

Key data on environmental care
and sustainability at Lufthansa

Reporting year 2004

Balance

Facts and Figures

- Group companies
- Business segments
- Performance indicators
- Commitment



Lufthansa
The Aviation Group

Lufthansa – the Aviation Group



The Lufthansa Aviation Group is one of the world's leading air transport corporations. It comprises more than 400 independent group and affiliated companies, which are active in six strategic business segments. Lufthansa's operational base for passenger and cargo transport is in Frankfurt. Corporate headquarters is in Cologne. Other key locations are Munich, Hamburg and Berlin.

Passenger Business

The Aviation Group's strategic business segments

The Lufthansa Passenger Airline is an independent unit within the Lufthansa Group. It is the world's number one in cross-border scheduled air transport. In addition, the Company provides ground services, such as check-in and ticket sales. It also operates Germany's leading online travel shop, lufthansa.com. Lufthansa is a founding member of the Star Alliance, the world's first airline cooperation of its kind.

Logistics

For many years, Lufthansa Cargo has maintained the top position in global scheduled freight transport. The Company carried 1.8 million tons of freight in 2004, an increase of 11 percent over the preceding year. Lufthansa Cargo is one of the founding members of the international freight carrier alliance WOW, which today has four members.

Maintenance, Repair, Overhaul (MRO)

The Lufthansa Technik Group is one of the world's leading providers of maintenance services for commercial airliners. More than 500 airlines and customers have their aircraft, engines or components maintained and overhauled at Lufthansa Technik's 100-plus locations around the globe. Lufthansa Technik is the industry's pacesetter in the development of innovative products and services, such as wireless on-board communications systems.

Catering

With a market share of more than 30 percent, LSG Sky Chefs is the world's largest airline caterer. The Company's 200-plus flight kitchens, spread across all continents, serve more than 270 international airlines. LSG Sky Chefs is also an active player in airport food services, other areas of catering and hygiene-related quality control for the food industry.

Leisure Travel

Thomas Cook AG is one of the world's largest tourism groups. It comprises 32 tour operators, more than 3,600 travel agencies, 76,000 hotel beds and the leisure airlines Condor, Thomas Cook Airlines Belgium, Thomas Cook Airlines UK and SunExpress (40-percent participation). Together, these airlines operate a fleet of 75 aircraft.

IT Services

Lufthansa consolidates its key activities in the area of information technology within the Lufthansa Systems Group. Today, it is one of the world's leading providers of IT services in the airline and aviation industry. It has also successfully established its reputation as a competent partner in related industries.

Service and Financial Companies

The activities of the Lufthansa Group are supported by a number of service and financial companies. These include insurance company Delvag Luftfahrtversicherung-AG, its subsidiaries Albatros Versicherungsdienste GmbH and Delvag Rückversicherungs-AG, as well as Lufthansa Flight Training GmbH, a global provider of training services, especially for cockpit and cabin crews. Lufthansa Commercial Holding GmbH unites further affiliated companies supporting Lufthansa's core business.

At a glance

Key business performance data¹		2004	2003	Change
Revenue	million €	16,965	15,957	+ 6.3 %
Traffic revenue	million €	12,869	11,662	+ 10.3 %
Loss/profit from operating activities	million €	1,004	- 147	-
Net loss/profit for the period	million €	404	- 984	-
Operating result	million €	383	36	-
Capital expenditure	million €	1,783	1,155	+ 54.4 %
Operating cash flow	million €	1,881	1,581	+ 19.0 %
Total assets	million €	18,070	16,732	+ 8.0 %
Shareholder equity	million €	3,974	2,653	+ 49.8 %

Key personnel data²		2004	2003	Change
Number of employees (on December 31, 2004)		90,673	93,246	- 2.8 %
Staff costs	million €	4,813	4,612	+ 4.4 %
Average age	years	39.61		-
Part-time ratio, absolute	percent	24.6	23.5	+ 1.1 % pts.
Part-time ratio, men	percent	13.9	15.1	- 1.1 % pts.
Part-time ratio, women	percent	40.4	35.5	+ 4.8 % pts.
Share of women in management	percent	13.3	12.3	+ 1.0 % pts.

¹ Source: Lufthansa Annual Report 2004.

² Consolidation scope as in Annual Report 2004.

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Environmental Data³		2004	2003	Change
Resource consumption				
Fuel consumption	tons	6,524,818	5,955,566	+ 9.6 %
Fuel consumption, specific, passenger transport	l/100 pkm	4.29	4.31	- 0.6 %
Fuel consumption, specific, freight transport	g/tkm	185	185	± 0.0 %
Emissions				
Carbon dioxide emissions	tons	20,579,279	18,783,853	+ 9.6 %
Carbon dioxide emissions, specific, passenger transport	kg/100 pkm	10.81	10.88	- 0.6 %
Nitric oxide emissions	tons	96,018	89,639	+ 7.1 %
Nitric oxide emissions, specific, passenger transport	g/100 pkm	49.5	50.9	- 2.8 %
Carbon monoxide emissions	tons	15,744	14,413	+ 9.2 %
Carbon monoxide emissions, specific, passenger transport	g/100 pkm	8.6	8.8	- 2.3 %
Unburned hydrocarbons	tons	2,253	2,338	- 3.6 %
Unburned hydrocarbons, specific, passenger transport	g/100 pkm	1.0	1.1	- 9.1 %

