protocol of December 1997 which requires participating Annex I Parties to reduce their overall emissions of greenhouse gases by at least 5% below 1990 levels in the period 2008-2012, in accordance with the quantified emissions

³ The so-called RFI or radiative forcing index, is defined by the IPCC 1999 report as the sum of all the forcings divided by the CO₂ forcing (chapter 6 paragraph 6.2.3)

⁴ For further details see the 1999 IPCC Special report on Aviation and the Global Atmosphere and the 2001 IPCC Third Assessment Report (TAR).

limitation/reduction commitments (QELRCs) as assigned to each of them individually in Annex B of the Protocol.

Parties' commitments under the Kyoto Protocol include emissions from domestic aviation, but emissions from international flights are not currently included. Article 2.2 of the Protocol states that "[T]he Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases (...) from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively".

Although non-Annex I Parties have no quantified obligations under the Kyoto Protocol, all Parties to the UNFCCC are called upon to take mitigation and adaptation measures, within the confines of their respective capabilities⁵.

Voluntary participation in emissions trading schemes is equally relevant to Annex I and non-Annex I Parties and may be considered as a cost-effective complement to technology transfer and other mechanisms to reduce fuel consumption and increase resource efficiency.

1.2 Voluntary emissions trading explained

1.2.1 Rationale behind emissions trading

Emissions trading is a market-based policy tool that can be used to promote economic efficiency in achieving environmental goals. By harnessing market forces, emissions trading regimes can create incentives for economic agents to discover and implement cost-effective approaches to complying with environmental targets.

The basic argument for using emissions trading as an environmental policy tool relates to the potential costs saving a trading system can generate relative to a conventional command and control approach. In particular, when regulated entities are allowed to buy and sell emission instruments, market forces can create an incentive for firms with relatively low-cost emission reduction options to reduce their emissions by more than needed to satisfy their regulatory requirements.

These entities are then able to sell surplus emission instruments to other regulated firms that are faced with relatively high-cost emission control options. The opportunity to sell surplus emission instruments can create incentives for cost-effective compliance with environmental targets. As a result, incorporating an emissions trading system into an environmental policy can mean that the same level of environmental protection can be achieved at a lower overall cost. Care must be taken, however, that the savings in mitigation costs across all participants are large enough to more than offset the combined administrative and transactions costs.

1.2.2 Description of voluntary emissions trading

Various interpretations exist as to what is meant by voluntary emissions trading and specifically what is meant by the term 'voluntary'. According to the Organization for Economic Co-operation and Development (OECD), for example, there are many different examples of voluntary initiatives, ranging from unilateral actions at the company level to negotiated agreements between governments and sectors⁶. The OECD also points to different ways in which voluntary programs can be combined with other measures such as taxes (most commonly involving some exemption), subsidies or standards. In practice, many voluntary agreements are in fact combined with some sort of incentive measure.

⁵ See Article 4 UNFCCC

⁶ See OECD (2003) *Voluntary approaches for environmental policy- effectiveness, efficiency and usage in policy mixes*, and OECD (1999) *Voluntary Approaches for environment policy: an assessment*, OECD, Paris

This report defines a voluntary trading scheme as any scheme in which participation is not made mandatory by a State. Schemes that involve some kind of government incentive for companies to participate therefore also fall under this definition.

For the purpose of this report, voluntary emissions trading for international aviation is considered to be one of the following:

1. a group of airlines decides to create its own ETS;

For example, airline alliance partners set up an ETS among themselves. This would be a sectoral trading system that could be designed in a way that would allow participants to purchase offsets outside the scheme in order to keep costs down.

2. the airline sector creates a new ETS together with other sectors

For example, members of a national air transport association get together with the national electricity companies and agricultural sector to establish and participate in a national emissions trading scheme.

3. an airline/a group of airlines decides to unilaterally join an existing ETS

- a) run by own government*
- b) run by other government(s)*
- c) run by a commercial entity*

For example, as part of national efforts to drive technology efficiency and reduce emissions, a group of national airlines choose to participate in a trading scheme a) administered by its own government; or b) run in a neighboring State; or c) run by an independent trading platform.

Under these scenarios, the money paid by those buying allowances helps to finance the development and/or implementation of CO₂ control measures by others who are selling the allowances. In addition to these options, more direct mechanisms may also be considered, for example:

4. an airline/a group of airlines decides to compensate for carbon emissions by using an offset mechanism

- a) run by the airline(s) itself (possibly as an option for passengers/customers)*
- b) run by an independent service provider.*

In this case, money is usually paid into a fund that sponsors specific projects to reduce or avoid emissions from sources or remove emissions from the atmosphere through so-called sink projects. An example would be an airline that sets aside a small amount per ticket sold to fund climate mitigation projects. Such offset programs, if only triggered by passengers or customers, may not result in the reduction of a predefined quantity of emissions.

1.2.3 **Key considerations**

A number of considerations are key in designing a workable and credible voluntary trading scheme. These include:

- ***Environmental results***—how stringent are the environmental targets, with what degree of certainty are these results achieved, how likely are entities to

participate and how broad is the emissions coverage under the agreement, and what factors might undermine achieving the environmental results⁷.

- ***Flexibility***—does the approach offer sufficient flexibility to ensure environmental benefits while allowing for economic growth within the sector and does it enable participants to take those actions that will most effectively reduce emissions and to encourage innovation in emissions reduction;
- ***Administrative & transaction costs***—how costly will requirements of the system be for the central administrative body and other entities (incl. the government) to administer and enforce, and how expensive will it be for entities to participate in the broad range of activities (such as monitoring and verification, reporting, and trading).
- ***Transparency***—how complex will the administration of the scheme be, how complex will it be for entities to participate in the scheme (incl. monitoring, verification, reporting and trading) and how transparent will the scheme be for third party stakeholders;
- ***Overall cost and cost-effectiveness***—does the option have adverse effects on the cost-effectiveness (i.e., the cost per tonne of CO₂ reduced) of control, or on overall control costs (i.e., the total costs of abatement plus purchase/sale of emission allowances and/or credits) for the aviation sector (domestic or international).
- ***Competitiveness***—how will the design of a trading scheme affect the competitive positions of participants and non-participants within the aviation sector, and between aviation and other transportation modes.
- ***Interactions with other mitigation options***—what types of issues arise regarding compatibility or conflicts with other policy instruments (standards, taxes, charges, other trading schemes, etc.) that exist or are being considered to address greenhouse gas emissions from aviation. Measures should not detract from other efforts to improve overall environmental performance.
- ***Political acceptability***—how will the trading scheme be viewed by the relevant stakeholders, including airlines and other industry actors that have an influence on aviation emissions but are not direct participants in the agreement (e.g. engine manufacturers, air traffic controllers), governmental and non-governmental bodies, etc.

1.2.4 Opportunities for airlines created by voluntary emissions trading

There are a number of reasons why voluntary emissions trading schemes may provide a helpful option for addressing aviation emissions, particularly from international flights.

