

**TOURISM, AIR TRANSPORT AND CLIMATE CHANGE
- A WORLD TOURISM ORGANIZATION DISCUSSION PAPER
September 2007**

FOCUS

Tourism – business and leisure travel - is a significant global industry making positive contributions to growth, trade and development, with particular potential for poor countries. Tourism is both affected fundamentally by climate change and a significant contributor to the global emissions of greenhouse gases (GHGs). Best estimates for 2005 are that domestic and international tourism contributed about 5 per cent of global carbon dioxide emissions and a little less in terms of radiative forcing (considering all GHGs).

The United Nations system is developing a long term post Kyoto response to climate change. The World Tourism Organization (UNWTO), as the specialized UN Agency “with a central and decisive role in promoting the development of responsible, sustainable and universally accessible tourism”, will work closely with other UN bodies to support this activity. UNWTO is seeking ways for tourism constituents, including tourists themselves as well as providers, both to adapt to climate change and to mitigate GHG emissions while reinforcing the contribution of the sector to socio-economic development in general and the Millennium Development Goals in particular.

This paper focuses on tourism’s air transport component, which is the primary contributor of GHGs in the sector and by far the dominant contributor as far as international tourism is concerned, as a basis for discussion alongside, and subsequently for policy integration with, analysis of other transport modes and of other components of the tourism product.

Initial research and discussion leads to the following tentative conclusions regarding air transport and climate change mitigation, for further investigation and consultation:

1. that GHG emissions from air transport need to be addressed more substantively from the perspective of the primary user, the tourism sector
2. that measures taken to reduce air transport emissions need to reflect coherence with strategies to reduce poverty and promote development in the world’s poorest countries
3. that all efforts to reduce emissions through improvements in airframe and engine technology, air traffic management and operational practices should be strongly supported
4. that economic instruments need to be addressed in partnership by all the international governmental parties directly concerned, notably UNWTO, UNEP and UNFCCC itself as well as ICAO, and in close consultation with the private sector

5. that funds collected from economic instruments should be applied to resolving the specific problems surrounding aviation and tourism rather than buried in general tax revenues
6. that amongst economic instruments currently under consideration:
 - Emissions Trading Schemes show promise, particularly if at the global level they apply the principle of *Contraction and Convergence*, providing net economic benefits for developing countries and preferential measures for the Least Developed Countries
 - the potential beneficial impact of carbon offset on total emissions can be questionable but the concept is worth further exploration on the basis of certain prescribed criteria plus validation and certification of appropriately directed offsets
 - levies (taxes, charges, duties) and incentives could lead to behavioural change affecting tourism as well as aviation, and should only be applied in the context of 4 above
7. that GHG emissions from air transport might be reduced without significantly affecting the socio-economic benefits offered by tourism through some substitution of alternative modes of transport for tourists for short haul and some adaptation of frequency of travel and length of stay for leisure tourism at both short and long haul; however, this would require fundamental behavioural and operational changes, particularly for short haul travel, and such developments should not impact on the growth of air transport to developing countries
8. that a systemic approach with a combination of measures outlined above is more likely to provide effective long term solutions geared to developmental patterns
9. that, whatever the approach taken for reducing GHG emissions, it should be even-handed in its application amongst primary users (tourism and freight) and amongst modes of transport
10. that further work should be undertaken on establishing baselines and both absolute and efficiency-based performance metrics regarding GHG emissions from tourism and its primary components (transport, by mode; accommodation type; activity, etc) globally and by destination.

1. Overview

1.1 The World Tourism Organization (UNWTO) has been fostering sustainable development of tourism for over 25 years, providing guidance and direction to industry stakeholders, destinations and tourists themselves.

1.2 A number of important initiatives have provided the foundation for a range of research, capacity building and technical cooperation activities and publications of the Organization (www.unwto.org/sustainable). These include: a Tourism Bill of Rights and Tourism Code (1985); Agenda 21 for Travel & Tourism (jointly with the World Travel and Tourism Council and the Earth Council, 1995); a Charter for Sustainable Tourism (jointly with UNEP, UNESCO and the European Union, 1995); and a Declaration on Ecotourism (2002). In September 2007, UNWTO launched a “Climate and Tourism Information Exchange Service” created to serve as a dynamic display for data, studies, policy papers, videos and other material related to tourism and climate change. (climate.UNWTO.org).

1.3 Sustainable development is an integrated component of the Organization’s broader commitment to tourism, travel and the Millennium Development Goals. In 2002, during the Johannesburg World Summit on Sustainable Development (WSSD), UNWTO launched a programme on Sustainable Tourism for Elimination of Poverty (ST-EP) to raise new funds for environmental improvement projects which specifically target poverty reduction. This was incorporated into a broad programme of Liberalization with a Human Face linking activities to support fair trade, sustainability and poverty alleviation.

1.4 In addition UNWTO has initiated an overarching grassroots programme to extend basic responsibility values to all stakeholders in the tourism sector. In 1999 the Organization issued a Global Code of Ethics for Tourism which incorporates the principles of sustainability as well as good governance and poverty responsiveness. This Code is being incorporated into national legislation in many countries and is also being strongly advanced at the community and individual level.

1.5 UNWTO is now moving into a new phase, fostering judicious growth as a prerequisite to consolidate tourism as a key agent in the fight against poverty and a primary tool for sustainable development.

1.6 In regard to climate change, which is increasingly emerging as one of the most trenchant long term global challenges, UNWTO convened a Conference on Climate Change and Tourism in Tunisia in 2003, a summit of public and private sector leaders which resulted in the Djerba Declaration on Tourism and Climate Change, setting out a sectoral framework for ongoing analysis and response. In order to take into account the progress made in knowledge as well as recent developments, UNWTO is holding a second Conference in 2007, with a technical segment 1-3 October in Davos, Switzerland,

supported by the World Economic Forum, followed by a Tourism Ministerial Summit in London, United Kingdom, 13 November. The results will be considered later in November by UNWTO's biennial Assembly session in Cartagena de Indias, Colombia and, last but by no means least, will be input to the United Nations Climate Change Conference in Bali, Indonesia, in December, where the focus will be on post-Kyoto action. The ideas in the present paper are *inter alia* serving as part of the general consultation process in association with these events, with a view to evolving strategies for the sector on the basis of partnership with other international bodies and with the private sector.