Transport performance³		2004	2003	Change
Number of aircraft in the fleet, on December 31, 2004 (active fleet)		456	434	+ 22
Number of flights		706,560	565,237	+ 25.0 %
Passengers carried		65,324,238	56,197,980	+ 16.2 %
Freight carried	tons	1,750,000	1,576,000	+ 11.0 %
Seat kilometers offered, SKO	million pkm	181,926	162,510	+ 11.9 %
Freight ton kilometers offered, FTKO	million tkm	11,293	10,958	+ 3.1 %
Ton kilometers offered, TKO	million tkm	29,033	26,789	+ 8.4 %
Passenger kilometers transported, PKT	million pkm	150,228	133,371	+ 12.6 %
Freight ton kilometers transported (incl. third-party performance), FTKT	million tkm	7,411	7,349	+ 0.8 %
Ton kilometers transported, TKT	million tkm	22,233	20,491	+ 8.5 %

³ The previous year's data are not fully comparable, due to a widening of the scope of consolidation. Regional partners Augsburg Airways, Eurowings and Contact Air have now been included. Please see also page 12, "About this report."

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Dear Readers,



For the aviation industry, 2004 was characterized by an initial round of economic recovery. At the same time, the public debate on the environmental effects of air transport grew fiercer. A debate in which Lufthansa too needs to make its views clear, as it has become apparent that a lack of awareness still prevails concerning the industry's long-term efforts and successes with regard to the environment. Yet continuous improvements particularly in the areas of noise and gaseous emissions have led to palpable improvements – and the potential for further advances is far from being exhausted. Likewise, technology, operational procedures and, above all, infrastructure hold considerable potential for improvements. The trading of emissions rights could also make an important contribution here, provided the general conditions for such trading are set up in a responsible manner. Burdening air transport with additional taxes and fees would be neither economically sensible nor environmentally productive.

Last year, Lufthansa once again implemented a broad range of measures to reduce the effect its activities have on the environment. These efforts were supported by the commitment of all employees across the Group. This report documents the results we have achieved together. I wish you a captivating read and invite you once more to share with us your opinions on the subject.

A handwritten signature in black ink that reads "Karlheinz Haag".

Dr. Karlheinz Haag
Head, Group Environmental Concepts



Over the past years, the Lufthansa Environmental Report "Balance" has increasingly covered social issues and thus broadened its scope beyond the environmental dimension. In this issue, the people at Lufthansa are now more than ever the focus of attention.

For Lufthansa as a service provider, this is a decisive perspective. Every day, more than 28,000 Lufthansa employees in direct customer contact demonstrate our high levels of service quality. This requires a willingness to perform which we can only achieve with enthusiastic and highly qualified employees.

As we expect the highest levels of performance from our employees, we must in turn provide a framework of suitable conditions and a beneficial corporate climate. This is what we expect of ourselves. We aim to treat the people who make up Lufthansa with the same level of professionalism as we treat our customers. This goal is not only expressed in efficient personnel services and optimum opportunities to obtain qualifications. But it is also evident in the great importance that issues such as diversity or the compatibility of family and career enjoy at Lufthansa.

In this report, we would like to give you an overview of how far our work for the benefit of employees and society has advanced. I wish you a stimulating read.

A handwritten signature in black ink that reads "Martin Schmitt".

Dr. Martin Schmitt
Senior Vice President Executive Personnel

Highlights in sustainability

Modern fleet – low fuel consumption

Thanks to our continuous modernization program, the average age of the Lufthansa Group's fleet declined from 8.4 to 8.1 years in 2004. With regard to modernity and environmental compatibility, the Lufthansa fleet holds a leading position worldwide, one that will be strengthened further by the operation of the Airbus A380-800 from 2007. The most fuel-efficient aircraft in the Lufthansa fleet is the A330-200 at Thomas Cook UK, with a fuel consumption of 2.67 liters per 100 passenger kilometers.

→ More on page 18

Less kerosene per passenger

Last year, the entire Lufthansa fleet completed 706,560 flights, clocking up more than 22 billion ton kilometers. And yet specific fuel consumption fell once again, especially thanks to improved fuel efficiency and increased aircraft utilization rates. In the area of passenger transport, this value fell to 4.29 liters per 100 passenger kilometers.

→ More on page 21

Diversity as a driving force behind success

Diversity is a key word in Lufthansa's human resources strategy and policies. Worldwide, the Aviation Group benefits from the experience and competence of its more than 90,600 employees from about 150 nations. And it has put numerous measures in place to respond to their specific needs.

→ More on page 49

New era in atmospheric research

Aboard a Lufthansa Airbus A340-600, a state-of-the-art mobile laboratory has been collecting data for scientific purposes since December 2004. In this way, the European joint project CARIBIC gains valuable insights for climatic research. This project is the continuation of a commitment stretching back more than a decade. Since 1995, Lufthansa passenger aircraft have completed more than 20,000 flights benefiting climate research in the framework of the MOZAIC project.