⁷ OECD assessment of voluntary initiatives in environmental policy concludes that their environmental effectiveness and economic efficiency is generally low compared to other approaches, but when measured against other criteria (so called 'soft' criteria) such as awareness raising they have been seen to have a very important role. See *supra* note 7

1.2.4.1 Flexibility

Voluntary trading schemes are not necessarily constrained by the framework of international agreements. This could allow early action under a voluntary framework while discussions on a possible mandatory approach are ongoing. It could also allow action that is broadly inclusive.

1.2.4.2 Cost containment

Successful voluntary measures can help to minimise costs, especially compared with the perceived cost of regulatory actions. As the action that needs to be taken to achieve a reduction target becomes more costly – approaching the cost of potential “command and control” regulations – the incentive to pursue voluntary trading diminishes. Therefore, successful voluntary measures should be cost-effective and have low administrative and transactions costs.

1.2.4.3 Competitiveness

Voluntary trading has potential to attract broad geographic participation by States and airlines. If the system attracts broad geographic participation, and since airlines are unlikely to join if they anticipate doing so will significantly hamper their ability to compete, competitive impacts are likely to be small.

1.2.4.4 Learning by doing

For companies not involved in mandatory trading schemes, a key benefit of voluntary trading might derive from “learning-by-doing” and from “institutional capacity building” within the airline sector. Starting out with a voluntary trading regime offers the important advantage of allowing participants the opportunity to develop skills and learn trading strategies that may be useful as emissions trading develops in the future. Voluntary emissions trading can be a step toward demonstrating to governments and the public that global warming concerns are being addressed responsibly.

The next chapter describes some examples of voluntary emissions trading schemes for greenhouse gases in which aviation participates or could participate.

CHAPTER 2 EXISTING VOLUNTARY EMISSIONS TRADING SCHEMES

At the present time there are only a handful of examples around the world of voluntary emissions trading schemes for greenhouse gases. Only one of these trading schemes has included the activities of an airline operator. Other types of schemes involve voluntary financial contributions by airline passengers to fund carbon dioxide emissions offset projects. While the overall contribution of these schemes to global emissions reduction is small at present, the potential exists for this contribution to multiply over time if more schemes are developed.

This chapter summarises the key elements of the following voluntary schemes:

- United Kingdom Emissions Trading Scheme;
- Japanese Voluntary Emissions Trading Scheme;
- Chicago Climate Exchange (with reference to the European Climate Exchange and the Montreal Climate Exchange);
- Asia Carbon Exchange; and
- Voluntary Carbon Offset Schemes.

2.1 UK Emissions Trading Scheme (UK ETS)

2.1.1 Overview

The UK ETS for greenhouse gases was launched by the Government in April 2002 as part of a wider range of measures in the UK designed to reduce greenhouse gas emissions under the UK Climate Change Programme. At the launch, it was claimed to be the world's first economy-wide greenhouse gas trading system.

A range of organisations, including British Airways as the only airline operator (domestic operations only), voluntarily undertook to reduce their emission of carbon dioxide equivalent (CO₂e) to below set targets. In return, these organisations receive incentive payments totalling £215 million from the Government. Over the lifetime of the scheme (2002-2006), almost 12 million tonnes of CO₂e emissions releases will have been avoided. Options for the future of the scheme beyond 2006 are currently being considered by the Government.

The scheme is also open to the companies with Climate Change Agreements with the Government. These negotiated agreements set energy-related targets and companies meeting their targets receive an 80% discount from the Climate Change Levy, a tax on the business use of energy. These companies can use the scheme either to buy allowances to meet their targets, or to sell any over-achievement of these targets. In addition, anyone can open an account on the registry to buy and sell allowances.

It was reported that over the first three years (2002 - 2004), the scheme delivered emissions reductions totalling 5.9 million tonnes of CO₂e.

2.1.2 Participants and incentives

Entry into the scheme is voluntary and open to all individuals or organisations in the UK. There are two principal types of participants - Direct Participants and Agreement Participants.

Direct Participants are organisations that agreed to take on voluntary targets for a five-year period, 2002-2006, in exchange for financial incentives provided by the Government. Thirty-three such organisations, including British Airways, committed to reduce their annual emissions against 1998-2000 levels by 3.96 million tonnes of CO₂e by the end of the scheme in 2006. In

addition to fulfilling the total annual reduction target by 2006, Direct Participants had to comply with interim targets for years 2002-2005. Each year, the reduction target was increased by one-fifth of the overall (2006) target. As a result, the original commitment made by Direct Participants equates to delivering 11.88 (that is, $(1/5+2/5+3/5+4/5+5/5) \times 3.96$) million tonnes of CO₂e worth of cumulative emissions releases avoided over the lifetime of the scheme.

As an incentive, the Direct Participants receive a total of £215 million in payments from the Government over 5 years or approximately £43 million (£30 million after tax) per year. The level of incentive payment and the associated targets for each Direct Participant were set through a competitive bidding process.

Agreement Participants are those 6000 companies which already had emission or energy targets set through Climate Change Agreements with the Government. Companies meeting these targets receive an 80 per cent discount from the Climate Change Levy, which is a tax on the business use of energy. These companies can use the scheme either to buy allowances to meet their targets, or to sell any over-achievement of these targets.

In addition to these participants, the UK ETS allows other parties to participate in the scheme as traders without compliance commitments.

2.1.3 Identifying emissions sources and calculating a Baseline

The Baseline for each Direct Participant was calculated on the basis of historic emission levels and was generally the average annual emissions in the three years up to and including 2000.

The Baseline was made up of emissions from individual sources, which Direct Participants had to list by way of an approved protocol. The total emissions calculated using the approved protocol formed the Baseline expressed in tonnes of carbon dioxide equivalent (tCO₂e). Emissions included both direct emissions such as those from fossil fuel combustion or other industrial processes, and indirect emissions associated with energy use.

The Scheme makes provision for adjustments to the Baseline to take account of changes in the structure or operations of a Direct Participant.

2.1.4 Allocation of allowances

For Direct Participants, a 'descending clock' auction was used to allocate the incentive money and the associated targets for emission reductions. Auction participants bid amounts of emission reductions in response to prices for tCO₂e announced by the Department for the Environment, Food & Rural Affairs (DEFRA), starting at a nominal £100. Companies submitted new bids in response to successively lower prices for tCO₂e until the total incentive payment implied was no more than the incentive budget of £215 million. This process gave a final price of £53.73 per tCO₂e reduction in 2006.

Because participants are required to make progressively larger reductions in each year of the Scheme, the 2006 reductions relative to the Baseline represent one-third of the cumulative total reductions from 2002-2006. The final price of £53.73 therefore corresponds to £17.79 per tCO₂e of cumulative reductions over the life of the Scheme, or £12.45 per reduction tCO₂e net of the maximum corporation tax due on the incentive payments.

The thirty-three Direct Participants pledged emissions reductions totalling 3.96 million tCO₂e in 2006, which is equivalent to 11.88 million tCO₂e of cumulative emissions releases avoided in total over the life of the Scheme. The 2006 target corresponded to a 13 per cent reduction from verified baseline emissions.

Direct Participants are subject to a 'cap and trade' emissions trading system. They are allocated allowances equal to the target for each year, provided they have been in compliance in the previous year. At the end of each compliance year, Direct Participants must reconcile their verified emissions against their allowances and undertake any further trading necessary to meet their target.