2. Tourism, Economic Prosperity and Social Well-Being

2.1 The number of international tourist arrivals has risen from 25 million in 1950 to 840 million in 2006. The revenues generated by these arrivals – not including airline ticket sales and revenues from domestic tourism¹ – have risen at an average rate of 11.2 per cent a year (adjusted for inflation) over the same span of time, that is nearly twice as fast as arrivals and a growth rate that far outstrips that of the world economy as a whole. International tourism receipts reached 735 billion dollars in 2006, almost 900 billion including air tickets, making tourism not only a socio-economic driver but one of the largest categories of international trade. Tourism represents one quarter of all exports of services – 40 per cent with air transport revenues included.

2.2 There can be particular benefits from tourism for the poorest economies, where international arrivals are growing at twice the rate in the industrialised States. Although they are still at a low level, the tourism receipts of the Least Developed Countries increased fivefold between 1990 and 2005, from 1 billion to 5 billion dollars. Tourism has become one of the largest sources of foreign exchange revenues for developing countries generally and for the 49 LDCs specifically, reducing their foreign debt and diversifying their economies. Tourism is often the principal service sector activity and it is a notably effective catalyst for gender equality, employment of young people, rural regeneration, cultural preservation and nature conservation

2.3 For all these reasons, tourism can play a major role in improving the standard of living of disadvantaged populations and helping them lift themselves above the poverty threshold. Tourism can be a primary tool for achievement of the Millennium Development Goals, as long as a balance with climate change effects is maintained.

3. Tourism and Sustainability

3.1 Sustainable development represents the continuous effort to balance and integrate the three pillars of social well-being, economic prosperity and environmental protection

¹ Domestic tourism is much larger than international tourism but the principles outlined in this paper, derived from international practice, are equally applicable. Through its work on destination management UNWTO brings these principles in to play at the domestic levels. This will be accentuated through the new Centre of Excellence for Destinations which was launched in Montréal in February 2007.

important where tourism is a source of development support and local community well-being in poor countries.

4.3 At the same time, UNWTO recognises that tourism contributes to the causes of climate change and the consequent need for **mitigation**. While concerns about tourism's polluting effects cover all aspects of a tourist's activity, the primary issue regarding climate change factors relates to the Greenhouse Gas (GHG) emissions in the sector. Current best estimates² are that in 2005 tourism (domestic and international) contributed approximately 5 per cent to global emissions of carbon dioxide and a little less than that in terms of radiative forcing (considering all GHGs). This is primarily generated through consumption by travellers of transport services (accounting for an estimated 75 per cent of the tourism contribution) and energy consumption in tourism establishments (like air conditioning, heating and lighting in hotels). The tourism sector has a responsibility to minimise harmful emissions by encouraging sustainable, carbon-neutral transport solutions and low carbon market destination combinations, to improve the use of natural resources (water, energy) and to contribute to the conservation of natural areas.

4.4 Tourism, like other sectors is capable of substantial reduction in its carbon emissions as a result of applying **new technologies**; for example, accommodations and restaurants can apply renewable energy (solar and wind); land transport can use cleaner energy and hybrid engines; aviation can benefit from technologies that shorten air routes and improve descent procedures and fuel consumption. Over the period to 2050 there are possibilities suggested by aircraft manufacturers and by IATA for alternative fuel powered and low emission aircraft.

4.5 Whatever the environmental outcome, tourism cannot be seen in isolation. Major changes in the pattern of demand will lead to wider impacts on many areas of economic and social policy - such as, for example, in employment and labour demand and in regional policy issues such as housing, transport and social infrastructure. Given tourism's significant catalytic impacts across the economy as a whole, knock-on effects will impact other sectors, such as agriculture supplying tourism demand, handicraft industries, local small business networks, financial services and so on. There is need to ensure that the poorest countries, for which tourism can be fundamental to development, are capable of playing their part in the process of adaptation and mitigation, as well as benefiting from new technologies. This will require new sources of financing as well as refocusing existing sources to support climate-related initiatives.

² *Climate Change and Tourism: Responding to Global Challenges*, paper prepared by a group of experts on Climate Change and Tourism for the UNWTO Conference on Tourism and Climate Change (eCLAT), September 2007; plus Gössling, S (2002), *Global environmental consequences of tourism*, *Global Environmental Change* 12, 283-302, supplemented by additional material provided by the author and his colleagues (including Peeters, P. et al., *Major environmental impacts of European tourist transport*, *J. Transp. Geogr.* (2007), doi:10.1016/j.jtrangeo.2006.12.007). The eCLAT and Gössling papers are a comprehensive collation and synthesis of a range of material on both adaptation and mitigation, including analyses from the Intergovernmental Panel on Climate Change.

4.6 The diverse impact is reflected in the broad network of cooperation by UNWTO on environmental issues with both the public and the private sectors. In the United Nations framework, UNWTO has collaborated with the United Nations Environment Programme (UNEP), United Nations Convention to Combat Desertification (UNCCD), United Nations Educational Scientific and Cultural Organization (UNESCO), United Nations Framework Convention on Climate Change (UNFCCC), International Civil Aviation Organization (ICAO), World Health Organization (WHO) and World Meteorological Organization (WMO), as well as the Intergovernmental Panel on Climate Change (IPCC).

