



Aviation and the Environment: From Kyoto to Europe's ETS

In December 2006 the European Commission put forward a proposal to include aviation in its Emissions Trading Scheme. This article plots the history of the climate change debate and action leading up to this green proposal and presents the industry's assessment of its impact on air transport, the economy and the environment.



Intergovernmental Panel on Climate Change (IPCC) project that global surface temperatures are likely to continue to increase, by between 1.1 and 6.4°C by 2100. Based on scientific evidence the IPCC also concludes that 'most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations', in other words the result of human activity, namely industrialisation, the burning of fossil fuels and deforestation. Higher than normal atmospheric levels of one greenhouse gas in particular are thought to be responsible: CO₂.

A climate change due to global warming brings other changes, such as melting ice caps and glaciers, a rise in sea levels and changes in precipitation patterns with the potential for more frequent and more intense extreme weather events. These effects in turn cause changes in fauna and flora, facilitate the proliferation of disease, impact on agricultural production and have the potential to change life on Earth as we know it.

The Kyoto Protocol: Objectives and Mechanisms

Growing awareness of climate change and the need for action resulted in the 1992 'Earth Summit' in Rio de Janeiro and the creation of a United Nations environmental treaty, the so-called 'United Nations Framework Convention on Climate Change' or UNFCCC. The aim of the treaty is to stabilise or reduce man-made greenhouse gas emissions to levels which will not have further negative impact on the climate. The means for achieving this goal are set by amendments to the treaty, of which 'Kyoto' is the best known.

The Kyoto Protocol was concluded in 1997 and was opened for signature between 1998 and 1999. The Protocol eventually came into force in early 2005

CO₂, GHG, Climate change

Carbon dioxide is a chemical compound composed of one carbon and two oxygen atoms. It is often referred to by its formula CO₂. In nature CO₂ is produced by plant, animal and human respiration.

Carbon dioxide, methane (CH₄), nitrous oxide (N₂O), fluorocarbons (HFCs, PFCs) and sulphur hexafluoride (SF₆) are greenhouse gases or GHGs. Greenhouse gases are important components of the Earth's atmosphere, absorbing radiation from the sun and enhancing the Earth's greenhouse effect. The greenhouse effect is essential if Earth is to be habitable, raising the average surface temperature to 25°C above what it would otherwise have been.

Variations are normal, but long-term observation now suggests that temperatures are rising alarmingly. Over the last decade the average surface temperature of the Earth increased by 0.74°. Climate models referenced by the

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Editorial

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The theme of this issue of Source is the environment and aviation's role in the climate change debate. The lead article on Page 1 plots the history from environmental awareness to action, with the Kyoto Protocol and the EU's Emissions Trading Scheme. The inclusion of aviation into the existing ETS for ground sources and its design elements are currently under debate at the EU Council and Parliament, and the industry is following developments closely.

On Page 6-7 we present a joint industry call for 'clearer vision, cleaner skies' which aims to 'set the record straight' on aviation's environmental responsibility. More information can be found at www.enviro.aero.

AEA Partner Embraer is our guest contributor this time, introducing the innovative environmental grading system applied by one European airline. Turn to Page 9.

On page 10 we summarise the status of research into alternatives to fossil fuels and jet fuel in particular, the burning of which is the source of aviation CO₂.

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following the ratification by Russia, which meant that the trigger condition of 'at least 55 countries ratified, covering at least 55% of total 1990 CO₂ emissions by industrialised countries' was met. All but a handful of countries worldwide are signatories to the Kyoto Protocol. Signing, which indicates an agreement in principle, must be followed by ratification, which represents a formal acceptance and legal commitment. Two significant signatory parties are currently refusing to ratify the treaty, namely the USA and Australia.

UNFCCC signatory countries are divided into two main groupings. 'Annex I' includes all developed and industrialised economies and economies in transition. Countries which do not fall into this category are mostly developing economies, collectively referred to as 'non-Annex I countries'. Annex I countries commit to reducing greenhouse gas emissions in 2008-2012 by an average 5% below 1990 levels. If they are unable to do so, the Kyoto Protocol provides for several mechanisms to help them achieve their Kyoto targets. The first is an emissions

trading scheme (ETS) or the purchase of allowances on the market. This is known as a 'cap & trade system'.

The other mechanisms are related to carbon offsetting, whereby a country invests in projects in other countries which contribute to global emissions reduction. If the project is in a developing country this is known as a Clean Development Mechanism or CDM. A project in another Annex I country is known as Joint Implementation or JI. Non-Annex I countries have no emissions reduction targets. They can

Fig. 1:

UNFCCC Parties to the Convention	Kyoto Protocol			CO ₂ Emission Ranking ³ 1 = high
	Emissions target 2008-2012 over 1990	Signed	Ratified	
'Annex I' countries with Emissions Targets¹				
USA	-7%	■	■	1
Europe		■	■	
EU-15 ²	-8%	■	■	3
EU Accession countries 1): Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Romania, Slovakia, Slovenia.	-8%	■	■	
EU Accession countries 2): Hungary, Poland	-6%	■	■	
Liechtenstein, Monaco, Switzerland	-8%	■	■	
Croatia	-5%	■	■	
Ukraine	0%	■	■	
Norway	+1%	■	■	
Iceland	+10%	■	■	
Canada	-6%	■	■	7
Japan	-6%	■	■	5
Australia	+8%	■	■	13
New Zealand	0%	■	■	49
Russian Federation	0%	■	■	4
Major 'Non-Annex I' countries				
China	-	■	■	2
India	-	■	■	6
Brazil	-	■	■	12
South Korea	-	■	■	8
Mexico	-	■	■	9
Indonesia	-	■	■	14
Taiwan	-	■	■	17

¹ Belarus (signed and ratified) and Turkey (neither signed nor ratified) are listed as Annex I countries, but were not party to the Convention when it was adopted and therefore have no target.

² Countries of EU15 have signed and ratified the Protocol individually and as a group (see Fig. 2). The newest Member States have mostly been set the same target as EU15 of -8%, except Hungary and Poland -6%. Cyprus and Malta (signed and ratified) are not Annex I countries and therefore have no target.