Companies entering the Scheme through the Climate Change Agreements participate in a 'baseline and credit' trading system. They do not receive allowances up front. At the end of each year in which they have targets, they receive allowances if they have beaten their target, or they are able to buy additional allowances if they have not beaten their target.

2.1.5 Trading of allowances

A computerised registry is the centralised means of managing all transactions. Anyone wanting to hold, buy or sell allowances or credits must have an account in the registry. The registry records all allowance holdings and tracks allowances from their initial allocation through all transfers of ownership until final cancellation or retirement.

Anyone holding an account in the registry is allowed to buy and sell allowances. Participants in the scheme are able to trade directly between themselves or through third party brokers.

2.1.6 Reporting, verification and compliance

At the end of each compliance period (calendar years for Direct Participants and every two years for Agreement Participants), target holders must report their emissions over that period. All target holders must ensure that they either hold sufficient allowances to cover their verified emissions (for Direct Participants), or that they hold sufficient allowances to cover any emissions or energy use in excess of their target (for Agreement Participants).

A three-month reconciliation period is allowed following each compliance period to enable participants to continue trading if required before a final deadline. After this, the Government checks the total holdings in each participant's account and all allowances needed to cover emissions over the preceding year are retired. Any allowances that remain can be banked for future use or sold.

Penalty provisions apply for non-compliance which are intended to be sufficiently strong to ensure the scheme operates effectively but not disproportionate for a voluntary scheme. For Direct Participants penalties can include financial penalties, non-payment of the financial incentive and a reduction in the number of allowances for the next compliance period. There is also the option for the Government to publicly list those Direct Participants who fail to hold sufficient allowances at the end of the reconciliation period. For Agreement Participants, the penalty is the removal of the 80 per cent discount on the Climate Change Levy.

2.1.7 Results

To date, British Airways has operated successfully within the UK ETS, meeting the reporting and verification requirements of the scheme, and keeping within its agreed emissions cap. Successful participation has been greatly helped by agreeing a protocol with the UK government, which deals with the key issues of monitoring and measuring emissions from mobile sources.

British Airways reports that participation in the UK ETS has brought valuable experience of operating with an emissions trading scheme. In addition to making cuts in CO₂ emissions and associated energy costs, the scheme has led to improvement in data accuracy and energy management information in a number of areas of operation.

The airline also cites a number of strategic benefits from participation in the scheme:

- Exposure to the concept within the business by taking into account the price of carbon in network planning decisions within its domestic network and integrating emissions trading into fuel hedging and financial management activities;
- Gaining experience of the processes and strategic implications, including the reporting of verifiable emissions data and credit trading; and
- Demonstration that emissions trading is a deliverable and practical policy tool for managing air transport emissions.

2.2 Japan's Voluntary Emissions Trading Scheme

2.2.1 Overview

In May 2005, the Ministry of the Environment launched Japan's Voluntary Emissions Trading Scheme (JVETS). Under the scheme, the Ministry subsidises the installation of emissions reduction equipment for selected participants who make a commitment to specific reductions in their CO₂ emissions. The scheme also allows these participants to trade CO₂ emission quotas to meet their reduction targets. The total emissions reductions for fiscal year (FY) 2006 are forecast to be almost 0.28 million tCO₂, while the total reduction over the officially-recognised service life of the subsidised equipment is calculated at about 3.8 million tCO₂.

The main purpose of the scheme is to achieve a cost-effective and substantial reduction in greenhouse gas emissions and to accumulate knowledge and experience relating to domestic CO₂ emissions trading.

A graphic illustration of the scheme is provided in Appendix A to this report.

2.2.2 Participants and incentives

An open invitation was made to private companies and other appropriate groups in Japan to participate in the JVETS. Of the 38 entities that applied, 34 companies and corporate groups were selected to participate based on the cost effectiveness of their emissions reduction proposals. In return for adopting specific emissions reduction targets, these 34 participants became eligible for Government subsidies for the installation of the emissions reduction equipment. Subsidies were only available for new facilities to improve energy efficiency or to promote renewable energy leading to greenhouse emissions reduction. The subsidies were capped at one third of the cost involved for each participant. The total Government budget for the subsidies is about 2.6 billion yen (about US\$23.6 million).

The scheme provides for trading by the participants as required to meet their emissions reduction targets. There is also provision for 'trading participants' who will be able to operate trading accounts but who will not be eligible for subsidies or the allocation of allowances. Eight companies were selected as trading participants.

2.2.3 Calculating baseline emissions and emission reductions

The calculation of baseline emissions for each participant is based on their average annual CO₂ emissions between 2002 and 2004. For the 34 participants involved this equates to a total of over 1.3 million tCO₂. The total emissions reductions promised by the individual companies for FY2006 is almost 0.28 million tCO₂, or 21 per cent of their average annual CO₂ emissions in the base years. The total reduction over the officially recognised service life of the subsidised equipment is calculated at about 3.8 million tCO₂.

Participants received subsidies for new facilities and their installation during FY2005. The new facilities were to be set-up before the end of FY2005 (end March 2006) and the calculation of base year emissions also had to be completed by October 2005.

Base year emissions for all participants were verified by a Ministry accredited verification entity.

2.2.4 Allocation of allowances

The Ministry of the Environment allocated emissions quotas based on the results of the base years verification process. The allocations for each participant was the average emissions for the base years minus the estimated or pledged emission amount for FY2006.

2.2.5 Trading allowances

Throughout FY2006, participants will implement their CO₂ reduction projects using the newly installed equipment. Participants will be able to trade their allowance throughout FY2006 which finishes at the end of March 2007. At that time, actual greenhouse gas emissions will be calculated and verified. A final trading period of about one week will be allowed for participants to trade allowances again if necessary. By June 2007, participants will need to retire allowances in the registry.

2.2.6 Reporting, verification and compliance

At the completion of FY2006, participants will have the period April to June 2007 to calculate their actual emissions for FY2006 and to submit the results to the third party entity for verification. The Ministry of the Environment will fund the cost of verification.

Participants will be non-compliant if they cannot retire sufficient allowances corresponding to the actual amount of their emissions. In the case of non-compliance, the participant must return the subsidy received to the Ministry for the Environment.

2.2.7 Results

The total emissions reductions for FY2006 are forecast to be 276,380 tCO₂, while the total reduction over the officially recognised service life of the subsidised equipment is calculated at about 3.8 million tCO₂. Final results for FY2006 were not available at the time of this report.

2.2.8 Remarks

The Ministry of the Environment selected 61 companies and corporate groups as subsidised participants for the second period of JVETS. The total emissions reductions are estimated to be 229,405 tCO₂ for FY2007 while the total reduction over the officially recognised service life of the subsidised equipment is calculated as 2.8 million tCO₂.

2.3 Chicago Climate Exchange (CCX)

2.3.1 Overview

The Chicago Climate Exchange (CCX) is a voluntary, legally binding, greenhouse gas emissions registry, reduction and trading system for emission sources and offset projects in the United States, Canada, Mexico, Brazil and worldwide. The development of the CCX was initiated through a feasibility study funded by a grant from the Chicago-based Joyce Foundation. A subsequent grant was given to initiate research on market implementation.