→ Feature on page 14

Trailblazer in noise avoidance

Today, well over 90 percent of the aircraft in the Lufthansa fleet already fly more quietly than the ICAO's newest noise limits, which will apply to new aircraft from 2006. When it comes to noise research, Lufthansa assumes a driving role. In cooperation with partners from research and industry, Lufthansa has committed to a number of projects working to reduce noise sources on the aircraft frame and research quieter flight procedures.

→ More on pages 26 and 58

Taking an active role in society

Lufthansa supports a broad range of environmental, cultural and social projects. Cooperating with environmental protection organizations, for example, the airline works for the conservation of threatened natural and cultural landscapes. In addition, the HelpAlliance, an association founded by Lufthansa employees in 1999, supports about a dozen development projects around the world.

→ More on page 56

Researching for the future

Lufthansa actively supports a multitude of research projects, as scientific knowledge is the very basis for effective environmental measures. These efforts range from determining the emissions characteristics of jet engines to measuring radiation levels encountered at cruising altitude.

→ More on page 58

Corporate governance and management structures

Successful and responsible corporate management, as Lufthansa sees it, focuses in equal measure on profits, sustainable value and the interests of its stakeholders. To achieve its goals, the Company needs future-oriented strategies, efficient structures and transparent processes. This chapter shows what counts for Lufthansa in this context.



Member of **WOW™**

International alliances and advanced fleet management

To be able to offer a dense global network of seamless connections, Lufthansa relies on partnerships with other airlines. The Star Alliance, which was founded in 1997 at Lufthansa's initiative and today counts 16 member airlines, is a worldwide leader in this area. Likewise, the WOW alliance, in which Lufthansa Cargo is one of the founding members, is increasingly gaining importance in global freight transport.

Airline cooperations do not just make sense economically. They also help avoid environmental pollution, as they ensure higher rates of aircraft utilization and thus reduce the relative fuel consumption per passenger. For Lufthansa, high fuel efficiency and low noise and emissions values are also critical considerations when purchasing aircraft. The airline's long-haul fleet is one of the most modern and environmentally compatible worldwide. By practicing far-sighted fleet management and withdrawing older models from service, Lufthansa exploits additional optimization potentials.

Corporate governance at Lufthansa

Deutsche Lufthansa AG counts on responsible and transparent corporate governance, oriented toward sustainable value. The Company places great emphasis on open and clear corporate communications. This is an indispensable prerequisite for maintaining and increasing the trust that investors, employees and the public have in Lufthansa.

The German Stock Corporation Act, industrial codetermination law and capital market law, complemented by Lufthansa's Articles of Association and a company-specific version of the Corporate Governance Code, form the basis for shaping the Aviation Group's management and supervisory structures. Beyond the important German legal regulations, the Corporate Governance Code spells out nationally and internationally recognized standards for effective and responsible management.

→ www.lufthansa-financials.de → Corporate Governance

Management and corporate structure

As a German stock corporation, Lufthansa has an Executive Board and a Supervisory Board, reflecting the split managerial and supervisory structure that is standard practice in Germany. The Executive Board is responsible for directing the Company. The Supervisory Board names, supervises and advises the members of the Executive Board.

Deutsche Lufthansa AG is the supreme parent company and concurrently the Group's largest individual operating company, running the Passenger Airline. The management boards of the other Group companies are responsible for their specific businesses and results, and report to the Group's Executive Board. In addition, these management boards are monitored by their companies' respective supervisory boards.

Assuming responsibility – maintaining a balance

Business success does not rule out a corporate policy geared to sustainable development and care for the environment. We are fully committed to keeping a balance between them. Protecting the environment is therefore a prime corporate objective, to which we subscribe with total conviction.

(from the Mission Statement of the Lufthansa Aviation Group)

The Company's strategy aims at securing the Group companies' favorable market positions long-term and expanding the Aviation Group in a sustainable manner, all within the framework of the defined guidelines. In addition, Lufthansa has anchored the principle of sustainable development in the Group's Mission Statement.

→ <http://konzern.lufthansa.com/en> → About us → Management → Strategy

Risk management

To handle opportunities and risks, Lufthansa operates a Risk Early Warning and Management System. It comprises numerous building blocks, which are embedded in the structural and operational organization of the Group as a whole and of the individual Group companies. All significant risks potentially affecting the Company's results or threatening its existence are documented in a continuously updated "risk landscape" and categorized by possible level of damage and probability of occurrence. This includes risks that might arise in the areas of the environment or social responsibility. Within the scope of its risk management, Lufthansa also documents the planned measures for identifying these risks as early as possible, as well as for limiting and coping with them. The Risk Management Committee develops the guiding principles of the Company's risk strategy and monitors adherence to them. It also initiates checks as needed, which are carried out by internal auditors.

Group-wide environmental management

At Lufthansa, caring for the environment is a top-priority corporate goal. The Guidelines for Environmental Protection, which Deutsche Lufthansa AG adopted in 1996, form the basis for its Group-wide environmental management. Among the standards formulated in these Guidelines is the systematic recording and evaluation of all operational activities with an impact on the environment. For this purpose, Lufthansa has created a comprehensive environmental database, into which all Group companies feed their data on an annual basis. This becomes the raw material for calculating key environmental values and performance indicators. In turn, these serve as the basis for planning and evaluating the success of the measures implemented to continuously improve the Company's environmental care.