³ CO₂ emissions data from the World Resources Institute are for 2002. Preliminary figures from Emissions Database for Global Atmospheric Research suggest that by 2006 China had overtaken the USA.

Source: UNFCCC. Countries shown in descending order of size of economy, based on 2006 GDP (ppp).

Fig. 2:

The EU Kyoto 'Bubble'	Emissions target 2008-2012 over 1990
Member States of EU15 have different individual targets which meet the collective Kyoto target of -8% reduction in emissions. This burden-sharing arrangement under the Protocol is known as a 'bubble'. The concept recognises different levels of economic development amongst countries and makes allowance for growth.	
Collective target	
EU15	-8%
Country-level targets	
Luxembourg	-28%
Denmark	-21%
Germany	-21%
Austria	-13%
United Kingdom	-12.5%
Belgium	-7.5%
Italy	-6.5%
Netherlands	-6%
Spain	+15%
France	+0%
Finland	+0%
Sweden	+4%
Ireland	+13%
Greece	+25%
Portugal	+27%

however benefit from 'carbon credits' from CDM projects, which can be traded with Annex I countries. The list of non-Annex I countries includes fast expanding economies such as China, India and Brazil which are now joining the group of the world's heaviest polluters. Objection to their exemption from reduction targets is one reason for non-ratification of the Protocol by the USA and Australia.

The Kyoto Protocol expires in 2012 and negotiations for a follow-up Protocol for the post-2012 period are underway.



Europe's Emissions Trading Scheme

In order to allow its Member States to achieve their collective Kyoto target of GHG reduction, the EU decided to set up its own Emissions Trading Scheme. The EU ETS (Directive 2003/87/EC), currently limited to land-based sectors, was approved by the European Parliament in 2003 and came into force in 2005. The first pilot phase runs from 2005 to 2007, and the second phase follows the mandatory Kyoto five-year period of 2008 to 2012. The EU's ETS is the first multi-national emissions trading scheme in the world and is seen as a forerunner and test case for an international emissions scheme under the auspices of the UNFCCC. Its creation advances action on emissions reduction without the need to wait for comprehensive political acceptance worldwide. But the EU ETS still aims to be compatible with Kyoto and its trading mechanisms and foresees an integration of the CDM and JI mechanisms from the second trading period in 2008.

Member States are free to determine how to meet their national commitments. Usually this is done by transferring the responsibility to a specific high-polluting industrial sector, such as energy production or heavy industry. The National Allocation Plans filed by EU countries cover 12,000 energy-intensive installations: combustion installations, oil refineries, coke ovens, ferrous metal production, cement, glass and ceramic production as well as the pulp and paper industry. A Member State may set a different cap and target for each sector.

It should be noted that 1990 is a Kyoto reference date for States to reduce their greenhouse gas emissions. For ground sources differing baselines have been applied, even differing amongst the various installations within a same sector, and these have generally been much closer to the first trading period, usually preceding it by just 3-4 years.

The role of International air transport

In principle the UNFCCC Convention covers all industries, including air transport, but because of the methodological problem of allocating emissions from trans-national flights to States, international aviation was not covered by the Kyoto Protocol.

However, Article 2.2 of the Protocol specifies that the United Nations' International Civil Aviation Organization (ICAO) should investigate ways to

2%, 5%, 10%?

The facts on Air Transport's contribution to GHG and CO₂ Emissions

- Transportation accounts for 14% of all greenhouse gases (2000);
- Transportation accounts for 19.2% of CO₂ emissions (2000);
- Air transport accounts for 2.2% of worldwide CO₂ emissions (2000);
- Eurostat puts air transport's share of EU25 CO₂ emissions at 3.6% (2004).
- ICAO's reference scenario sees air transport's share of global CO₂ emissions growing to 2.8% by 2050.

Transportation accounted for 14% of global greenhouse gases in 2000 according to EDGAR, the acclaimed 'Emissions Database for Global Atmospheric Research'. CO₂ is the most prolific greenhouse gas, representing 72% of total GHGs.

Transport by all modes accounted for 19.2% of worldwide CO₂ emissions.

Road transport is responsible for three-quarters of this segment; air transport accounts for just over one tenth of transport CO₂, or 2.2% of all CO₂. For air transport, with its high reliance on fossil fuels, CO₂ is the only GHG. It is also the aviation emission about which there is the best scientific understanding, compared to the sector's other non-CO₂ emissions and, on recommendation of ICAO, the only measure to be used when including air transport in the European ETS.

Various scenarios exist which look at the future evolution of CO₂ emissions by aviation. The ICAO reference scenario, which assumes mid-range growth, sees aviation's share increase from 2.2% in 2000 to 2.8% by 2050. Other mainstream forecast scenarios see emissions growth to a 1.6 to 4.4% share in 2050.

According to Eurostat figures for 2004, transport accounted for 26% of CO₂ emissions in EU25, composed of 22% road transport and 3.6% air transport (domestic, intra & international flights).

Fig. 3:

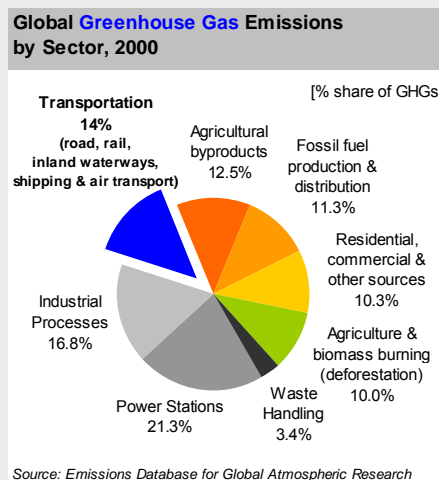


Fig. 6:

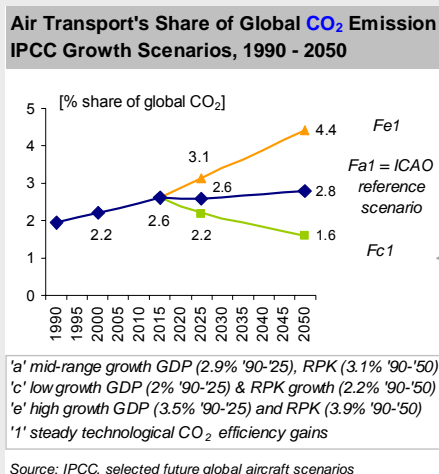


Fig. 4:

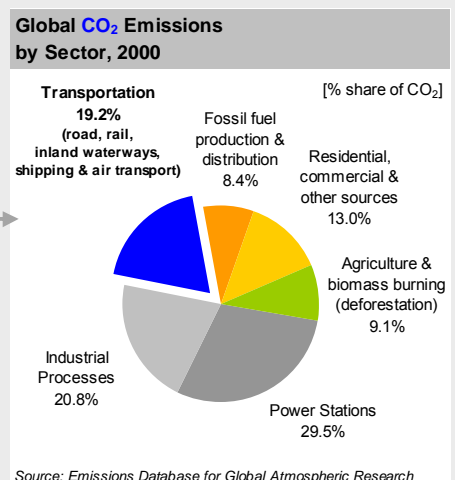
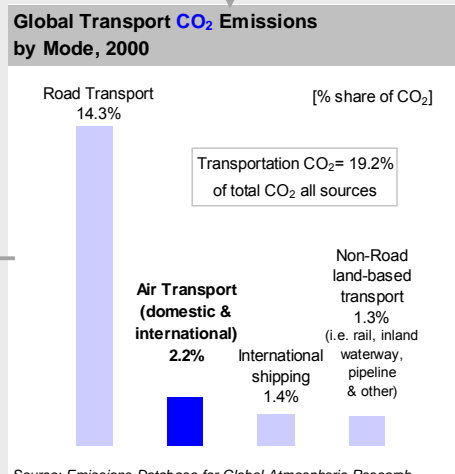


Fig. 5:





address global emissions from 'aviation bunker fuels', to use official terminology. The task falls to ICAO's Committee on Aviation Environmental Protection or CAEP.

To start with, ICAO and IPCC studied the topic of aircraft emissions in some detail. Aviation emits several gases and particles which contribute to climate change, including NO_x and contrails, but carbon dioxide, produced through fuel burn, is the sector's only GHG. ICAO concluded that of all aviation emissions the effects of CO₂ are well understood whilst for others there is still scientific uncertainty and need for more research.

ICAO then assessed several approaches to the problem, from operational to market-based measures.

A review of operational practices led to the 2004 publication of ICAO Circular 303 'Operational opportunities to minimize fuel use and reduce emissions'. This includes tips such as optimising aircraft speed, eliminating non-essential weight and reducing taxiing time, which could save 2-6% of fuel burn. ICAO also identified a further potential saving of 6-12% related to improvements in air traffic management and the elimination of inefficient routings, holding patterns and sub-optimal flight profiles.

ICAO further assessed market-based measures such as environmental levies (charges and taxes), emissions trading, voluntary schemes and transport mode substitution.

It concluded that emissions trading is the most cost-effective long-term measure to limit CO₂ from air transport, providing it is an open trading system. Air transport is a growth industry and airlines would be net buyers of allowances. A trading system which is limited to the aviation sector only (a closed system) does not provide a market from which to purchase allowances. Access to other sectors (an open system) is therefore a prerequisite for a successful system.

Ultimately, for many complex legal, political and technical reasons, ICAO finds itself unable to realise an ETS system which meets its own specified criteria: a global and open system. Instead, ICAO is now concentrating on providing non-binding guidance through recommendations and assistance in the establishment of national/regional systems, the principles of which were adopted by CAEP/7 in early 2007, with final endorsement due in the autumn.

The European Aviation Industry's Emissions Containment Policy

Meanwhile, in 2005, Europe's aviation industry, including passenger and cargo airlines and manufacturers, published its Emissions Containment Policy, as input to the on-going debate on air transport and climate change in Europe.

The industry stresses that a sound aviation climate change policy should be based on four pillars. The first pillar is 'technological progress', representing the significant past achievements attained by airframe and engine manufacturers and future potential for further emissions reduction. Pillars two and three, infrastructure improvements and operational measures, reiterate the ICAO conclusions mentioned above. In particular Europe's industry calls on its leaders to strengthen political support for the Single European Sky initiative, conceived in



1999 to rationalise Europe's airspace and air traffic control. The fourth and final pillar allows for market-based solutions, notably the inclusion of aviation in a European emissions trading scheme, which could and should be used in combination with the other elements of the Containment Policy for environmental benefit.

EC Proposal on including aviation in ETS: A Joint Industry response

Picking up on only the fourth pillar of the industry's Containment Policy, there is currently a proposal for legislation on the table from the European Commission to amend Directive 2003/87/EC to include aviation activities in the existing scheme for land-based emissions trading within the Community. Once again the EU wishes to take a lead, stating: 'The objective of this proposal is to provide a model for aviation emissions trading that can be a point of reference in the EU's contacts with key international partners

and to promote the development of similar systems worldwide.'

The main design elements of the Commission proposal are the following.

Coverage:

- The scheme applies to countries of the European Economic Area (EEA), being the 27 EU Member States, Norway, Iceland and Liechtenstein.
- 'Aircraft operators' are the responsible entities.
- Aircraft with maximum take-off weight of 5,700 kg or more are included.
- Domestic and international aviation are included in the scheme.
- It will cover all flights **within** the EU in the first trading period 2011-2012, thereafter (2013 to 2022) it will be expanded to all flights **to, from and within** the EU.
- No special treatment for remote or isolated regions is foreseen.

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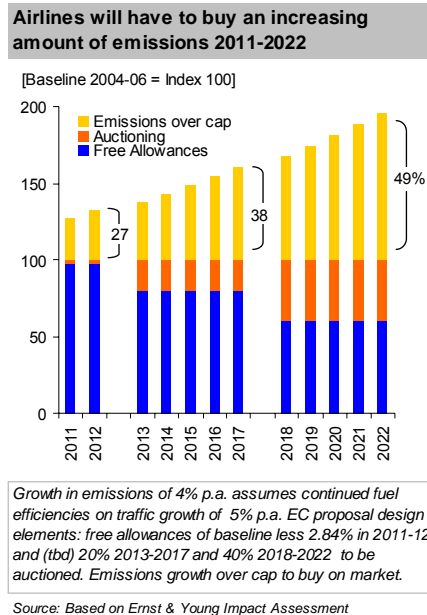
- The scheme will consider only **CO₂**. The Commission will conduct an impact assessment and make a proposal to cover NO_x emissions in 2008.
- The **baseline** for the allocation of allowances will be the average emissions for aviation between 2004-2006.
- The baseline is the ETS **cap**, which implies stabilisation of emissions at 2004-2006 levels, with everything beyond that to be purchased.
- A fixed percentage of allowances will be allocated **free of charge** (grandfathering).
- Purchase of some allowances through **auctioning** will be mandatory. (Note that for land-based sectors in the existing ETS auctioning is an option.)
- It will be an **open trading** system, with access to other sectors.
- Players can make use of project credits, Emission Reduction Units or ERUs, and Certified Emission Reductions (CERs) from **CDM and JI** up to a predefined limit.