CCX is a self-regulatory, rules-based exchange designed and governed by CCX members. Members make a voluntary but legally binding commitment to reduce their emissions of greenhouse gases. By the end of Phase I (December 2006) all Members will have reduced direct emissions by four per cent below the average of their 1998-2001 baseline. Phase II, which extends the CCX reduction program through to 2010 will require all members to reduce

greenhouse gas emissions by six per cent below the baseline.

Continuous electronic trading of greenhouse gas emission allowances and offsets began on 12 December 2003. CCX reduction commitments and trading apply for years 2003-2010. With a total emission baseline of about 231 million tCO₂e for 2006, the CCX program aims to achieve a total emissions reduction of over 9 million tCO₂e (4 per cent) by the end of Phase I in December 2006. Actual emissions reductions by the end of the 2004 compliance year were over 32 million tCO₂e, which was substantially better than the target for that year.

The CCX market price in October 2006 for CO₂ was about US\$4 per tonne. The price has risen from around US\$0.98 in December 2003 and reached a high of US\$5 in April 2006.

2.3.2 Participants and incentives

Membership of the CCX is open to a wide range of participants. There are four classes of CCX membership, which together are referred to as CCX Registry Account Holders. The classes are:

- a) CCX Members include corporations, municipalities and other entities that have direct GHG emissions from facilities in the United States, Canada or Mexico.
- b) CCX Associate Members are entities that have insignificant or no direct GHG emissions and comply with CCX rules by offsetting all indirect emissions associated with a selection of business related activities.
- c) CCX Participant Members include Offset Providers and Liquidity Providers.
 - (i) Offset Providers are entities such as project owners, project implementers and registered aggregators that sell Exchange Offsets produced by qualifying CCX-registered Offset Projects.
 - (ii) Liquidity Providers are entities or individuals who trade or engage in market-making activities on the Exchange for purposes other than compliance with the CCX emissions reductions schedule.
- d) CCX Exchange Participants are entities that establish a CCX Registry Account for the purpose of acquiring and retiring CCX Carbon Financial Instruments (CFIs) the CCX tradable commodity.

As at 12 September 2006 CCX membership totalled 142. No airline operators or aircraft manufacturers were included in the membership. While Rolls-Royce is a member, this is in the context of its manufacturing activities and not in the context of aircraft engine emissions.

There are no Government funded incentives to participate in the CCX. The CCX promotes the benefits of membership as being:

1. First-mover advantage.
2. Helping to build a transparent and credible first step solution.
3. Ease and security of trade execution.
4. Helping to shape environmental policy for the 21st century.
5. Global exposure.

2.3.3 Identifying emissions sources, calculating baselines and setting emission reduction targets

Emissions of the following greenhouse gases from facilities owned by CCX members are included in the scheme as applicable: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

Emissions of all non-CO₂ greenhouse gases are converted to metric tonnes CO₂ equivalent using the one hundred year Global Warming Potential (GWP) values established by the Intergovernmental Panel on Climate Change.

The unit of emissions measurement, reporting, price quotation and trading is metric tons of carbon dioxide equivalent or tCO₂e. Each CCX Carbon Financial Instrument represents one hundred tCO₂e.

CCX emitting Members make a voluntary but legally binding commitment to reduce direct emissions below an emissions baseline. An emissions baseline is calculated by taking the average of emissions inventories from a specific timeframe, or 'baseline period'. Baselines are adjusted to reflect acquisition or disposal of facilities.

Phase I Members: By the end of Phase I (December 2006) all Members will have reduced direct emissions by 4 per cent below a baseline period of 1998-2001. Members that participate in Phase II will reduce emissions by an additional 2 per cent below baseline by 2010 to achieve the Phase II reduction target of 6 per cent below baseline. CCX Members were issued greenhouse gas emission allowances at the inception of the program for the four-year period (2003-2006) in an amount reflecting the CCX emission reduction schedule below:

Phase I	CCX Emission Reduction Target
2003	1 per cent below Member's baseline
2004	2 per cent below Member's baseline
2005	3 per cent below Member's baseline
2006	4 per cent below Member's baseline
Phase II	CCX Emission Reduction Target
2007	4.25 per cent below Member's baseline
2008	4.5 per cent below Member's baseline
2009	5 per cent below Members baseline
2010	6 per cent below Members baseline

Phase II Member joining in 2006: New Phase II Members' emission baseline is the annual average of emissions from facilities included in the baseline period 1998-2001. If data is insufficient, new Phase II Members may use a year 2000 baseline. The Phase II reduction target is 6 per cent below baseline by 2010. CCX Phase II Members will be issued greenhouse gas emission allowances in an amount reflecting the CCX emission reduction schedule below:

Phase II	CCX Emission Reduction Target
2006	1.2 per cent below Member's baseline
2007	2.4 per cent below Member's baseline
2008	3.6 per cent below Member's baseline
2009	4.8 per cent below Member's baseline
2010	6 per cent below Member's baseline

2.3.4 Emission offsets

Eligible projects can be recorded in the CCX Registry and are issued Exchange Offsets on the basis of mitigation tonnage realized during 2003-2006. Exchange Emission Offsets are issued after mitigation occurs and required documentation is presented to the CCX. Project eligibility, project baselines, quantification, and monitoring and verification protocols are specified in the CCX Rulebook.

The initial categories of eligible offset projects are:

- Methane destruction;
- Agricultural practices;
- Forestry practices;
- Other greenhouse gas emission mitigation in Brazil;
- Renewable energy; and
- Clean Development Mechanism Eligible Projects.

2.3.5 Allocation of allowances and offsets

The tradable Carbon Financial Instruments employed in CCX are Exchange Allowances (XA's) and Exchange Offsets (XO's). Exchange Allowances are issued to Exchange Members and Associate Members in accordance with each Member's Emission Baseline and Emission Reduction Schedule, subject to provisions outlined in the CCX Rulebook. They are also issued on the basis of forest carbon sequestration and reductions in electricity use. Exchange Offsets are generated by qualifying mitigation projects and registered with CCX by Exchange Participant Members.

Each CCX Carbon Financial Instrument resides in the CCX Registry in a manner that designates the Instrument's annual vintage. Each Carbon Financial Instrument is recognized as equivalent when surrendered for compliance. Carbon Financial Instruments may be used for compliance in their designated vintage year or banked for use in later years, subject to provisions outlined in the CCX Rulebook. CCX Carbon Financial Instruments may not be used for compliance in years that precede the vintage of an Instrument.

2.3.6 Trading of allowances and offsets

The CCX Trading System has three component parts:

1. *The CCX Trading Platform* is an internet-accessible marketplace that is used to execute trades among CCX Registry Account Holders. The system utilizes SUN java technology to bring live and active content to a screen. The Platform features a price transparent marketplace that displays order size, market depth and a market ticker. The system supports both exchange-cleared trades which preserve anonymity, and bilateral trades that are established through private negotiations off-system.
2. *The Clearing and Settlement Platform* receives information daily from the CCX Trading Platform on all trade activity. It processes all transaction information, nets out positions, and produces payment instructions for settlement of trades. Daily statements are provided to members when trading occurs. All corresponding changes are automatically updated in a Registry Account Holders' holdings of Carbon Financial Instruments in the CCX Registry.