4.7 Addressing the UNEP Governing Council in February 2007 Francesco Frangialli, Secretary General of UNWTO, pledged to help bring the tourism sector to the table in the global response to climate change. He announced a programme of work culminating in the two major conferences in 2007 mentioned above – the sectoral event in Davos in October and the global ministerial-level conference in London in November. “There is now unequivocal proof from the Intergovernmental Panel on Climate Change (IPCC) and the United Kingdom Stern report that the climate challenge is real and that we must all play our part in its resolution. Tourism is an important sector of the global economy and a vital link in human communications, cultural interface and development. We know that like other key sectors we play a part in the problem and that we have to be responsive and responsible as temperatures, sea levels and other climactic conditions evolve. We will work even more closely with UNEP and other sister agencies like ICAO as well as the private sector in exploring new patterns of consumption and conservation, as well as fast track strategies for adaptation”.

4.8 Mr Frangialli added that there will be two overriding considerations for UNWTO: “First, promoting responsible growth of the sector to promote global trade, as well as strengthening the links between people and cultures which foster mutual understanding. This will mean innovative adaptation across the sector using all the tools and technologies as they become available. Second, ensuring that tourism remains a key tool to achieve the Millennium Development Goals, helping poor nations lift themselves out of the poverty trap. Tourism represents 40 per cent of services exports and the world’s poorest countries have comparative advantage in this area which must be encouraged as a part of responsible climate change strategies”.

5. Tourism and Air Transport

5.1 In focussing on tourism, air transport and the environment it is important to place the analysis in the broader dimension of transport as a whole. In domestic tourism road and rail are generally the dominant modes. And within regions such as Europe or North America, for example, the car is frequently used for origin to tourism destination transport as well as for local use at destination.

5.2 At the same time, over 40 per cent of the 840 million *international* tourist arrivals worldwide in 2006 reached their destination by air, with much higher percentages being recorded for long-haul destinations and for those not readily accessible by other means of

transport, including island and landlocked developing countries. Conversely, the vast majority of the 931 million international passengers (including 91 million on non-scheduled services) estimated by ICAO for the same year are defined as international tourists (any traveller staying overnight in a foreign country, thus including the majority of international business travellers)³.

5.3 Thus the tourism sector represents the primary user of air transport. Concomitantly, air transport is the primary contributor to GHG emissions in the tourism sector. Many air routes have been initiated and are sustained by the demands of growing business and leisure markets. Conversely, other air routes, notably those with charter and low-cost carrier operations, have created new tourism streams. Developing countries in particular rely on aviation-led tourism as a lifeline to inclusion, exports, foreign investment, equitable progress and poverty reduction.

5.4 Historically, there has been a close correlation between global patterns and trends in the number of international tourists and the number of international airline passengers. While in the 1990's, growth in tourist arrivals exceeded that in passengers carried, there is some indication that this trend is now being reversed.

5.5 Air transport is estimated as contributing about 40 per cent of carbon dioxide⁴ emissions from the tourism sector and over half the radiative forcing, including the domestic segment (which is much larger than international), exceeded by cars only at shorter distances including, on average, all domestic trips. Less precise estimates are currently available for international tourism, but air transport is undoubtedly the dominant contributor of GHG emissions (estimated at over 60 per cent of tourism generated carbon dioxide and higher still in terms of radiative forcing on average, with even greater dominance at longer distances, notably in connection with inter-regional transport).

5.6 A group of experts on Climate Change and Tourism, which prepared a paper on *Climate Change and Tourism: Responding to Global Challenges*, for the 2007 UNWTO Conference on Tourism and Climate Change consequently concluded that:

“While there are many options to reduce emissions [in the tourism sector], by far the greatest potential is related to air travel; reducing flight numbers and flight distances will achieve more to make tourism more sustainable than most other measures taken together.”⁵

5.7 The tourism sector consequently has a key interest in environmental issues related to civil aviation and a fundamental stake in solutions sought.

³ ICAO records passengers in terms of numbers on each flight; thus an international tourist travelling by air will count as at least two international passengers (inbound and outbound at destination, plus any connecting international flights).

⁴ Op cit footnote 2 above.

⁵ Op cit footnote 2 above.

6. Air Transport and the Environment

6.1 *Aircraft noise and local air quality* not only affect tourists en route to and from their destinations, they can constrain air transport and thus tourism development. UNWTO is therefore fully supportive of the Standards and Recommended Practices developed and promulgated by ICAO in Annex 16 Volumes I (Aircraft Noise) and II (Aircraft Engine Emissions) to the Chicago Convention and the continuous efforts to introduce greater stringency.

6.2 *Aircraft engine emissions.* Aircraft engines produce emissions that are similar to other emissions resulting from fossil fuel combustion but which are unusual in that a significant proportion is emitted at altitude, giving rise to important environmental concerns regarding their global impact. Technical improvements in aircraft and airspace have failed to keep pace with growth in air transport, with the result that emissions from the sector have been continuously rising.

6.3 *Aviation and the Global Atmosphere*, the comprehensive Special Report by the Intergovernmental Panel on Climate Change (IPCC) in 1999 remains the definitive assessment of the effect of aircraft on climate and ozone. However, as will be discussed below, the global *Fourth Assessment Report* of the IPCC, known as “*Climate Change 2007*”, contains some new material touching on aviation which attenuates some of the earlier conclusions. The 1999 Report concluded *inter alia*:

- that aircraft emit gases and particles which alter the atmospheric concentration of greenhouse gases, trigger the formation of condensation trails and may increase cirrus cloudiness, all of which contribute to climate change;
- that aircraft were estimated in 1992 to contribute about 2 per cent of emissions of carbon dioxide, the primary greenhouse gas (GHG), and 3.5 per cent of the total radiative forcing (a measure of change in climate, which includes the effect of other GHG emissions by aircraft and their effects at high altitude) by all human activities; and
- that these percentages, which exclude the effects of possible changes in cirrus clouds, were projected to grow significantly over both the short and the long term.