Administrative:

- Monitoring, reporting and verification principles apply. Airlines' first application for allowances relates to 2008 data for the first year of trading (2011).
- Each aircraft operator will be administered by one State and although the allocation method (benchmarking) is harmonised across the EU the conditions for auctioning will be defined by each Member State.



Fig. 7:



This Commission proposal was issued in December 2006 and is, at the time of writing, being reviewed by the European Council and Parliament. Therefore the design elements are not yet final and may still change before being adopted.

However, the industry considers that the impact assessment conducted by the Commission to support its proposed directive is inadequate and its assumptions faulty. For this reason the main associations representing European aircraft operators commissioned their own impact assessment from **Ernst & Young and York Aviation**. The study was conducted at the request of the AEA, European Business Aviation Association (EBAA), European Cargo Alliance (ECA), European Low Fares Airline Association (ELFAA), European Regions Airline Association (ERA) and International Air Carrier Association (IACA). It was published in June 2007, entitled '**Analysis of the EC Proposal to Include Aviation Activities in the Emissions Trading Scheme**', and can be found at www.aea.be.

The study finds that in its current format the proposal from the European Commission will jeopardise the long-term viability of the European aviation industry. Its key findings, summarised in a joint industry press release of 6 June, are:

- Barely one third of the cost of the Commission's proposed scheme will be recoverable from customers,

whereas the Commission assumes a significant or even full 'cost pass-through.'

- Demand for air travel is highly price-sensitive, contrary to the Commission's statements. Therefore, any price increase will result in a loss of passengers for European airlines.
- The aviation sector will have to purchase allowances to cover up to 45%¹ of its emissions by 2022, which will make it the only sector in the current EU ETS to pay for its own growth. This is despite the fact that airlines have been able to decouple emissions growth from traffic growth. If aviation has to pay for its own growth, which itself is both a driver and a consequence of overall economic growth, this will have a perverse effect on the environment, as it will severely reduce the ability of the aviation sector to invest into cleaner and quieter modern technology.
- The costs of purchasing allowances for airlines will be substantial, with an 'optimistic' estimate of over €45 billion² from 2011 to 2022 or an additional cost of €4 billion per year. This is approximately equivalent per annum to twice the combined profit of Europe's airlines over the last decade.
- Aircraft operators' overall profits will be reduced by over €40 billion² during

the same period, weakening the financial stability of a number of operators.

- EU aircraft operators will be at a perpetual competitive disadvantage vis-à-vis non-European carriers, regardless of the geographical scope of the scheme. EU aircraft operators will bear emissions-related financial costs for their entire network, whilst only a small part of the operations of non-EU carriers will be affected. Similarly, the proposed inclusion of intra-EU flights only during the first year from 2011 will have an uneven impact on European operators, depending on the proportion of their network captured and, more importantly, will produce no significant environmental benefit.
- The complexity and costs of administering the scheme will be a challenge, particularly if the scheme is applied to small operators, such as business aviation and helicopters.
- The impact of ETS on EU aviation will reflect on the European economy as a whole. Decreases in both connectivity and tourism will penalise regions and peripheral communities. It is also likely that intercontinental traffic flows would be diverted from European to non-European hubs, thus making Europe a less attractive place to invest and to do business.

The European aviation industry recognises its environmental responsibility. It will continue to implement operational efficiencies and invest in fleet renewal. It accepts the concept of the inclusion of aviation in a European ETS and is committed to a constructive dialogue with the EU Council and Parliament to improve the current proposal. It is clear that inclusion in ETS will not be without implications for the industry and it is therefore essential that any cost burden be reasonable and balanced by a demonstrable environmental benefit. ■

¹ This is based on a scenario without auctioning.

² This, again, is based on a 'without auctioning' scenario, assuming an allowance cost of €30.



Visit www.enviro.aero
for everything you need to know
about aviation and the environment

clearer vision cleaner skies

As climate change rises up political agendas, there's a lot of debate about aviation's impact on the environment, and confusion surrounding the facts.

To set the record straight, airlines, airports, air navigation service providers, manufacturers and others have come together to develop a website: www.enviro.aero. This is the only global cross-industry initiative to communicate what the aviation industry is doing to limit its impact on the environment.

www.enviro.aero demonstrates that all industry players are serious about the environment and are taking practical measures to limit emissions. It is THE information resource providing facts and examples of good practice and how the air transport industry is meeting its environmental responsibilities.

This site is for anyone who has an interest in finding out about aviation and the environment – from journalists, to politicians, to members of the general public.

Visit www.enviro.aero for:

- Latest industry news
- Facts & figures
- Case studies of environmental best practice
- Contacts for press enquiries
- Sign-up for industry media briefings
- Access to industry experts
- Information about upcoming events
- Links to industry websites





Aviation and the Environment: the Industry Finds its Voice

Getting all sectors of the air transport industry to agree on anything is never easy. However, mention the need to improve the environmental reputation of aviation, and chances are you will not hear a single voice of dissent.

Between airlines, airports, manufacturers and ANSPs, there is a wealth of information on all the initiatives taken by the industry to reduce its environmental impact. The only problem is this: the public seems unaware of them, getting from many media and politicians the impression that the aviation industry is a primary polluter and should therefore be heavily penalised.

It was high time the industry got together and came up with a unique source of information on their environmental performance and all they are doing to improve it. This long-awaited source is now on-line, and can be accessed at www.enviro.aero.