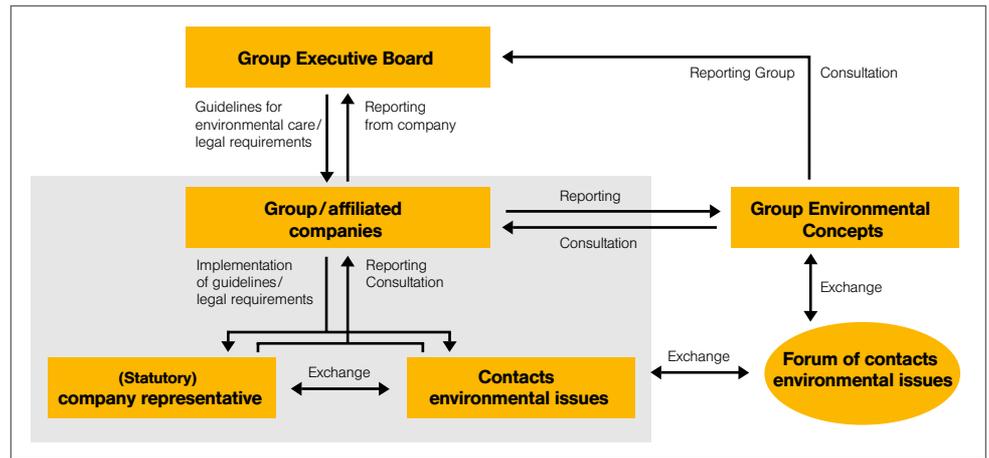
Communications is another key element in Lufthansa's environmental management – both internally vis-à-vis our employees and externally. Lufthansa emphasizes open and constructive dialog with all target audiences. The most important medium in this context is this Environmental and Sustainability Report.

It is the task of the Aviation Group's Executive Board to ensure that the Company fulfills its responsibilities in the area of environmental protection. It is advised and supported in this work by the Head of Group Environmental Concepts, who reports directly to the Executive Board. His department coordinates all Group-wide goals, strategies and measures related to the environment.

In addition, each management division of Deutsche Lufthansa AG and each Group company in Germany whose activities affect the environment and where Lufthansa holds a majority share has named a contact person for environmental issues or an Environmental Commissioner. On behalf of his or her Executive Board or management, this person advises and supports all efforts to implement and improve environmental policies, comply with legal requirements and meet environmental goals.

→ <http://sustainability.lufthansa.com>

Diagram of procedures and processes concerning environmental issues within German Group companies with environmental relevance and Lufthansa majority interest.



Responsibility for employees and society

For Lufthansa, pursuing economic goals while acting responsibly toward people and the environment is not a contradiction, but rather an obligation and a commitment. Even during times of economic crises, the Company has always placed great importance on giving its employees reliable perspectives and avoiding operations-related layoffs as far as possible. All parties benefit from maintaining social harmony – employees and management alike.

Since 2002, Lufthansa has been an official supporter of the Global Compact, launched by UN Secretary-General Kofi Annan. The members of this worldwide initiative undertake to adhere to ten principles, related to respecting human rights, labor and environmental protection standards and a commitment to fighting corruption. These efforts are supported by cooperations with organizations such as Transparency International and Deutsches Netzwerk Wirtschaftsethik e.V.



Principles of the "UN Global Compact"

Human rights

The Secretary-General asks world business to:

Principle 1: support and respect the protection of international human rights within their sphere of influence; and

Principle 2: make sure their own corporations are not complicit in human rights abuses.

Labor

The Secretary-General asks world business to uphold:

Principle 3: freedom of association and the effective recognition of the right to collective bargaining;

Principle 4: the elimination of all forms of forced and compulsory labor;

Principle 5: the effective abolition of child labor; and

Principle 6: the elimination of discrimination in respect of employment and occupation.

Environment

The Secretary-General asks world business to:

Principle 7: support a precautionary approach to environmental challenges;

Principle 8: undertake initiatives to promote greater environmental responsibility; and

Principle 9: encourage the development and diffusion of environmentally friendly technologies;

Anti-corruption

Principle 10: businesses should work against corruption in all forms, including extortion and bribery.

Positions:

Lufthansa in the context of society and politics

Air transport as an economic factor

The air transport industry offers a large potential for growth and affluence. In Germany alone, 770,000 jobs¹ are directly or indirectly dependent on air transport. The ACARE study² commissioned by the European Union shows that currently 3 million jobs across Europe directly depend on air transport. By 2020, this number will rise to 5-7 million.

German and European airports compete directly with each other. If capacities in Germany lag behind demand, passengers will migrate to the hubs located in neighboring countries. For this reason, the infrastructure serving air transport in Germany must urgently be adapted to increased requirements.

Subsidies distort competition

Lufthansa strongly advocates fair competition. For this reason, the airline criticizes the uncoordinated investments in expanding regional airports. This creates surplus capacities, leads to fare dumping and threatens all companies that – like Lufthansa – defend their position in competitive settings without taking recourse to subsidies. In addition, state aid hinders the consolidation process urgently needed in the European air transport industry.