6.4 Anticipated continuing improvements in airframe and engine technology, and in air traffic management and operational practices (estimated at reducing fuel consumption and emissions by about 1.3 per cent per annum) would be insufficient to offset the continuing growth in air transport (estimated increasing at about 5 per cent per annum). Unlike other industries and transport modes, there was no practical alternative to kerosene-based (fossil) fuels for commercial jet aircraft for the next several decades. Thus by 2050 the carbon dioxide contribution from air transport could rise three-fold and radiative forcing 3.8 times in absolute terms from 1992 at the mid-range of scenarios. The IPCC’s reference scenario in 1999 estimated that aircraft GHG emissions would rise to

5.0 per cent of the global total by 2050, with the scenarios ranging from 3.5 per cent to 15.0 per cent. If other industries achieve significant cuts in GHG emissions, as is now anticipated, aviation's share as a proportion of the remaining emissions will rise.

6.5 Much of the ongoing emissions will not dissipate, but will accumulate in the atmosphere - carbon dioxide has an effective residence time in the air of from fifty to a hundred years and more. Thus, while air transport made a relatively small contribution to GHG emissions in 1992, it is the fastest growing contributor in relative terms (with an increase approaching 80 per cent since the Kyoto Protocol base year of 1990), it would be amongst the fastest growing in absolute terms before 2050, and it is almost the only one for which there are limited technical options at hand for substantial reductions. Thus air transport has been a focus of increasing public concern regarding climate change in recent years, has fostered a burgeoning array of studies and NGO activities, and in Europe in particular has become a mainstream issue.

6.6 As regards the global *Fourth Assessment Report* of the IPCC, "*Climate Change 2007*", this contains the fundamental conclusion that the human impact on climate change is now "unequivocal". The Report is generic to all economic sectors but, at the request of ICAO, it did in certain aspects touch specifically on aviation. In this regard, the Report concludes that the effect of linear contrails is less than previously estimated and that, while cirrus cloudiness is now seen as a fixture of global aviation operations, there is no longer any best estimate for its effect. The radiative forcing impact of aviation for the year 2005 is consequently estimated at about 3 per cent (excluding cirrus cloudiness). The Report states that "Medium term mitigation potential for carbon dioxide emissions from the aviation sector can come from improved fuel efficiency, which can be achieved through a variety of means, including technology, operations and air traffic management. However, such improvements are expected to only partially offset the growth of aviation emissions. Total mitigation potential in the sector would also need to account for non-carbon dioxide climate impacts of aviation emissions".

6.7 While not by any means discounting the responsibility of tourism in generating aircraft emissions and the need for countervailing action, it is worth pointing out that the tourism "contribution" is lower than the air transport totals estimated above, because air transport aircraft generally carry freight and mail as well as passengers.

6.8 Estimation of the passenger component is complex, depending for example on both the space and weight occupied on a passenger-carrying aircraft (including provision for cabin crew, galleys, toilets, baggage etc) and on business strategy (many airlines operate and schedule passenger-carrying aircraft on the basis solely of passenger demand and sell freight space on these aircraft at marginal cost). The ICAO Secretariat has concluded that the only realistic way of estimating the passenger contribution is to break out the whole of the cargo component (freight plus mail) carried on all aircraft, whether they are passenger or all cargo aircraft.

6.9 Hence, in 2005 passengers represented globally⁶:

International	63 %
Domestic	84 %
Total	70 %

6.10 Both Airbus and Boeing currently forecast that total cargo traffic will grow at 1.2 per cent per annum greater than passenger traffic over the next 20 years, which would reduce the total passenger contribution above by about five percentage points. International passenger traffic growth is expected marginally to outpace domestic traffic, but UNWTO forecasts tourist arrivals to grow at about a percentage point per annum less than international air passengers through 2020 (i.e. a slightly smaller percentage of tourists worldwide would arrive at their destination by air).

7. Climate Change Mitigation Measures for Air Transport

7.1 The Kyoto Protocol (1997) to the United Nations Framework Convention on Climate Change (UNFCCC) is of particular importance. The Protocol, which entered into force on 16 February 2005, requires countries listed in Annex I to the Convention (industrialized countries) which have signed and ratified the Protocol (37 of 40 on the list) to reduce their collective emissions of six greenhouse gases by an average of 5.2 percent below 1990 levels by 2008-2012. International aviation emissions are currently excluded from the targets. Instead, Article 2, paragraph 2 of the Protocol states that the responsibility for limiting or reducing greenhouse gas emissions from aviation shall fall to the Annex I Parties, working through ICAO. ICAO's geographic and policy ambit reflects its membership of 190 States, well beyond the 37 ratifying Annex I countries or even the 171 which have ratified the Protocol.

7.2 ICAO's work has been carried out by a Committee on Aviation Environmental Protection (CAEP), with members and observers from 23 States, UNFCCC, WMO, European Commission, Arab Civil Aviation Commission, industry (ACI, IATA, IBAC, IFALPA and ICCAIA) and NGOs (International Coalition for Sustainable Aviation). The organizations involved have played an important role in the process (for example IATA has co-chaired the Emissions Trading Task Force).

7.3 ICAO has placed special emphasis on airframe and engine technology, air traffic management and operational approaches but, recognizing that these will prove inadequate on their own, has also addressed "voluntary measures" and "market-based measures" such as taxes, charges and emissions trading. In the case of such economic instruments, UNWTO notes that they would have effects well beyond the aviation sphere, impacting tourism in particular, and believes that their evolution should be carried out in close partnership with UNWTO and other representative bodies. UNWTO also believes

⁶ Based on tonne-kilometres performed (a metric tonne of revenue load carried one kilometre, with each passenger with baggage generally being considered as contributing 90 kilogrammes). This methodology would rather tend to minimize the passenger contribution and the eCLAT study referred to in footnote 2 estimates the contribution of tourism-related emissions at 78.5 per cent.

that the situation has now reached a stage where more proactive policies and implementation strategies are needed. There needs to be closer interrelationship amongst UNFCCC, UNEP, ICAO and UNWTO on these issues.