This website, which has just been launched but will steadily be growing in the months to come, intends to provide reliable and verifiable information on aviation, the environment and climate change, from clear descriptions of what happens at all stages of the flying experience to case studies and key statistics through a constantly updated press room. And more than a simple repository of information, it also intends to be a place where members of the public and the media ask questions, environmental experts give their points of view, and proper debate is encouraged.

Because climate change is such a crucial issue, and because the industry is constantly investing in new ways to improve on its environmental performance, the [enviro.aero](http://www.enviro.aero) website will by definition never be exhaustive. But the whole industry chain – and AEA members in particular – as well as its stakeholders are encouraged to make this website as complete as it can be. Spread the word, click on www.enviro.aero, have a look round, and let us know what you think is missing and how it could be improved.

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US carriers are back

AEA airlines have been generating profits again over the past couple of years. US carriers on the other hand suffered severe losses during the same period. The US industry has accumulated huge losses since 2001, and four of their major airlines had to file for bankruptcy. Massive restructuring programmes covering cost structure, balance sheet and networks are now showing results: the airlines are starting to post profits and are seeing unprecedented expansion - mainly in international markets.



The positive results for AEA airlines in 2006 do not come as a surprise; the year benefited from good macroeconomic conditions and continued strong demand. Coupled with further efficiency gains, mainly through higher load factors and improvement in unit costs, the aggregate profit (before interest) reached EUR 2.5 bn, the best result for many years.

Financial figures for US airlines were depressed over the last few years. The crisis, triggered by the 9/11 attacks and the subsequent negative impact on US carriers, led to an accumulated loss of more than USD 35 bn since 2001.

Twenty US airlines filed for bankruptcy (Chapter 11, see 'Source', issue 4/2005), amongst them four of the major players:

Fig. 1:

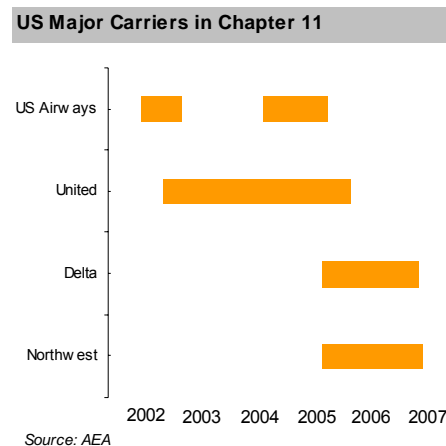
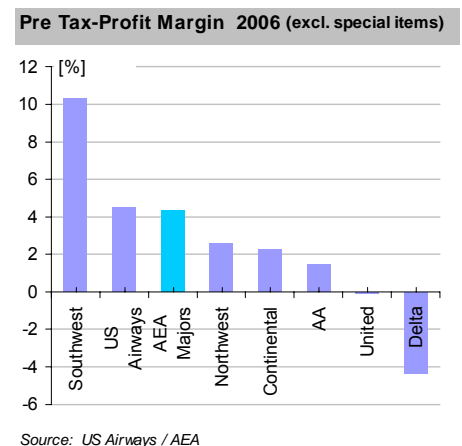


Fig. 2:





US Airways, United Airlines, Delta Air Lines, and Northwest Airlines.

The companies remained under Chapter 11 protection for between 21 and 39 months, giving them time to devise a restructuring plan. At the end of May 2007 Northwest was the last of the four majors to emerge from bankruptcy. The others exited a month prior (Delta) and in 2006 (United) and 2005 (US Airways), all after a period of extensive restructuring that is reflected in the results for 2006. Two of the four carriers posted pre-tax profits and Q1/2007 results show a continuation of this positive trend. The margin (+4.5%) of US Airways, which was the first to emerge from Chapter 11 and has since merged with America West Airlines (in September 2005), is already above the aggregate margin for the major AEA airlines. Rightly, US Airways calls it an 'outstanding' year. Northwest Airlines, the 6th largest in the world, also reported its first positive results in 2006. The 10 largest US airlines posted an aggregate profit of USD 1.36 bn in 2006, compared to a loss of 0.6 bn in 2005.

The restructuring measures taken by these airlines basically covered three areas: the achievement of a competitive cost structure, optimisation of fleet and network and improvement of the balance sheet. Between 2004 and 2007, Northwest Airlines will have reduced costs by USD 2.4 bn., including 1.4 bn. in labour cost alone - a reduction of 40% within 3 years. Delta's transformation plan foresees a cost elimination of USD 2.0 bn.

Potentially, cost savings could also be achieved by cutting unprofitable routes, for example in the domestic market where US majors face fierce competition from low cost carriers. The aggregate figures of the major US carriers show that since 2000 domestic capacity has been reduced by an average 1.5% per

year (in available seat-miles). On the other hand, international capacity is growing significantly from its lowest level in 2003. Growth rates were 11.7% (2004), 8.4% (2005), and 4.8% (2006). By comparison, AEA airlines matched the US figures only in 2006 (4.6%) on their 'intercontinental' routes and remained below these levels during the previous years.

This pattern is repeated on AEA's strongest intercontinental region: North Atlantic. The offer by AEA carries is - in absolute terms - still above their American competitors, but the capacity expansion by the Americans on this region is clear. The capacity shares will soon converge as a result of additional capacity of between 7 and 10% over the last 4 years.

In its reorganisation plan (December 2006) Delta describes its transformation from a 'domestic oriented' to a 'globally balanced' business with 'profitable hubs and services to five continents'. International expansion will account for 15% of revenue in 2007. On the transatlantic route Delta expects to benefit from a 'first mover advantage to Eastern European countries'. Non-stop operations to Budapest, Bucharest, Kiev and Prague, amongst others, are planned. In 2006 nearly 50 international routes were added.

Northwest, with 18 firm orders for Boeing 787 aircraft, is also seeking international growth opportunities. The new aircraft will have a range of 8,000-8,500 miles compared to 7,500 miles for their existing B747-400s. This will allow Northwest to add new non-stop services to destinations such as Shanghai, Delhi, and Mumbai. An average capacity growth of 8.9% is planned on North Atlantic routes between 2006 and 2010 (domestic growth is only 0.5%). The Pacific region is another focus in this network development,

particularly Japan where the company is strengthening its already strong position (N^o. 1 US carrier).