Taxing kerosene or trading emissions – which helps?

The current decision not to tax kerosene is often interpreted as an indirect subsidy for air transport. However, this assessment is not correct. Unlike rail or road transport, air transport pays directly and fully for its infrastructure. But it is not only economic and legal objections that speak against the introduction of a kerosene tax: It would also be not very efficient in ecological terms. According to an EU study, such a tax would reduce CO₂ emissions by 0.3 percent at best³. By comparison, the effects that could be achieved by creating a uniform European air traffic control system and avoiding holding patterns thanks to sufficient infrastructure on the ground would lead to a 7-percent reduction of CO₂ emissions⁴.

From an ecological point of view, the international trading of emissions rights could be a far more effective instrument to reduce the environmental impact of air transport. In principle, this would allow the achievement of a defined ecological goal using economically efficient means.

The skies above Europe

Since the expansion of the EU to 25 members, free trade has prevailed from Tallinn to Lisbon, yet national responsibilities are still in force in the air. The consequences are delays, detours, additional costs – and more pollutants in the environment. Several studies (including one by the IPCC) have shown that improvements in air traffic management could reduce fuel consumption and overall emissions from air transport by 6–12 percent⁵. The EU directives concerning the “Single European Sky” were intended to remedy the situation by the end of 2004, but they have not had that effect yet. To ensure fair competition and transparent costs, national borders in European air space must finally be removed in the next few years.

¹ Initiative Air Traffic for Germany: Master Plan for the Development of Airport Infrastructure, October 2004

² Advisory Council for Aeronautics Research in Europe (ACARE): Strategic Research Agenda 2, October 2004

³ Air Transport and the Environment: Paths toward Sustainable Development, Brussels, 1999

⁴ Environmental Benefits associated with CNS/ATM Initiatives, Eurocontrol and FAA, 2000

⁵ Aviation and the Global Atmosphere, IPCC Report, 1999

Protection from aircraft noise

While aircraft have become increasingly quieter over the last years, the number of takeoffs and landings has risen. Lufthansa continues to take the issue of aircraft noise very seriously. To keep adverse effects to a minimum, the airline uses noise-reducing technologies and flight procedures. For many years, it has also supported scientific projects in the field of noise reduction, in which the airline takes an active part.

The amendment of the aircraft noise act currently under discussion stands beyond question for Lufthansa. However, two points should be taken into consideration. First, the new noise protection limits should follow from the insights generated by noise effect research. Second, noise protection areas should be calculated on the basis of actual aircraft movements.

The EU guidelines on aircraft noise should be implemented point for point, and should not lead to unilateral tightening at the national level. The latter would lead to a distortion of competition and thus a disadvantage for Germany as a business location.

Group-wide environmental goals

Key environmental goals	Environmental measures	Degree of attainment	Status
Reduce 1991 specific fuel consumption of the passenger fleets by 33 percent by 2008, and by 38 percent by 2012. Achieve related reduction in specific emissions of pollutants.		By the end of 2004, specific fuel consumption could be decreased by 31.7 percent. Thus, 96 percent of the goal set for 2008 has already been achieved.	▶▶
	Acquisition and operation of 10 A340-600s (from October 2003), 10 A330-300s (from 2004), 5 MD-11s (from 2005) and 15 A380-800s (from 2007).	Cutoff date 31.12. 2004: The modernization of the fleet has largely been implemented. Ten A340-600s and six of ten A330-300s on order are in service. One MD-11 is in service and four are being converted.	▶▶
	Introduction of an optimized contingency fuel procedure, to minimize fuel consumption and emissions of pollutants by determining fuel requirements more accurately.	This measure helps conserve about 17,000 tons of fuel per year. This is equal to avoiding emissions of 54,000 tons of CO ₂ annually.	▶▶
	Optimization of flight routings in the Asian region and resulting reduction of fuel consumption and emissions by 2005.	Fuel conservation on selected routes is about 1 percent. Emissions are reduced correspondingly. In 2004, the route to Hong Kong was specifically optimized, which yielded a savings of 15-20 minutes per return trip and a related reduction in fuel consumption of about 1,800 tons.	▶▶
	To reduce delays on arrival at Frankfurt Airport, the peaks in traffic volumes are flattened slightly. Significant quantities of fuel can thus be conserved.	Implementation started in April 2004. The expected reductions in fuel consumption have largely been achieved.	✓
	Whenever possible, the use of aircraft auxiliary power units (APUs) on the ground is to be avoided, by increasing the use of ground-based energy supplies and preclimatized air (PCA).	When ground times allow, Lufthansa uses ground-based energy supplies and preclimatized air (PCA) at all airports offering this option.	✓