7.4 With this in mind, there follow below some comments on various options under consideration by ICAO and elsewhere:

- A. Airframe and engine technology, air traffic management (ATM) and operational practices**
- B. Use of alternative modes of transport and communication**
- C. Operating restrictions**
- D. Levies (charges, taxes and duties)**
- E. Emissions trading**
- F. Carbon offset**

7.5 The underlying perspective on these options is: a) the principle of *Contraction and Convergence*, which is widely applied in the UN and other international bodies and conventions (including the Kyoto Protocol) which as applied to GHG emissions would require industrialized nations to make substantial cuts in their emissions while permitting some other countries, including industrializing nations, to increase theirs; and b) pro-development, maintaining the socio-economic advantages of tourism. These observations are also underscored by four central propositions:

- First – that a range of instruments will most likely be required to respond effectively to the climate change challenge. This will include regulatory intervention providing incentives and penalties as well as trading schemes and voluntary actions
- Second – that technology is a fundamental component of the evolution of aviation and tourism and that there must be a continuous priority focus and support for new approaches to help adaptation
- Third – that the policy requirements and targets applied to aviation to help respond to climate change must be equitably applied in relation to other sectors and to other transport modes (recognizing that the choice of instrument may vary since international and regional rules differ between modes). Effects should be measured to ensure that the reality matches the theory. Amounts collected should be applied to helping solve the problems that are created by air transport and not simply buried in general tax revenue
- Fourth – no matter what combination of solutions is applied, the overriding issue of reaching the Millennium Development Goals and alleviating poverty must be respected.

A. Airframe and engine technology, air traffic management (ATM) and operational practices – Such measures have been the primary focus of ICAO activity, and have achieved significant improvements through more stringent Standards and Recommended Practices, shortened air routes and a better operating environment. Further incremental improvements can be anticipated, but within limits. For example, new aircraft types (such as the Airbus A350XWB, the Airbus A380 and the Boeing 787) will help, but earlier types already in operation have a long lifespan. More efficient blended wing-body (BWB) aircraft designs could provide a quantum leap forward, but they would require massive investments and be unlikely to have a significant impact on aircraft fleets before 2050.

As for moving away from fossil-based fuels, the benefits of hydrogen-powered aircraft remain uncertain and the potential use of bio-fuels is limited as well as being controversial in terms of land usage. On ATM, anticipated improvements have not been achieved in recent years and there remain recognised inefficiencies, notably in Europe, where the system is fragmented. Nevertheless there is potential for significant improvements around the world, including Europe in particular, where the “Galileo” satellite navigational system will provide an added potential enhancement. The primary factor in optimization of ATM in Europe is overcoming the political hurdles in getting a common system, realigning Flight Information Region (FIR) boundaries, etc. The spreading application of Continuous Descent Arrival and approach is a factor which could show benefits worldwide.

For its part, in 2007 IATA launched a strategy on climate change issues including: improved ATM; technology (10% of fuel replaced by carbon alternatives in ten years, a 25% improvement in aircraft fleet fuel efficiency by 2020, and “a zero emissions aircraft in the next 50 years”); and implementation of global best practice Environmental Management Systems. All the proposed technological measures combined will have a significant impact but in practice for the coming decades will still fall well short of countering air traffic growth (by some 3 to 4 per cent per annum) and hence additional mitigation measures are required for air transport.

B. Use of alternative modes of transport and communication – At shorter hauls, one option would be to encourage use of alternative modes of transport. Comparison of carbon dioxide emissions according to mode depends on many factors, including length of haul; availability of renewable or nuclear energy; availability of infrastructure; vehicle type, size and age; vehicle occupancy, etc. Hence precise comparisons are very much dependent on particular circumstances. However, drawing on a wide range of available data the IPCC, in its report on *Aviation and the Global Atmosphere*, shows estimates for carbon dioxide emissions per passenger-kilometre for air travel more than twice as high as a coal-fired high-speed train and many times as high as a non-fossil fuel electrical powered train; three and a half times as high as a low occupancy, high comfort bus; and five times as high as a two-occupant small car (but at a similar level to a single-occupant

light truck)⁷. Also advanced turboprop aircraft on average emit about 20 per cent less carbon dioxide per passenger-kilometre than new jet aircraft and more than one-third less than older jet aircraft on the same route, with little addition to overall journey time. Easyjet, a European Low Cost Carrier, has recently come up with a proposal for a novel, rear-mounted “open rotor” engined, aircraft to replace short-haul aircraft like the Airbus A320 and Boeing 737 families. This “easyJet ecoJet” would emit 50 per cent less carbon dioxide, be “25 per cent” quieter than these aircraft and could be in operation by 2015. This initiative, like those of IATA mentioned above, provides valuable, if undoubtedly challenging, goals for the airframe and engine manufacturers.

Of course, all these alternatives have to be measured against convenience and price, and in Europe in particular ticket prices offered by Low Cost Carriers are very low. Some tour operators and airlines are mitigating transport emissions not only through selection of appropriate transport mode but are also through evaluation and use of multimodal options (for example coach, train or other public transport to aircraft).

At longer hauls, there is little alternative to air transport and, from the perspective of minimizing the negative impact on tourism while reducing GHGs significantly, one option might be to encourage the concept of fewer trips and longer stays by tourists (an option which could also apply to short haul). To achieve a major impact, this would require a reversal of current trends and substantial changes in consumer behaviour, especially as regards short haul travel, in tourism private sector practices and in employment culture. However, given the high stakes, the option is worth exploring further. Every small change, even a diminution in current trends, would make a contribution.

In the case of business travel, the concept of longer stays is not generally applicable. However, higher fuel prices and the increasing pressure to be “seen to be green” may finally provide the long-promised tip of the balance towards substantial inroads in air travel from video-conferencing, “telepresence” and podcasts, as well as reduction in some M.I.C.E. activity (Meetings, Incentives, Conferences and Exhibitions).