3. *The CCX Registry* is an electronic database that serves as the official holder of record and transfer mechanism for Carbon Financial Instruments owned by Registry Account Holders.

The three components are integrated to provide Registry Account Holders with real-time data to support trading, assist in managing member emissions baselines, reduction targets and compliance status.

2.3.7 Reporting, verification and compliance

CCX has contracted with the National Association of Security Dealers (NASD) to provide regulatory services. NASD assists in the registration, market oversight, and compliance procedures for CCX members. NASD audits a representative sampling of each member's emission baseline and annual true-up, and reviews offset projects verification procedures. NASD utilises its state-of-the-art market surveillance technologies to monitor CCX trading activity. To ensure environmental integrity, offset verification services are provided by CCX-approved verifiers and are required for all exchange offset projects.

2.3.8 Results

As of September 2006, results had only been released for the first two emission reduction compliance periods (calendar years 2003 and 2004). This showed that the direct emission reduction achieved in the first year was some 21.6 million tCO₂e or 8.7 per cent better than the emissions objective, while the reduction achieved in the second year was some 32.3 million tCO₂e or 13.8 per cent better than the emissions objective. All CCX Members with direct emissions reduction commitments were in compliance.

2.4 European Climate Exchange (ECX)

2.4.1 Overview

The European Climate Exchange (ECX) was established in 2004 and is a wholly-owned subsidiary of the Chicago Climate Exchange. It manages the sales and marketing for ECX Carbon Financial Instruments (ECX CFIs) listed on the Intercontinental Exchange (ICE) Futures electronic platform. Each ECX CFI is based on emission allowances issued under the EU's Emissions Trading Scheme. There is no information available at this time as to whether the ECX has the potential to also support a voluntary emissions trading scheme involving aviation, but given the link with the CCX, voluntary trading could be a matter that interested airlines or other parties could explore with the ECX. ECX daily prices per tonne of CO₂ have ranged from €20 or US\$25 (April 2005) to €30 or US\$37 (April 2006). The ECX market price in September 2006 for CO₂ was about €16 or US\$20 per tonne. In October 2006 the ECX traded its first emission option, giving buyers and sellers the ability to hedge price risks.

2.5 Montreal Climate Exchange (MCeX)

2.5.1 Overview

The Montreal Climate Exchange (MCeX) was established in July 2006 as a partnership arrangement between the Montreal Exchange (MX) and the Chicago Climate Exchange (CCX). It is intended to accelerate the development of a structured environmental market in Canada. The MX brings to the new climate exchange its expertise in leading-edge trading systems, clearing, market regulation and financial risk management. The CCX contribution is its extensive experience in operating climate exchanges in North America and Europe.

The mission of the MCeX is to offer price transparency, environmental integrity, low cost, wide access and reliability to those sectors of the Canadian economy involved in air quality and climate change concerns. Further details on the nature of the intended trading were not available

at the time of writing (August 2006), but given the link with the CCX, it could be expected to include some form of voluntary emissions trading.

2.6 Asia Carbon Exchange (ACX-Change)

2.6.1 Overview

The Asia Carbon Exchange (ACX-Change) was launched in August 2006 and is a fully owned subsidiary of the Asia Carbon Group, which is headquartered in the Netherlands. The ACX-Change is a Clean Development Mechanism (CDM) focused exchange. It claims to be uniquely positioned as a global platform for sellers and buyers of Certified Emission Reductions (CERs), having a presence in both Annex 1 and non-Annex 1 countries. It gives sellers of CERs an exposure to a large number of potential buyers while giving buyers a broad range of CER sources with varied risk/benefit profiles to choose. There is no indication as to whether this trading platform could be used to support a voluntary emissions trading system involving aviation.

2.7 Voluntary Carbon Offset Schemes

2.7.1 Context

For a number of years now, consumers have been able to offset the emissions from their flights via the facility provided by independent carbon offset providers. These organizations sponsor projects, which aim to reduce carbon emissions. Initially the focus was on reforestation (tree-planting), but emphasis has now shifted towards renewable energy supply and energy conservation in countries not covered by the Kyoto protocol (hence avoiding double-counting of emissions reductions).

There is increasing interest among private and corporate airline customers in the climate change impact of air travel. Within the UK, the aviation industry, as part of its Sustainable Aviation strategy, made a commitment in 2005 to “evaluate carbon offset initiatives” as a practical, short-term measure with the aim of informing passenger understanding of the impact of air travel. The UK Government has committed to offset the emissions from central government official air travel from April 2006.

2.7.2 British Airways’ offset scheme

In September 2005 British Airways launched a voluntary carbon offset scheme which operates via its website. The scheme is aimed at raising passenger understanding of the climate impacts of air travel. Alongside the opportunity to offset emissions, customers are provided with information about how the airline is seeking to reduce its climate change impact.

Passengers are able to offset the CO₂ emissions created during their flights by making a voluntary contribution to an organisation called Climate Care. The money raised is used by Climate Care to invest in projects that avoid, reduce or absorb carbon dioxide emissions through renewable energy, energy efficiency and forest restoration. The voluntary contribution is calculated on an emissions cost of approximately £7.50 per tCO₂, using actual fuel consumption and load factors from the British Airways’ aircraft fleet. This translates to a contribution of £5.00 per passenger on a return flight from London to Madrid and £13.30 for a return flight from London to Johannesburg. On longer routes, such as a return flight between London and Sydney, the contribution is £28.83.

Climate Care’s work is scrutinised by an Environmental Steering Committee, which includes environmentalists and NGOs including WWF and Forum for the Future. To ensure that the projects achieve the CO₂ emission reductions that they claim, the Committee requires them to meet three criteria for each project. These are:

- that a third party report be obtained;
- that the CO₂ reductions be monitored on an on-going basis; and
- that any shortfall is made up in other projects.

For more details of the scheme and offset projects, see www.ba.com/offsetyouremissions.

CHAPTER 3 FUTURE DEVELOPMENT OF VOLUNTARY EMISSIONS TRADING SCHEMES INVOLVING AVIATION

3.1 Introduction

As can be seen from Chapter 2 of this report, voluntary emissions trading schemes are becoming established in a number of countries – including the two largest economies of the world, United States and Japan. Aviation participation is confined so far to the UK Emissions Trading Scheme, and even there, it involves domestic aviation services only. However, there is scope for more airlines to become involved in some form of voluntary emissions trading. While there are a number of possible options for achieving this, as identified in Section 1.2.2, this chapter considers four broad ways in which this might be done:

- through participation in an existing voluntary emissions trading scheme;
- through the development of carbon offsets;
- through the development of voluntary agreements as a precursor to an emissions trading system; and
- through the establishment of an aviation-only voluntary emissions trading scheme.