Key environmental goals	Environmental measures	Degree of attainment	Status
Work toward the introduction of uniform standards to calculate specific fuel consumption at the AEA level by 2005.	Harmonization discussions within the AEA's Environmental Working Group.	Concept has been developed. Vote of the AEA is pending.	▶▶
Reduce noise emissions in the vicinity of airports.	Support for the use of the Continuous Descent Approach (CDA) to reduce aircraft noise during nighttime hours.	Procedure will be implemented in Frankfurt in 2005.	▶▶
Launch research and development project to identify noise-reduction options on the aircraft frame and in flight procedures.	Initiation and guidance of a joint research project (FREQUENZ) in coordination with eight partners from industry, universities and large research institutions, aimed at developing and validating concepts and refitting measures to reduce noise at the source. Project duration until end of 2007.	Project was launched at the start of 2004. Initial milestones have been reached successfully.	▶▶
	Main project partner in the joint research project "Noise-Optimized Approach and Departure Procedures." Using an advanced simulation program from DLR, the assessment of flight procedures with regard to noise development is set to improve significantly. Project duration until end of 2006.	By carrying out noise measuring flights, Lufthansa contributed decisively to creating (A319: 2001) and expanding (A319: 2004) a database on sources of noise on an aircraft's surface for the simulation program.	▶▶
Create intelligent mobility concepts in cooperation with railway operators in order to shift short-haul traffic to the rails (AIRail).	Introduction of AIRail connections on certain short-haul routes.	In March 2001, AIRail connections between Frankfurt Airport and Stuttgart Central Station were launched (6x daily). In May 2003, the route Frankfurt Airport-Cologne Central Station was added (15x daily). Thus, two of six flights between Frankfurt and Cologne could be withdrawn. The route Frankfurt Airport-Dusseldorf Central Station is to follow when Deutsche Bahn's timetable better suits our requirements.	▶▶
Create intelligent mobility concepts in cooperation with Fraport.	Support an IT-supported exchange of dynamic car pools via mobile phone.		!
Reduce the use of paper made from fresh fibers.	Conversion of Lufthansa's internal and external media as well as the paper used in printers and photocopiers for internal use from fresh-fiber paper to recycling paper.	Conversion of additional internal media has been accomplished. Lufthansa CityLine has already changed all paper used for internal copying and printing to recycling paper.	▶▶
Improve the Group-wide energy management.	Creation of a Group-wide energy forum as a part of Facility Management.	A forum has been established for the exchange of information concerning all aspects of energy, consumer-related capturing and processing of data for 2005/2006 at the Frankfurt Base (software-based remote data capture and processing).	▶▶
Improve the internal and external sustainability communications.	Reporting of environmental and social issues in Lufthansa's Annual Report, organization of regular internal road shows on environmental and social issues within the Group. Expansion of our Internet presence.	Environmental and social issues have been included in the Lufthansa Annual Report; further expansion is planned. Internet presence is continuously updated and improved. Scope of social topics covered in Balance has been expanded.	▶▶
Expand and improve the Group-wide environmental database.	Integration of further environmental data; development of a module to automatically import performance and consumption data.	Environmental database was introduced in 2003. Transfer to SAP base is planned for 2005.	▶▶
Reduce the energy consumption of newly-built office building to one-third of that of "conventional" buildings.	Construction of the Lufthansa Aviation Center as a "low energy building" by using a system of thermo-active construction components, highly insulating elements for the facade, a heat recycling system and other measures.	The new building is to be occupied from year-end 2005.	▶▶

 Goal reached
  Not reached
  Goal remains valid
  New goal

About this report

Scope of consolidation

This report describes the activities and performance of the Lufthansa Group and its relevant subsidiary companies in areas related to the environment, society and social issues. Essentially, two criteria were applied when deciding whether to include particular facts and figures about a Group company in this Report:

1. Does Lufthansa hold a stake of 50 percent or higher in this company?
2. Are these central processes and ratios when viewed in the context of the entire Group?

When both criteria were fulfilled, the relevant facts and figures were covered in this Report.

The most significant environmental effects in the framework of the Group's business activities result from flight operations. For this reason, we have consistently placed heightened emphasis on the consideration of kerosene consumption, emissions and noise.

In certain cases, the data presented in this report is based on a scope of consolidation differing from that applied in the Lufthansa Annual Report. While the Annual Report must fulfill the requirements of economic evaluation, Balance emphasizes a comprehensive consideration of the effects the Company's activities on the environment and society. This difference in perspective leads to differing values for transport performance and the size of the fleet.

Transport performance: The economic performance indicators in the Annual Report are based on the number of revenue passengers. By contrast, the Environmental Report takes all passengers aboard into account – including traveling employees and passengers traveling on “Miles&More” award tickets – as all travelers cause environmental effects.

Size of the fleet: The Annual Report indicates the total number of aircraft in the Group's possession. This figure refers to the value of these assets and includes all airplanes owned by Lufthansa, irrespective of their being used in operations, leased out or withdrawn from operations. By contrast, the Environmental Report takes only the operational fleet into consideration, as only these aircraft have an impact on the environment which Lufthansa can control.

Locations included

Lufthansa is a company with global operations and is thus present at locations worldwide. The dynamics of a Group with changing subsidiaries, differing levels of development of the environmental management systems at the individual, independently-acting subsidiaries and marked differences in environmental awareness from one country to another make a standardized method of data collection for the entire Group impossible. Where necessary, the boundaries of consideration concerning specific topics and companies are indicated in the respective chapters.

Evaluation and validation of data and information

Environmental management system

The data used in this report was collected by means of our Group-wide integrated environmental management system. This system also determines the methods for data verification and transmission to the Group division Environment. The basis for data collection is our Database for the Environment and Sustainability. In it, all environmentally relevant data are captured systematically.