C. Operating restrictions – Recently, there have been suggestions that older aircraft be phased-out of operation, as was done in response to aircraft noise concerns regarding continuing operation of “Chapter 2” aircraft long after the more stringent “Chapter 3” ICAO Standard came into effect. This year, there have also been political initiatives in Europe for rationing the number of flights by airlines or individual passengers (with incrementally punitive taxes on multiple flights by the latter). While such proposals presently exist only in embryo form, they provide an indication of the concern regarding continuing growth in GHG emissions from air transport. A less direct form of rationing

⁷ In the case of public transport, these estimates exclude transportation (by different mode) to, from and at the airports or stations of departure and arrival, or of the use of ferries. No comparative estimates are presently available regarding the impact of the emissions generated by the manufacture (or decommissioning, ie lifecycle “dust-to-dust”) of the vehicles, or the manufacture or operation of infrastructure.

which is likely to have an increasing impact is that of airport capacity capping – expansion of existing airports and development of new airports, already facing strong resistance in many countries, is likely to intensify, with Local Air Quality and GHG emissions being added to established concerns regarding noise.

D. Levies (charges, taxes and duties) – ICAO makes a distinction between a charge and a tax, in that charges are levies to defray the costs of providing facilities and services for civil aviation while taxes are levies to raise general national and local government revenues that are applied for non-aviation purposes. Thus emissions charges may be applied in instances where they may be set against a demonstrated environmental cost. There are in practice a limited number of cases where emissions charges have been applied in connection with local air quality at airports. ICAO’s CAEP has managed to develop guidance on emissions charges related to local air quality, but legal and political issues in connection with GHG emissions charges have proven intractable to date.

As far as taxes are concerned, there is growing support in many countries for the imposition of carbon taxes, to be imposed on the carbon dioxide or GHG emissions of each entity defined. Carbon taxes are seen as an efficient economic instrument with a precisely identified and stable cost, transparent, simple and equitable, and revenue generating (with potential for investment in GHG reduction activities). However, their impact on changing high income travel habits and patterns is an uncertain quantity, and in the case of international air transport there are legal constraints on their application. Contrary to often expressed belief there is no provision in the 1944 Convention on International Civil Aviation that exempts aviation fuel from taxation (Article 24 refers only to fuel retained on-board in transit). But ICAO does have guidance material promoting such an exemption on a reciprocal basis and this concept has been included in the vast majority of the air services agreements which regulate international air transport (no less than 98 per cent of the more than 2 200 bilateral agreements filed with ICAO). Thus, except within regions such as Europe where there is a multinational body (the EU) with the authority to supplant air services agreements between individual States, agreement on taxation of aviation fuel for international operations has also proved intractable to date⁸. While fuel for other modes of transport is taxed, airlines argue that this does not discriminate in their favour since, unlike other modes of public transport, the providers pay for much of their infrastructure through airport and air navigation charges (although at the same time they often do not pay Value Added Tax for international routes or for new aircraft purchases). As regards other (non-fuel) taxes, 17 per cent of bilateral air services agreements filed with ICAO provide for reciprocal exemption from taxes on revenues or profits. However, several countries levy a tax on fuel used on domestic routes.

Other forms of levies are available. For example, the United Kingdom introduced an “excise duty” in the form of an Air Passenger Duty in 1994. Although revenues go to the general exchequer, this Duty has since ostensibly been earmarked for environmental

⁸ The EU also has a policy of removing the exemption clause from agreements by the EC or any of its Member States with other parties (this was not, however, achieved in the case of the recent EU-US “open skies” agreement).

funding applications. The Duty was doubled with effect from 1 February 2007, to £10 in the lowest class of travel and £40 in other classes for European routes, and double these for intercontinental routes. The increases are said to be aimed at behavioural change as well as providing funds for environmental projects. There is no comparable duty for air freight. At this time there is no evidence of correlation between the Duty, its increases and better environmental behaviour. However, some other countries are now considering taking a similar approach.

E. Emissions trading – Emissions trading is most often based on the concept of “cap and trade”, whereby the regulatory authority concerned places a limit on the volume of emissions covered under a scheme, allocates permits of shares of the overall emissions quota amongst the different entities included under the scheme, and allows buying and selling of these permits. Since some firms will find it easier and cheaper to cut their emissions than others, they can make money by selling their surplus quota to firms that find it more costly to cut back⁹. In contrast to carbon taxes, emissions trading produces a precise quantity impact, but at an uncertain and often volatile cost. Misjudged allocations have been shown to lead to radical price fluctuations, although safety valves are now being incorporated to counter this. Again in contrast to carbon taxes, emissions trading is opaque, complex, and can produce inequities from free initial allocation of for new entrants. However, an important consideration is that capping of emissions is readily comprehensible and individual travellers and airlines can readily assess their contribution to the reduction of GHGs (or at least carbon dioxide, which is the simple surrogate generally preferred in emissions trading schemes).

Article 17 of the Kyoto Protocol makes emissions trading available to States as a means of meeting their obligations under the Protocol. However, ICAO has ascertained from UNFCCC that the inclusion of international aviation emissions, of either Annex I Parties or non-Annex I parties, is not provided for in emissions trading under the Protocol and has decided not to develop an emissions trading scheme for aviation¹⁰. ICAO has therefore been addressing the concept of incorporating international aviation emissions into the schemes of States, in the form of “open” emissions trading whereby airlines may trade permits with other entities from the aviation sector or from elsewhere. ICAO’s

⁹ One approach under early assessment in some countries is for permits to be issued not only to firms but also to individuals. Thus a member of the public, using a “carbon card” (like a debit card but with an carbon cap rather than a financial cap) would be able to apply allocated permits for a certain amount of carbon dioxide emissions proportionally amongst home heating, fuel for personal vehicles, travel, etc as he or she prefers, with provisions to sell or purchase permits to/from others. This has a number of advantages, including equity and avoidance of sovereignty issues by confining national regulation to national residents while retaining the concept of individual choice, but also has disadvantages including regulatory control, administration, and potential abuse. However, it is a serious possibility for the long term which would almost certainly have important implications for air transport and hence tourism.