The same strategy towards 'international' can be observed at United, the 4th biggest carrier in the US. 'Given the domestic market's slow revenue growth and excess capacity, we believe that removing marginal domestic capacity is the appropriate response', the company explains on their website. A 3% reduction is planned in 2007. However, system wide capacity will grow in 2007 through expansion in international markets. An increase of 3-4% is planned to 'meet the service needs of the United customer'.

These examples demonstrate a common pattern: the move of capacity towards long haul markets. AEA carriers currently do well on their most important intercontinental route, the 'North Atlantic', thanks to a restrictive capacity management, stabilised yields and high load factors, which is so unlike the experience on other long haul markets. The region became an important main pillar for the overall profitability of AEA carriers.

The addition of new capacity by re-emerging US carriers will possibly reshape the current market. The introduction of a European ETS has the potential to become another challenge for European carriers. The additional cost on European routes would put them at a disadvantage compared to US carriers, which are in better shape than ever before. ■

Fig. 3:

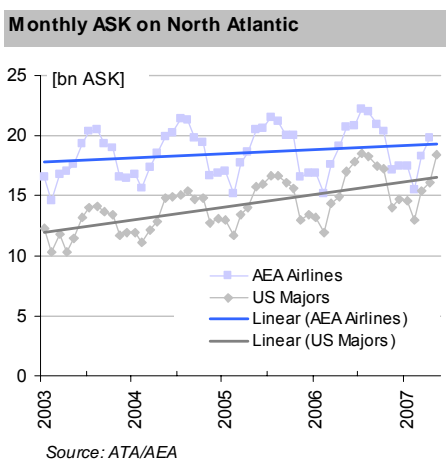
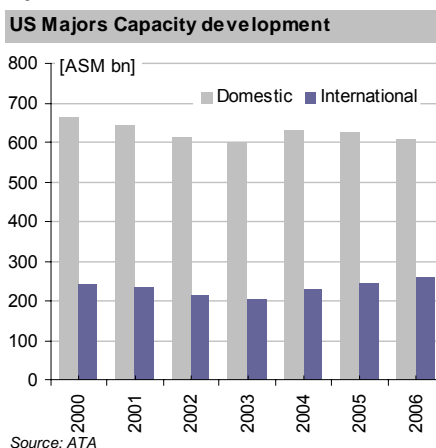


Fig. 4:





Guest Article by Embraer

New Generation Jets are Turning Green

The high-efficiency design of Embraer's new family of E-Jets helps to limit carbon emissions.

The growing scrutiny of the by-products of jet engine combustion have brought renewed focus on the efficiency of aircraft and a call to lower the volume of carbon dioxide and nitrous oxide emissions. While the development of new propulsion technology may help to curb future output, some of today's new-generation aircraft, like Embraer's family of E-Jets, incorporate design elements that maximize efficiency to keep engine CO₂ levels in check.

The high structural design efficiency of E-Jets (the ratio of payload to operating empty weight) results from optimizing the aircraft specifically for the 70 to 120-seat capacity segment. Compared to some larger jets that have been down-sized to offer similar capacity, Embraer E-Jets are up to 30% more efficient and consume fuel more economically, carrying more payload per kilo of aircraft structure.

But aircraft weight is only one aspect. On short-haul sectors of 500 km, a take off and landing cycle generates about one third of a flight's total CO₂ output, a figure which drops to about one quarter for a 1,000 km trip as the cycle emission is amortized over greater distance. Although they are unable to affect the efficiency of airport ground movements and the air traffic control system, manufacturers, like Embraer, are working to control what they can. Thanks to design enhancements that reduced aerodynamic drag, the company recently announced a 3% improvement in fuel burn for its larger E190 and E195 jets. For all jet and turbo-prop aircraft, every kilo of kerosene burned generates approximately three kilos of CO₂, so any decrease in consumption has a dramatic effect on emissions output.

The mounting awareness of global environmental impact raises new issues about responsibility. Airlines have been quick to remove ageing aircraft from their fleets and ensure their replacements are, at the very least, compliant with ICAO Stage IV noise restrictions. Yet there is much that can be done to ensure aircraft are dispatched as expediently as possible, both on the ground and in the air. For airlines, acquiring aircraft that are the right size for their markets and avoiding costly overcapacity means that CO₂ out-



Flybe Embraer 195		flybe
Local Environment		
Noise Rating		B
Less		
Take Off & Landing CO ₂ Emissions		C (220kg/seat)
Take Off & Landing CO ₂ Emissions (per seat)		17.5kg
Take Off & Landing Local Air Quality ¹		7kg
Journey Environment		
Total Aircraft Fuel Consumption By Journey Length	Domestic (500km)	B (2677kg)
	Near EU (1000km)	B (2719kg)
	Short Haul (1500km)	B (3962kg)
CO ₂ Emissions Per Seat By Journey Length	Domestic (500km)	B (45kg)
	Near EU (1000km)	B (73kg)
	Short Haul (1500km)	B (106kg)
Passenger Environment		
Minimum Leg Room		30"
Number Of Seats		118
<small>Emissions of nitrogen oxides as an indicator of the effects on local air quality</small>		

put, while inevitable, is generated in the most efficient way.

One airline that has been particularly progressive about environmental responsibility is Flybe of Exeter. The company developed a labelling system for all aircraft in its fleet so that consumers can better understand the noise and emissions impact on the communities near airports and the production of CO₂ for their air journey.

The Flybe labelling model categorizes an aircraft's noise rating on an A (best) to F scale; measures CO₂ and NO_x emissions

associated with take off and landing; grades the efficiency of fuel consumption and CO₂ generation per seat for a range of sector distances; and adds the element of passenger experience by disclosing seat configuration and pitch. The statistical results are neatly presented to show how each aircraft rates on environmental impact. A passenger can then decide whether he/she wants to carbon-offset the trip by participating in the airline's offset scheme.

As the newest jet in Flybe's fleet, the E195 is rated "B" for both CO₂/NO_x emissions and its noise footprint.

With their new technology and optimized design, Embraer's family of E-Jets produces an average of 50% less CO₂ than older aircraft like the B737-200, MD87 and DC9, and 15-30% less than previous generation jets such as the B737-300, B737-500, Fokker 100 and RJ100. All Embraer E-Jets meet the latest, stricter noise limits set by ICAO.