→ also see page 7

Audit

After 11 years of environmental reporting, this year marks the first time that the methods used to produce this report were audited by independent certified public accountants from the firm Deloitte. This audit focused primarily on how data is collected and how information is combined in this report.

→ also see page 62

Methodology of calculations

Emissions

The calculation of emissions from flight operations is based on the actual transport performance and fuel consumption for the reporting year. In this context, each aircraft-engine combination that exists in the fleet is considered separately, and the corresponding values are calculated by means of programs provided by the respective aircraft and engine manufacturers. The annual average flight profile of each such subset in the fleet is then fed into these programs. Emissions are determined in relationship to flight altitude, distance, thrust and load. This is necessary for NO_x, CO and UHCs in particular. CO₂ emissions do not require special calculation methods, as they are generated in a fixed relationship to the quantity of kerosene burned.

Specific consumption and emission values

Calculating specific consumption and emission values means expressing absolute values in relationship to transport performance. For example, the ratio "liters per 100 passenger kilometers" (l/100 pkm) is calculated on the basis of actual load factors, actual distances flown and actual kerosene consumption figures.

Accuracy

The figures shown in the tables are rounded due to considerations of presentation. However, values indicating changes from the previous year always refer to precise figures. For this reason, it is possible that a specific value may remain the same from one year to the next, while a relative change is indicated.

Disclaimer of liability

The data included in this report have been collected and processed with the utmost care. Nevertheless, errors in transmission cannot be wholly ruled out. In addition to retrospective observations regarding the past business year, this report contains statements directed toward the future. These statements are based on current assumptions and expectations, and on existing prognoses and currently available information. While such statements and calculations have been made with the utmost care, the developments and results projected in them are not to be understood as guaranteed, due to the large number of external variables which may have an impact.

Tracking climate gases

In the framework of the CARIBIC and MOZAIC projects, sensitive measuring devices aboard Lufthansa long-haul aircraft collect data on the composition of the Earth's atmosphere. Scientists worldwide benefit from this research, which helps them better understand the causes and developments of climatic changes.



En route in the service of climate research: On long-haul flights, at an altitude of 12,000 meters, the air intake system under the fuselage of the A340-600 "Leverkusen" collects samples that will yield climate-related data.



**Global Compact
Project**

THE GLOBAL
COMPACT

CARIBIC: Climate data in the cargo hold

It weighs 1.5 tons, measures over 3 meters in length and is more than 1.5 meters in width. A shiny, silvery air freight container stands in the middle of a laboratory at the Max Planck Institute for Chemistry in Mainz. "What you see here is the very heart of CARIBIC," explains Carl Brenninkmeijer, scientific coordinator of this research project. The inside of this impressive box holds highly sensitive instruments. They are capable of measuring substances such as ozone, carbon monoxide, nitric oxides and microscopic dust particles contained in the air at concentrations as low as 1 to 1 billion parts – and at altitudes of up to 12,000 meters. This is so because the measuring container's place of work is in the cargo hold of a Lufthansa Airbus A340-600.

"The special feature of CARIBIC is that, for the first time, it gives us an opportunity to accurately identify more than 100 substances at cruising altitudes between 9 and 12 kilometers, and this in a regular and systematic manner," says Brenninkmeijer. "And the 13,000-kilometer range of the A340-600 means that we're also in a position to collect data virtually around the globe, including above the oceans, the tropics and the southern hemisphere." Researchers need the information thus generated to gain a better understanding of the causes driving climatic changes and to make prognoses. The project was set in motion by Nobel Prize winner Paul Crutzen as far back as 1993. Since December 2004 CARIBIC (Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container) has been taking off on long-haul flights with Lufthansa, with support from the European Union and Germany's Federal Ministry of Education and Research.



A sensitive job: A technician installs the air inlet system under the fuselage. It guides air samples to the measuring container, where they are analyzed for up to 100 substances.

Ten research institutes from five European countries joined forces to develop and equip the automated measuring container. A special air inlet system on the surface of the aircraft's fuselage makes it possible to analyze the surrounding air for aerosols and trace gases at cruising altitude. The data thus generated help researchers gain a better understanding of a sensitive region in the Earth's atmosphere: the transition layer between the troposphere and the stratosphere. The processes that take place here – in the so-called tropopause – are exceedingly complex. They influence the atmosphere's radiation household and thus the Earth's climate. How the air masses between troposphere and stratosphere mix and change, what chemical and physical processes take place and how quickly, what seasonal fluctuations exist – these are all important issues about which too little is known. CARIBIC helps to close these gaps in scientific knowledge.

"Some of the instruments on board are being used for the very first time," Carl Brenninkmeijer explains. For example, the Leipzig-based Leibniz Institute for Tropospheric Research developed an instrument to identify particles. These are important as they influence the formation of clouds, which has a direct impact on the Earth's heat household. Other renowned institutes also contributed to this project: The German Aerospace Center (DLR) provided a highly-sensitive system to measure nitric oxides. The Institute for Meteorology and Climate Research in Karlsruhe provided innovative systems that measure water vapor, overall water content and ozone. Heidelberg University developed the differential-optical spectroscope – no bigger than a pack of cigarettes – which determines the concentration of specific trace gases. All told, the CARIBIC container houses 15 different measuring instruments. Among other substances, they measure the concentrations of the greenhouse gas carbon dioxide, trace gases such as carbon monoxide or acetone, and the heavy metal mercury.