3.2 Participation in an existing voluntary emissions trading scheme

The extent of significant voluntary emissions trading schemes worldwide is generally as described in Chapter 2. On this measure, there would presently appear to be few opportunities available for airlines to participate in existing voluntary schemes. Furthermore, some of these schemes are either not open to new participants, are limited to certain countries, or do not appear to be readily adaptable for participation by airlines. These existing voluntary schemes may nevertheless be a first step towards voluntary emissions trading and might be expanded in the future.

The UK Emissions Trading Scheme (UK ETS) is a 5 year pilot scheme that ended in December 2006, so it is not possible for other airlines (or organisations of any type) to join the scheme

Japan's Voluntary Emissions Trading Scheme (JVETS) is based on the provision of government subsidies to participants for the installation of emissions reduction equipment. It is difficult to see how this approach could be applied to airline operations given the technology constraints with aircraft engines. It is most unlikely that new aircraft engines or even replacement aircraft could be justified within the current structure of the scheme. However, there may be opportunities for certain airline ground operations to qualify for participation in a voluntary scheme of this type, for example, replacement of auxiliary power unit operation by fixed airport power supply.

The Chicago Climate Exchange (CCX) and similar schemes would therefore seem to be the only types of existing schemes that have any potential for providing a voluntary emissions trading facility for aviation. Even here there are significant implications for airlines that may wish to participate particularly in relation to the emissions reductions targets specified by the CCX.

It is likely that new voluntary emissions trading schemes for ground sources will be developed in the future. The adaptability of future schemes for aviation is a matter that cannot be assessed in advance. When considering the possible integration of aviation into such voluntary schemes, it could be expected that the aviation specific issues that arise would generally be similar to those applying to the integration of aviation into mandatory emissions trading schemes. Entities considering participation in a voluntary trading scheme should therefore refer to the *ICAO*

Guidance on Aviation Emissions Trading for a detailed discussion of relevant issues.

3.3 Development of carbon offsets

Some airlines may face a position where no suitable voluntary emissions trading scheme exists in their country or region. Alternatively, they may prefer to initially become involved in a more basic scheme rather than a relatively complex trading scheme involving other airlines or sectors. In these circumstances, airlines may consider carbon offsets as a market-based mechanism for reducing emissions. Carbon offset providers are active in Europe, North America and in many other regions around the world.

There are two approaches that might be considered.

1. An airline provides a capability for its customers to voluntary offset their emissions.

This could be similar to the British Airways' offset scheme described in Section 2.7.2 of this report. The key feature of this approach is that the airline actively promotes the scheme as part of the ticket booking system rather than just leaving it to passengers to find a carbon offset provider through their own initiative. It would be the airline's responsibility to:

- select the most appropriate carbon offset provider;
- determine the voluntary contribution rate per ton of CO₂ emissions based on fuel consumption performance;
- facilitate calculation, arrange collection and on-forwarding of customer contributions to the offset provider; and
- promote the environmental benefits of the scheme.

Some of the main advantages of this type of scheme are its simplicity, short lead time for implementation and independence from other airlines or industry sectors. A key disadvantage is that there is no predetermined amount of emissions reduction over a specific period or the course of the scheme. This could be addressed by the following approach.

2. An airline decides to offset some or all of its emissions, using its own resources.

In many respects, the steps in establishing this scheme would be similar to the scheme above except that responsibility for funding the offsets would fall on the airline itself rather than on individual passengers. The financial implications for the airline would be directly dependent on the amount of emissions that the airline chose to offset. The main benefit of this type of scheme is that the amount of emissions reductions for a defined period could be predetermined by the airline, and associated offset projects could be more substantial and better planned because of income predictability.

3.4 Development of voluntary agreements as a precursor to an emissions trading system

ICAO has created a Template for Voluntary Measures that may be used by airlines and/or governments as a starting point for the development of voluntary agreements to achieve emissions reductions. For example, such agreements might be based upon the establishment of a future fuel efficiency target for aircraft operators. To provide a basis for emissions trading such an agreement should include an enforceable commitment to achieve emissions reductions that are below an appropriate baseline.

To the extent that voluntary trading would be part of a voluntary agreement between government and industry partners, the ICAO Template for Voluntary Measures may be a useful reference

document. It should however be noted that the ICAO Template was not designed with voluntary emissions trading schemes in mind and would have to be adapted for this purpose. The ICAO Template is available from ICAO at http://www.icao.int/icao/en/env/Caep_Template.pdf.

3.5 Establishment of a voluntary emissions trading scheme for aviation

One approach might involve the establishment by a group of airlines of a new voluntary emissions trading scheme for international aviation. This option would have more chance of being realised if it had the support of government(s). Given the greater worldwide focus by governments on solutions to climate change issues, the likelihood of such government support could be expected to increase over time.

This section will not attempt to address all of the issues involved in establishing a new emissions trading scheme but will only focus on aviation specific issues. In doing so, it is recognised that many of the aviation issues would be common to participation in either a voluntary scheme or a mandatory scheme. For other aviation issues, there would be specific differences between voluntary and mandatory schemes.

3.5.1 Commonalities between voluntary and mandatory emissions trading schemes

The *ICAO Guidance on Aviation Emissions Trading* discusses the aviation specific issues relevant to the inclusion of international aviation in mandatory emissions trading scheme. This section draws on the guidance provided in that document to identify issues whose consideration in voluntary or mandatory schemes would be similar.

3.5.1.1 Accountable entities

Given that the voluntary emissions trading scheme considered in this section is assumed to be established by a group of airlines, then it follows that the accountable entities would be aircraft operators.

Accountable entities participating in a voluntary emissions trading scheme will be required, individually or jointly, to hold at the end of a trading period the necessary number of allowances (or credits) covering all relevant emissions, based on measured or modelled (calculated) emissions of their operations under the scope of the scheme.

3.5.1.2 Emission sources

The relevant sources of emissions that are to be controlled by the aircraft operator need to be defined. It is preferable that for international aviation the emission source be defined as all civil flights by the aircraft operator within the geographic scope of the scheme. Depending on the number and type of aircraft operators seeking to join the scheme, to lower the administrative burden it may be necessary to make exceptions by establishing an inclusion threshold based on aggregate air transport activity, aggregate emissions (measured in CO₂) or aircraft weight.

3.5.1.3 Emissions species

While participants are free to choose which emissions species to include in the scheme, there are several factors that could lead airlines to only include their CO₂ emissions. CO₂ emissions are the largest and most certain of the greenhouse gas emissions from the aviation sector. While non-CO₂ gases are potentially significant, there currently exists a high degree of scientific uncertainty associated with most of them. A CO₂ based scheme is most likely to be compatible with other trading schemes and so increase the potential for future trading between schemes. This would not preclude the inclusion of other aircraft emissions that contribute to climate change in the longer run.

3.5.1.4 International and domestic emissions

As States may take action to address international or domestic emissions in the future, any voluntary emissions trading scheme should take the precaution of distinguishing between international and domestic aviation emissions.

The IPCC definition of international and domestic emissions should be used for the purposes of accounting for greenhouse gas emissions from civil aviation. This approach is internationally accepted and will help ensure consistency between the various approaches of States and participants in voluntary schemes.