As a company, Embraer has incorporated many green initiatives in its manufacturing processes and facilities. After a brief energy crunch in Brazil earlier in this decade, investments were made to improve the efficiency of the compressed air network in the factory complex and use natural gas to power the air conditioning systems in office buildings. Embraer's re-use rates for materials in its industrial processes – metal particles, organic residues, wood, Styrofoam, plastics, paper and cardboard – keep growing. In 2006, it recycled 80% of these materials, representing a 66% increase since 2000.■

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Alternative Fuels for Aviation: What are the Options?

With the high and rising cost of fuel and a raging environmental debate, the air transport industry looks to science to develop an alternative to fossil fuels. So far suitable options to replace jet fuel are limited and do not come without 'cost'.

Airlines' fuel bills represent more than 20% of their total cost base. This percentage has increased steadily in recent years, providing the most important driver for airlines to consider alternatives to conventional jet fuel. Another driver is the concern about security of energy supply. Future crude oil production may be less than world demand, pushing prices up even further. Finally, the environmental impact of aviation has become a global issue, pushed not only by a few but increasingly by the wider public.

Initiatives to develop 'synthetic' aviation fuels were first explored in the 70s and 80s, but were eventually abandoned as cost ineffective. More recent geopolitical, economic and social events are now providing the impetus to re-launch research into alternative fuels.

But aviation is not the first candidate when it comes to fuel flexibility. Most alternative fuels such as bio-derived fuels, methanol, ethanol, liquid natural gas, liquid hydrogen or synthetic fuels, present major challenges for airplane design, safety, logistics and performance. Ultimately, road transportation or electricity generation can adapt more easily to these alternatives.

Nevertheless there are certain alternatives, some of which are also viable for aviation. A 2003 study by Imperial College London, entitled 'Potential for Renewable Energy Sources in Aviation' pinpoints three options that could bring potential benefits: Fischer-Tropsch (FT) kerosene, bio-diesel and hydrogen. The study also looked at other alternatives but these were not considered suitable: methanol and ethanol because of their low energy density and low flash-point, biogas due to limited volumes and uncertain quality, and finally nuclear power, which is deemed too dangerous in the event of an accident or a terrorist attack.

FT-Kerosene (synthetic jet fuel) is produced from feedstock such as coal, biomass or natural gas. A synthesis process produces a fuel that is almost an identical replacement for kerosene. The combustion of synthetic kerosene produces equal levels of CO₂, but certain emissions can be lower. The transformation process is energy intensive and releases large quantities of CO₂ and greenhouse

gases. FT-Kerosene can be blended with conventional kerosene.

Bio-diesel: Biofuels are manufactured from renewable resources such as crops (soy beans, rapeseed, sunflowers), animal fats, etc. It is obtained through a transformation process known as transesterification. The main challenge is that it freezes at normal aircraft cruise altitudes. Another shortfall is the limited production capacity. A NASA/Boeing study calculated that if Germany would want to replace its diesel fuel demand by bio-fuels from rapeseed, an arable land area equivalent to 120% the country's size would be needed to produce enough crop! Bio-diesel has the potential to be a 'kerosene extender', i.e. blended to max. 20% with regular kerosene.

Hydrogen is often mentioned as the most environmentally friendly alternative. Indeed, the combustion emits no CO₂. Its production however needs large sources of energy (electricity) and water. Handling, transport and storage can represent other challenges but the main drawback is that use of this energy would require significant changes to aircraft design. It is therefore assumed that this option is unlikely to be introduced within the next decades.

Because synthetic fuel and bio-diesel have a similar weight and volume to conventional jet fuel, these alternatives would not affect the design of the aircraft and seem more viable.

According to the aforementioned study, 'the three described alternative energies would be significantly more expensive to produce than the current cost of conventional aviation kerosene'. Production cost might drop in future but the new fuels might be fully absorbed by road transportation, which has different safety requirements to aviation and is therefore more likely to be an early adapter.

Certainly a number of challenges still have to be overcome before widespread adaptation of alternative fuels in the aviation sector. Nevertheless the benefits of a wider use are evident and in many respects crucial for the airlines: improving price stability of energy cost, increasing the security of energy supply and providing possible improvements in local

air quality and a reduction in greenhouse gases.

Further R&D into alternative fuels for aviation is required. In view of the proposed inclusion of aviation in the EU carbon trading system (ETS), emission related benefits in particular are set to boost the sector's interest in continuing the search for new solutions as part of its (environmental) strategy. ■

Interesting reading:

- 'Alternative Fuels and Their Potential Impact on Aviation', October 2006, Boeing Commercial Airplanes, Seattle USA; Glenn Research Center, Cleveland USA; MTU Aero Engines GmbH, Munich Germany
- 'The Potential for Renewable Energy Sources in Aviation', August 2003, Imperial College London, Center for Energy Policy and Technology
- 'The Potential Use of Alternative Fuels for Aviation', February 2007, International Civil Aviation Organization, Committee on Aviation Environmental Protection (CAEP)

AEA Technical Specifications

2007 Edition

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The story:

In the early 1980s European airlines, members of the AEA, took an important decision in driving a new technology in the field of ticketing and check-in.

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Throughout its development experts from all AEA member airlines were involved in deciding and defining the hardware

and software/firmware specifications, linking the airport based ticket processes with the airline's own host computer.

The joint initiative by European airlines has allowed AEA to adopt a standard approach to the machine printing and reading of ticket information as well as being the leaders in launching a new technology, based on existing industry standard and designed in conjunction with airlines and vendors.

AEA specifications are now recognized worldwide as industry standard for ATB, BTP and BGR equipment.

The product:

The AEA ATB, BTP and BGR specifications detail the message exchange method between applications and the printers / readers used in the airport and airline travel environment. The "how" you get the data to hardware and the "what" the responses must look like.

The data content itself is defined by IATA or ICAO in the corresponding resolutions and recommendations and technical rules are established by ISO standards.

Compatibility:

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What is new in the 2007 Edition?