¹⁰ One concern with the application of emissions trading to non-Annex I parties is that it might not take into account the principle of common but differentiated responsibilities which, for example, are provided through the Clean Development Mechanism, an arrangement under Article 12 of the Kyoto Protocol whereby Annex I Parties with a GHG reduction commitment may invest in emission reducing projects in developing countries as an alternative to what is generally considered more costly emission reductions in their own countries.

CAEP has developed extensive guidance on the inclusion of aviation in States' emissions trading schemes¹¹ and has produced a report on various options for voluntary emissions trading for aviation. The inclusion of air transport in emissions trading schemes is generally, but by no means unanimously, accepted by the air transport industry¹², and considered preferable by the industry to the application of levies.

Emissions trading has been applied very successfully in the United States for sulphur dioxide emissions, and there are also a number of voluntary trading schemes in existence around the world for various types of emissions with the potential for encompassing air transport emissions (although only one airline has so far participated in such a scheme)¹³. A European Union emissions trading scheme for GHG entered into effect in January 2005 with regard to electricity generators, some big heating plants and certain industrial producers, and the European Commission proposes to extend the scheme to include aviation emissions between EU points in 2011 and to/from the EU in 2012. Supporters of the inclusion of aviation believe that it will enable air transport to continue to grow at a relatively small price (the EC estimates a cost increase for an intra-EU flight of up to €9 and for a long-haul flight of up to €40, round trip) while others in the industry believe that it will ultimately increase the price of air travel significantly and/or result in capacity reduction. Opponents claim that the inclusion of aviation in the scheme would have an inadequate impact on GHG emissions, that it would lead to market distortion and/or that the EU has no legal right to impose the system beyond the geographic scope of the territories of EU Member States, which lies under the jurisdiction of other States or is over the high seas.

The central point of disagreement is whether States may integrate international aviation emissions from aircraft operators of other States into their emissions trading schemes without the explicit agreement of those other States ("mutual agreement"). At the same time, application of Articles 11 and 15 of the Chicago Convention means that there must be no discrimination between carriers, national or other. These issues are crucial to the debate which was to be taken up at the ICAO Assembly Session in September 2007 and to the future mitigation of GHGs from aviation. In the meantime UNFCCC continues to monitor progress closely.

F. Carbon offset – Some industries are able to reduce their atmospheric carbon dioxide emissions through sequestration, whereby the emissions are safely stored, but this is not a feasible option for air transport in the next decades. Another approach is carbon offset, whereby emissions are countered by investment in GHG reducing activities. A number of airlines, tour operators and travel agencies as well as an increasing proliferation of third parties already offer tourists (both business- and leisure-related) the carbon offset

¹¹ The ICAO Council has agreed that this guidance be published as "draft".

¹² Including IATA, the Association of European Airlines, the European Low Fares Airline Association and Airports Council International, which however each have reservations regarding certain provisions in proposals by the European Commission (see next paragraph).

¹³ Including: the United Kingdom Emissions Trading Scheme (which expired at the end of 2006 and in which British Airways participated regarding its domestic operations); the Voluntary Emissions Trading Scheme in Japan; the Chicago Climate Exchange; the European Climate Exchange; the Montreal Climate Exchange; and the Asia Carbon Exchange.

opportunity of purchasing items in support of local initiatives for introducing energy efficient or renewable energy projects, such as heat-saving stoves or lamps, electricity from methane or solar home heating, many in developing countries. Carbon dioxide is the primary GHG and is generally used as a relatively straightforward surrogate in offset programmes.

Carbon offset has moved beyond provision of opportunity for philanthropic gesture to an international commodity market, with both benefits and downsides. But the offset programmes currently on offer are by no means of equal value. And, while offset investments may generally be of benefit to the recipients in their own right, UNEP has concluded that it is unlikely in practice that such schemes will have a major countervailing impact on the reduction of aviation GHG emissions. Also, the schemes are generally voluntary¹⁴ and airlines report low take-up by passengers of the option, although some national administrations and private companies are now including carbon offset purchase as a mandatory component of travel policy. The calculation and efficacy of offsets, and in particular the use of “future value accounting”, has been brought into question (notably regarding offset investment in tree planting projects, which has recently become somewhat discredited as a valid option unless very strict criteria are met). There is a wide variety of estimates of the carbon produced and the costs per unit of carbon on offer and a wide variety of administrative overheads¹⁵, with apparently no particular account of the impact of aviation emissions at high altitude or of carbon reduction as opposed to “carbon neutrality”. There are also schemes with uncertain outcomes, which have not been validated or which have demonstrably failed.

Despite these identified weaknesses, the carbon offset option warrants further evaluation for application to air transport, in conjunction with carbon reduction. A number of offset schemes are subject to a form of certification to ensure that they have a genuine impact and there is now at least one independently audited globally applicable best practice methodology for project development¹⁶. More than one organization, including a major travel management company, now offers a carbon calculator by which the potential traveler can not only assess the total carbon consumption of a planned journey but also variants according to different modes of transport used, including travel on different airlines. And at least one offset programme has a direct application to tourism in a developing country). One European carrier, Easyjet, has an offset programme directly linked, without intermediary and on a non-profit basis, with a UN approved Certified Emission Reduction project in Ecuador. Under the Kyoto Protocol, if Annex I countries wish to set offsets against their GHG emissions, the Clean Development Mechanism requires that the offset be in a developing country. Independent (private or public sector) certification of valid and focused offset schemes for travel and tourism may thus provide a legitimate tool for countering GHG emissions by the sector.

¹⁴ A few airlines now include the cost of carbon offsets in the fare paid.

¹⁵ Stefan Gössling *et al*, in *Voluntary Carbon Offsetting Schemes for Aviation: Efficiency, Credibility and Sustainable Tourism* (2007, Journal of Sustainable Tourism Vol. 15, No. 3) show that the estimated volume of carbon to be offset can vary according to provider by a factor of 4 for the same flight, the cost of the carbon to be offset by a factor of 10, and the proportion of the price paid for the offset which is invested in a project ranging from 100% to as low as 40%.