3.5.1.5 Distribution of allowances

Distribution of allowances could occur through grandfathering, auctioning or benchmarking. Grandfathering and auctioning do not raise specific issues that are significantly different for aviation than for other sectors. If benchmarking is being considered for distributing emissions allowances within the scheme, then recognition should be given to previous investment in new technology. Incentives should also be provided to operate the most emissions efficient aircraft in the most efficient way in the future.

3.5.1.6 Monitoring, reporting and verification

To ensure the integrity of the trading system clear procedures should be defined for monitoring, reporting and verification of emissions data. These procedures are primarily needed to help accountable entities identify and correct data and/or calculation errors. To avoid misrepresentation of actual emissions, verification procedures are important to ensure equitable treatment of all participants and to publicly demonstrate that obligations are fulfilled. Scheme participants would be responsible for the accurate and timely reporting of emissions data.

3.5.2 Differences between voluntary and mandatory emissions trading schemes

There are a number of issues that would clearly be different in a voluntary scheme compared with a mandatory scheme. One overarching consideration is whether the voluntary scheme would be accepted for trading by other emissions trading systems. Additional considerations are as follows:

3.5.2.1 Participation

By definition, there would be no compulsion to participate in a voluntary emissions trading scheme. In order to widen the scope of the scheme, increase the potential environmental benefits and the economic efficiency, and minimise competitive effects, airlines could consider joint participation, for example, as part of an airline association or airline alliance. New entrant airlines would not be obliged to participate in a voluntary scheme but should be able to join if they wished. Once emissions reductions commitments were made, there would need to be an enforceable obligation for participants to meet their targets.

3.5.2.2 Incentives

Governments may see benefits in providing financial support or incentives for the establishment or ongoing administration of a voluntary trading initiative. A voluntary scheme with incentives may encourage wider industry participation leading to additional environmental benefit. Incentives may also facilitate quicker implementation.

3.5.2.3 Targets and timelines

Participants could decide amongst themselves the stringency and the timing of the emissions reduction targets that would apply under the scheme. Targets would need to be set at a level that would give credibility to the scheme as an effective emissions reduction initiative. Conceivably, airline trade bodies could facilitate the negotiation and definition of relevant targets and timelines.

3.5.2.4 **Types of trading systems**

There is more flexibility in designing a voluntary trading scheme. Besides having the choice between adopting a capped system with allowances or some form of baseline and credit system, participants could opt for meeting their reduction targets separately and individually or for example jointly under a “bubble” agreement. The latter approach may combine a semi-open trading system with a clearinghouse function managed by a central administrator⁸.

3.5.2.5 **Trading unit**

The participants in a voluntary scheme can decide amongst themselves the nature of the trading unit (or “allowance”) to be used in the scheme. The allowance could represent an absolute amount of emissions (e.g. 1 tonne of CO₂) or, alternatively, an amount of emissions related to some measure of output (e.g. grammes of CO₂ per ATK, RTK, ASK, or RSK).

To avoid the drawbacks of a ‘closed’ trading system, the scheme could be designed in a way that would allow participants to purchase offsets outside the scheme in order to keep costs down. However, selling scheme allowances into other trading schemes would depend on whether those other schemes accept these.

3.6 **How voluntary emissions trading for aviation could develop**

Looking at how voluntary emissions trading measures involving aviation have developed to date may provide some insight as to how new measures may develop into the future.

It would seem that carbon offset schemes have potential for early expansion. They can be implemented unilaterally by an individual airline and do not require any form of support from governments or other industry partners. Such schemes could be used as a positive marketing tool by airlines. Initial schemes could be based on carbon offset decisions by individual customers. They could then evolve into a defined reduction scheme where the airline predetermines the amount of emissions reduction to be achieved.

Carbon offset schemes or voluntary agreements, depending on their nature, could be seen as a first step towards wider voluntary emissions trading although it is recognised that this is not a prerequisite. With more airlines having experience with carbon offset schemes and/or voluntary agreements, it might then be easier for them to turn their attention to a voluntary trading scheme as a group than it might be at the present time.

Government support would appear to be an important ingredient in a voluntary emissions trading scheme although not essential. With the back-up of a well established carbon offset scheme and/or voluntary agreements, airlines may find that government support for a trading scheme is more forthcoming.

The establishment of an airline-only emissions trading scheme would be within the capability of a group of airlines. The limitations of a closed trading system could be overcome by the ability to purchase offsets from other sectors. The level of sophistication and degree of integration with other sectors could then evolve over time.

⁸ The role of administrator could be filled for instance by a governmental agency, an industry body or an independent entity.

3.7 **Role of ICAO**

While the possibility exists in theory, ICAO would not normally be directly involved in setting up voluntary emissions trading schemes. There are however roles that ICAO could pursue to encourage and support the development of voluntary schemes that interested Contracting States and international organisations might propose, for example by

- Providing a forum to develop and review voluntary emissions trading schemes;
- Providing technical information to support such schemes;
- Encouraging consistency between such schemes;
- Encouraging the use and recognition of such schemes; and
- Facilitating or assisting in the verification of aviation emissions data.

3.8 **Further information**

Further information can be found in the draft *ICAO Guidance on Aviation Emissions Trading* where the various design options are discussed in more depth and a number of recommendations are provided.

3.8.1 Finally, more general background information on emissions trading is available from the ICAO web site at (www.icao.int).

GLOSSARY

The terms contained herein are not intended to be universal definitions, but rather to clarify concepts as used in this document.

Accountable Entity

A physical or legal person which, in a given emissions trading scheme, is responsible for emissions from international aviation under the scheme.

Allocation

Method for initial distribution of allowances among States for a commitment period.

Allowance (Emission allowance)

An allowance is a tradable emission permit that can be used for compliance purpose in an emissions trading system. An allowance grants the holder the right to emit a specific quantity of pollution once (e.g. one tonne of CO₂).

Annex B Parties or Countries

Annex B countries are the 39 emissions-capped industrialised countries and economies in transition listed in Annex B of the Kyoto Protocol.

Annex I Parties or Countries

Annex I countries are the 36 industrialised countries and economies in transition listed in Annex I of the United Nations Framework Convention on Climate Change (UNFCCC).

Anthropogenic greenhouse-gas emissions

Greenhouse-gas emissions resulting from human activities.

ATK

Available Tonne Kilometres - a measure of an airlines total capacity (both passenger and cargo).

ASK

Available Seat Kilometres – a measure of an airlines passenger carrying capacity.

Auctioning

Auctioning is an initial distribution method in which allowances are sold in an auction.

Baseline

Total amount of allowances distributed to a sector or an accountable entity.

Benchmarking

An initial distribution method in which allowances are allocated free of charge based on a specific benchmark, for example emissions per unit of output.

Bubble

A bubble is a regulatory concept whereby two or more emission sources are treated as if they were a single emission source.

Buyer

A legally recognised entity (individual, corporation, not-for-profit organisation or government, etc.) who acquires credits, reductions or allowances from another legally recognised entity through a purchase, lease, trade, or other means of transfer.