ATB Amendments

- Read Configuration (RC)
- AEA Version (AV)
- Bin Status (BS)
- Configuration status request (RC)
- Barcode Contrast per Bin (BC)
- Hard Coded Transaction Code (CT)
- Barcode printing more detailed, 1D & 2D barcode handling separated, QR barcode added

BGR Amendments

- BCRI# for BCR input as BGR
- New timer value added for light indicator on Cut Command (CC)
- New timer value added for coupon eject command (CE or CB)

BTP Amendments

- AEA Version (AV)
- Bin Status (BS)
- Barcode Contrast per Bin (BC)
- Hard Coded Transaction Code (CT)
- RFID support

Who should buy the AEA Technical Specifications?

- **Vendors** who wish to offer their hardware product (printers, readers, scanners, etc.) with AEA compatibility to airport, airline, shared systems providers and other transport business related clients.
- **IT companies** / system integrators who wish to integrate airport, airline and other transport business related hardware to conform to AEA standards.
- **Airlines and handling agent** IT departments who have to certify hardware or have to understand or explore the technical "hows" of the business.

AEA – the **Association of European Airlines** – brings together 31 major airlines, and has been the trusted voice of the European airline industry for over 50 years.

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Aer Lingus
Air France
Air Malta
Air One
Alitalia
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Cyprus Airways
Finnair
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Luxair
Malev
Olympic Airlines
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Spanair
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TAP Portugal
TAROM
Turkish Airlines
Virgin Atlantic Airways

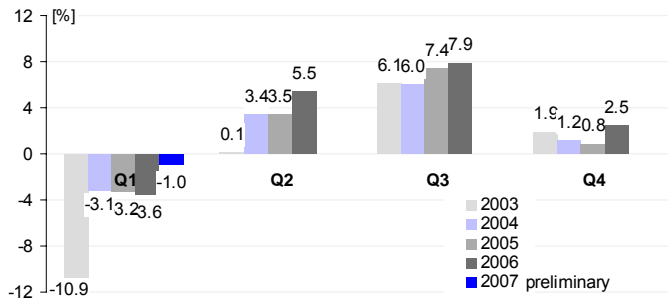




House Numbers

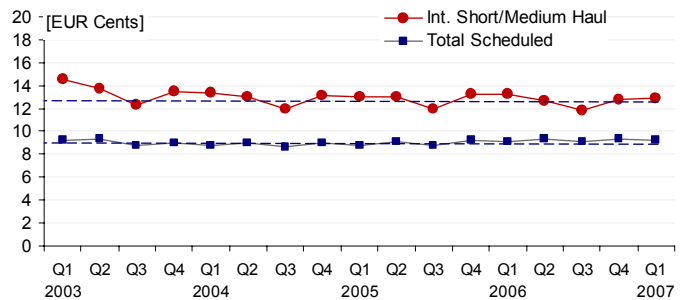
Operating Margin before interest [%]

Q1	%	Δpts
2007:	-1.0	
2006:	-3.6	2.6 ↑



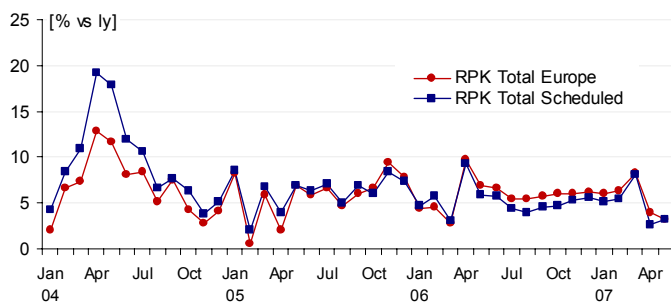
Passenger Yields (Gross Passenger Revenue per RPK)

Q1, 2007	Δ%
Int. Short/Medium Haul	-2.7 ↓
Total Scheduled	0.8 ↑



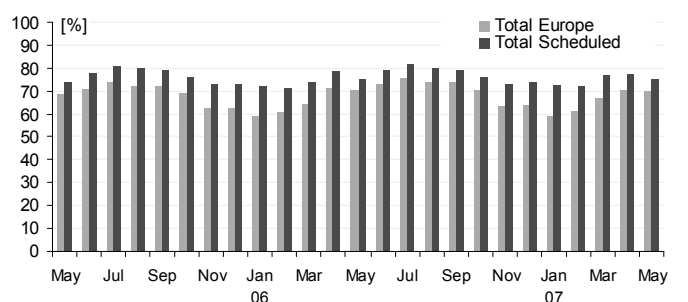
Monthly Traffic Growth [%]

Year to date (-May)	Δ%	May	Δ%
Total Europe	5.3 ↑	yoy	3.3 ↑
Total Scheduled	4.8 ↑	yoy	3.2 ↑



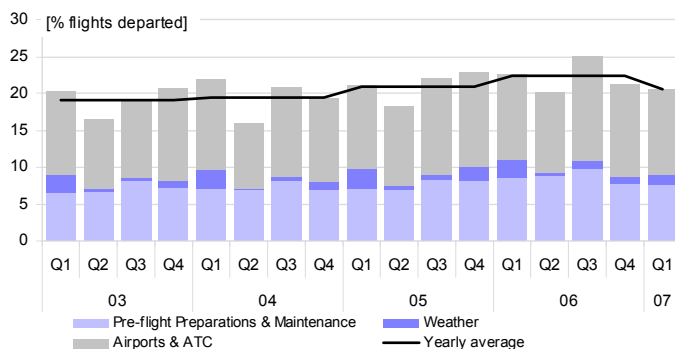
Passenger Load Factor (PLF)

Year to date (-May)	Δ%pts	May	Δ%pts
Total Europe	0.4 ↑	yoy	-0.6 ↓
Total Scheduled	0.5 ↑	yoy	-0.1 ↓



AEA Quarterly Delay Rates on Intra-European services

% Departures delayed more than 15 minutes by reason



Δ = Deviation
 ly = last year
 Q = Quarter
 RPK = Revenue Passenger Kilometres
 Total Europe = incl. Domestic

Operating Margin: Operating Result (before interest) in % of Total Operating Revenues; Submission currency = EUR

Passenger Yields: Based on constant membership; Submission currency = EUR

Monthly Traffic Growth: Based on constant membership

Passenger Load Factor: PLF = RPK/ASK

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