¹⁶ See the Gold Standard (www.cdmgoldstandard.org).

Various audit processes have been developed by non-governmental organizations for both projects and providers, and the United Kingdom is developing a Code of Practice regarding carbon offsets. UNWTO for its part is studying the application of carbon offsets in the tourism sector and sees this as one amongst a combination of measures which may assist in achieving the desired balance between climate change mitigation and poverty alleviation, if appropriately accounted, directed, validated and certified¹⁷. ICAO is starting to develop methodology to enable precision in estimation of the volume of carbon to be offset, according to aircraft type, class of travel, route, etc, which will be an important tool in the evaluation process. There would be value in close cooperation on this between the two Organizations, along with others representing different transport modes, tourist accommodation and activities, as well as UNEP and UNFCCC.

The following criteria, under preliminary consideration by UNWTO in relation to application of carbon offsets in the tourism sector (and going beyond air transport or, in some respects tourism, in isolation), are designed to optimize the benefits of carbon offset for sustainable development to the satisfaction of the purchaser, the tourism industry and the recipients of the project concerned:

- the offset scheme should preferably include an educational component on the impact of tourism on climate change and on tourism as a vehicle for poverty alleviation
- offsets should be directed at energy efficiency or renewable energy projects which support the transition to non-fossil fuel based energy systems, and projects which make a valid contribution to sustainable development
- offsets should deliver a real additional emission saving and not apply to projects which would have occurred in any case
- offset purchase availability should be clearly identifiable as part of the tourism product purchase process and may be offered as a “default” option (that is, the price of offsetting would be automatically included within the product price and consumers would have to actively opt out of offsetting)
- offset purchase information should include: an accurately assessed volume of emissions being offset; identification of the offset project(s); cost of the contribution to the project(s); any charge for processing and administration; and the total cost of the offsetting service being purchased
- the offset scheme should be subject to independent verification and certification to ensure that emissions, their costs and their offsets are properly assessed and that administrative overheads are minimal

¹⁷ UNWTO is planning the Tourism and Climate Change Conference in October 2007 as a “carbon neutral” event, including the purchase of offsets for travel to and from the Conference by participants.

- the offsets themselves should be purchased from projects which have been certified by an independently audited globally applicable best practice methodology, such as the Gold Standard¹⁸, which is based on the Kyoto Protocol's Clean Development Mechanism (and therefore benefits developing countries) and has been developed by several international non-profit organizations
- the offset scheme may complement, but should not either conflict with or duplicate, any parallel mechanism for countering the impact of GHG emissions such as the Emissions Trading Schemes of the European Union and local or regional entities, or national Codes of Practice on carbon offset
- the scheme should preferably offer a selection of offset options, assessed in a transparent manner, enabling a purchaser to evaluate integrity and quality and to choose amongst the options
- the scheme should preferably include some form of supplement for GHG emissions from air transport to reflect their high altitude impact
- the scheme should preferably go beyond "carbon neutral" to carbon reduction (consistent with Kyoto targets, for example)
- offset projects should preferably be located in developing countries (thereby both supporting the Millennium Development Goals and, in the case of developed countries which have validated the Kyoto Protocol, enabling these countries to set the offsets against their GHG emissions through the Clean Development Mechanism of the Protocol)
- offset projects should preferably be related to tourism development, consistent with the UNWTO programme for Sustainable Tourism – Eliminating Poverty (ST-EP).

8. Conclusions

8.1 UNWTO is fully committed to promoting reduction in the impact of GHG emissions from tourism activities, of which aircraft engine emissions are the primary contributor (and the dominant contributor at the international level). At the same time the contribution of tourism to the fight against poverty and to job creation, support for developing countries and the United Nation's Millennium Development Goals are key to UNWTO's platform.

¹⁸ www.cdmgoldstandard.org. A less comprehensive consumer "stamp of approval" is offered by the Environmental Defense Fund in the United States (see www.fightglobalwarming.org) through which offset projects of identified providers (but not the providers themselves) have been informally reviewed for quality.

8.2 In seeking to achieve an appropriate balance between reductions in GHG emissions and the socio-economic benefits of tourism, UNWTO feels that aircraft emissions should be addressed on the basis of *Contraction and Convergence*, and measures taken to reduce air transport emissions need to reflect coherence with strategies to reduce poverty and promote development in the world's poorest countries, with preferential treatment for air services supporting the development of tourism in developing countries¹⁹.

8.3 In this context, the discussion above leads to the tentative Conclusions regarding GHG emissions from air transport which appear at the outset of this paper and which will form the basis for consultation and further research.

8.4 The aviation environmental agenda may well soon be drawn into a broader environmental schema, to its advantage in that "open" emissions trading could open a door to the future sustainable development of the industry and that mitigation measures may be found which are globally acceptable. In the absence of multilaterally agreed action in the near term, aviation faces the prospect of a disjointed proliferation of unilaterally applied levies and operating restrictions, which will have serious implications for tourism as well as aviation. There is a need for close cooperation between aviation and tourism institutions to spearhead a more harmonized approach. With the ICAO Assembly, the UNWTO Tourism and Climate Change Conference and the UN umbrella Climate Change Conference all in the last quarter, 2007 could be a defining year for the long-term future of aviation and tourism.

- END -

¹⁹ In this regard, at the instigation of UNWTO a study was recently carried out jointly by the ICAO and UNWTO Secretariats on *Essential Service and Tourism Development Routes*. This important safeguard takes existing concepts such as Essential Air Services in the United States, Remote Air Services in Australia, and Public Service Obligations in the European Union, and applies them to routes to and from the Least Developed Countries. The joint study showed that the concept was viable and provided guidance as to its implementation. Provision supporting its application should be made in all applicable schemes aimed at the reduction of GHGs from aviation.