Cap and Trade

The Cap and Trade system involves trading of emission allowances, where the total amount of allowances is strictly limited or 'capped' by a regulatory authority. Allowances are created to account for the total allowed emissions. At the end of each compliance period each entity must surrender sufficient allowances to cover its emissions during that period. Trading occurs when an entity can reduce units of emission at a lower cost than another entity and then sells the allowance. A Cap and Trade system is generally based on those entities included in the cap.

Carbon Dioxide (CO₂)

A naturally occurring gas that is also a by-product of burning fossil fuels and biomass, land use changes and other industrial processes. Carbon dioxide is the reference gas against which the global warming potential of other greenhouse gases is measured.

Carbon Dioxide Equivalent (CO₂e)

The universal unit of measurement used to indicate the global warming potential (GWP) of a greenhouse gas.

Certified Emission Reductions (CERs)

A Kyoto Protocol unit equal to 1 metric tonne of CO₂ equivalent. CERs are issued for emission reductions from CDM project activities.

CH₄

Methane – a greenhouse gas.

Cirrus cloud

A type of cloud composed of ice crystals and shaped like hair like filaments. May partly be aviation induced.

Clean Development Mechanism (CDM)

A mechanism under the Kyoto Protocol through which developed countries may finance greenhouse-gas emission reduction or removal projects in developing countries, and receive credits for doing so which they may apply towards meeting mandatory limits on their own emissions.

Climate Change

A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods (Source: UNFCCC).

Closed emissions trading

An emissions trading scheme that is designed to limit or reduce emissions within one sector only without providing access to allowances or credits outside the scheme.

Contrails

The condensation trail left behind jet aircraft. Contrails only form when hot humid air from jet exhaust mixes with ambient air of low vapour pressure temperature.

Credit

A term most commonly used in relation to emission reductions that have been achieved below a predefined, agreed baseline. Once the reduction has been verified by an accredited entity, the authority issues a credit. The credit grants the holder the right to emit a specific quantity of pollution once (e.g. one tonne of CO₂).

Distribution

Method for apportioning allowances among accountable entities.

Domestic flights

Emissions from civil domestic passenger and freight traffic that departs and arrives in the same country (commercial, private, agriculture, etc.), including take-offs and landings for these flight stages.

Domestic operations

Domestic flights and other aviation activities by an airline relating to those flights.

Emissions Trading

Emissions Trading is a market-based system that, in principle, can allow accountable entities the flexibility to select the most cost-effective solutions to achieve established environmental goals. With emissions trading, entities can meet established emission goals by: (a) reducing emissions from a discrete emissions unit within an entity's boundaries; (b) reducing emissions from another place within the entity; or (c) securing emission reductions from the marketplace. Emissions trading can encourage the implementation of cost-effective emission reduction strategies and provide incentives to emitters to develop the means by which emissions can inexpensively be reduced. Under the Kyoto Protocol, "emissions trading" is one of the three Kyoto mechanisms, by which an Annex I Party may transfer Kyoto Protocol units to or acquire units from another Annex I Party. An Annex I Party must meet specific eligibility requirements to participate in emissions trading.

Fiscal Year (FY)

A fiscal year (or financial year) is a 12 month period used for calculating ("yearly") financial reports in business and other organisations. The specific 12 month period varies between countries,

Fossil Fuels

Carbon-based fuels that include coal, petroleum, natural gas and oil.

Geographic scope

Refers to the geographic coverage of aviation emissions under the trading scheme, i.e. specification of the countries, routes and type of flights/aircraft to be included.

Global Warming Potential (GWP)

Global Warming Potentials (GWP) are calculated as the ratio of the radiative forcing of one kilogramme greenhouse gas emitted to the atmosphere to that from one kilogramme CO₂ over a period of time (100 years). Carbon dioxide has been designated a GWP of 1; Methane, for instance, has a GWP of 23.

Grandfathering

Method for the initial distribution of allowances free of charge to entities in an emission trading scheme according to historical emissions.

Greenhouse gases (GHGs)

The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Less prevalent --but very powerful -- greenhouse gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

Greenhouse gas reduction or Emissions reduction

A reduction in emissions intended to slow down the process of global warming and climate change. Greenhouse gas reductions are often measured in tonnes of carbon-dioxide-equivalent

(CO₂e), which is calculated according to the GWP of a gas.

H₂O

Water (vapour).

HC

Hydrocarbons.

Hydrofluorocarbons (HFC)

A group of greenhouse gases subject to limitations under the terms of the Kyoto protocol.

Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) has been established by the World Meteorological Organisation (WMO) and the United Nations Environmental Programme (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is open to all Members of the UN and of the WMO.

Kyoto Protocol

An international agreement standing on its own, and requiring separate ratification by governments, but linked to the UNFCCC. The Kyoto Protocol, among other things, sets binding targets for the reduction of greenhouse-gas emissions by industrialized countries.

Methane (CH₄)

A greenhouse gas.

Nitrogen oxides (NO_x)

Generic term for oxides of nitrogen (NO, NO₂, NO₃).

Nitrous oxide (N₂O)

A greenhouse gas.

Non-Annex I Parties or Countries

Countries not included in Annex I of the United Nations Framework Convention on Climate Change UNFCCC.

O₃

Ozone.

OECD

The Organisation for Economic Co-operation and Development.

Offsets

An emissions reduction achieved by undertaking a greenhouse gas emission reduction project.

Open emissions trading

An emissions trading system where allowances can be traded in and outside the given scheme or sector. E.g., within an emissions trading scheme for aviation, participants would be allowed to buy allowances from sectors outside the aviation emissions trading scheme.

Perfluorocarbons (PFC)

A group of greenhouse gases.

Radiative forcing (RF)

A change in average net radiation (in Wm^{-2}) at the top of the troposphere resulting from a change in either solar or infrared radiation due to change in atmospheric greenhouse gas concentrations; perturbation of the balance between incoming solar radiation and outgoing infrared radiation.

RSK

Revenue Seat Kilometres.

RTK

Revenue Tonne Kilometres.

Seller

A legally recognised entity (individual, corporation, not-for-profit organisation, government, etc.) who sells reductions, credits or allowances to another legally recognised entity through a sale, lease, trade, or other means of transfer.

Soot

Substance emitted by aircraft; may have both warming and cooling climate impacts.

Sulphate

Substance emitted by aircraft; which may have a cooling impact.

Sulphur hexafluoride (SF₆)

A greenhouse gas.

Surrender

The handing in of allowances for emissions by the accountable entity in order to fulfil the obligations under the emissions trading scheme.

United Nations Framework Convention on Climate Change (UNFCCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 189 countries having ratified. Under the Convention, governments gather and share information on greenhouse gas emissions, national policies and best practices, launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries and cooperate in preparing for adaptation to the impacts of climate change.

Verification

Verification provides independent assurance that emissions reporting has been realised in an accurate manner. The verifiers are accredited. The level of assurance provided will depend on the scope of the verification which is usually agreed by the transacting parties and may include: adequacy of measuring and monitoring systems for emission reduction credits, reviewing the operations of the underlying emission reductions project etc.

Voluntary Action/Commitment

Actions taken by an entity that reduces greenhouse gas emissions in the absence of any regulatory requirements compelling it to do so.

Water vapour

H₂O.

APPENDIX A