Alongside the data generated by these automated analyses, the container returns from each flight with 28 air and 14 aerosol samples, which are taken above specific regions. This gives researchers a basis for analyzing the composition of the air. "After forest fires or a volcanic eruption, it would be possible, for instance, to determine when which particles reached the upper troposphere and how long they lingered there," Brenninkmeijer explains. "These data also help us to investigate the effect industrial activities, such as the rapid growth in Asia, have on the global climate."

Cleared for takeoff: the flying laboratory

In Lufthansa's hangar at Frankfurt Airport, the Airbus A340-600 christened "Leverkusen" is waiting for its unusual cargo. In 20 minutes, after the scientists in Mainz have prepared it for another takeoff. An aerodynamically shaped aluminum construction projects 30 centimeters from the A340-600's belly. "On this brand-new A340-600, we've installed a complex air intake system specifically for CARIBIC", explains Andreas Waibel, responsible for environmental concepts at Lufthansa. Just like the measuring instruments housed inside the container, this system is based on state-of-the-art technology. After all, CARIBIC is to provide reliable information about the air masses the "Leverkusen" will traverse until 2014.

"Neither satellites nor measuring stations on the ground give us the same level of accuracy in spatial resolution of the data from the atmospheric layers



The heart of CARIBIC: The 1.5-ton container is installed once or twice a month in the cargo hold of the “Leverkusen,” where it works autonomously during its flight.

Measurements taken aboard passenger aircraft have three important advantages for scientists:

- They generate data with high spatial and temporal resolution.
- Measurements can be conducted worldwide aboard long-haul jets.
- Commercial jets fly in the tropopause, the transition layer between troposphere and stratosphere, an important, but relatively little-researched region.

as an aircraft does,” says Waibel. Satellites can only determine the vertical distribution of individual trace gases relatively roughly. A more detailed vertical resolution can be achieved with research aircraft, but because of cost considerations these special planes can only be deployed for short periods. Most importantly: “Passenger aircraft fly at regular intervals and are able to cover much longer distances than research aircraft,” Waibel explains.

Yet CARIBIC is not the only research program to benefit from the advantages Lufthansa passenger aircraft have to offer. The planes flying under the sign of the crane have been serving atmospheric research since 1995: Every day, three Lufthansa jets gather data on the concentration and distribution of ozone, water vapor, carbon monoxide and nitric oxides in the atmosphere for the European project MOZAIC (Measurement of ozone, water vapor, carbon monoxide and nitrogen oxides aboard Airbus in-service aircraft). With more than 20,000 flights completed so far, they have allowed scientists virtually global monitoring of these substances.

Unlike MOZAIC, which provides data on a daily basis, CARIBIC takes to the skies just once or twice a month. But during these flights the laboratory container collects data concerning a far larger number of parameters than MOZAIC does. The equipment to install the container aboard the aircraft required quite a lot of preparation, though. The engineers of Lufthansa Technik planned this project over a three-year period. Then it took about 1,000 technician hours to install the air inlet system, its cabling inside the aircraft and the hookup to the measuring container. “During its one or two flights per month, the container occupies the furthest position in the freight compartment. Then it’s not in the way of loading or unloading other freight items,” Waibel explains. All during the conversion, safety had the top priority. Strict requirements of the Luftfahrt-Bundesamt (Germany’s Federal Aviation Authority) needed to be fulfilled and proved in a test flight. To keep the pilots’ additional work load to a minimum, the CARIBIC system works entirely autonomously. It can be monitored from the cockpit and switched off in the event of an emergency.

When the “Leverkusen” arrives in Frankfurt after one of its measuring flights, the container is unloaded within half an hour and taken to the Max Planck Institute for Chemistry in Mainz. There scientists first download all data, examine them and send some of the air samples to other European institutes for further analysis. Aerosol samples, for example, go to Lund, Sweden, where they are checked with highly-sensitive instruments for their sulfur content. Finally, the experts in Mainz feed all the generated data into international databases, so that all research institutions have access to the measuring results.

“These data are very important for climate research, as we’ve already seen with MOZAIC,” says Waibel. “All climatic prognoses are based on mathematical models. And in the final analysis, these models are only as good as our understanding of the chemical and physical processes in the atmosphere.” These models can only be verified by making comparisons with the actual situation in the atmosphere. The better the basis of data, the more realistic the prognoses. “Projects like CARIBIC can help advance climate research quite a bit. As an Aviation Group, we want to contribute to this, in the future as well.”



At work every day: For 10 years, the MOZAIC sensors have routinely generated data for climate research.

Findings based on the data gathered so far

60 scientific publications have been based on MOZAIC measurements. These are the key results:

- **The troposphere contains distinct layers.**

The assumption that the air masses in the troposphere were thoroughly mixed has to be revised. As a result, climate models must incorporate a more accurate vertical resolution and improved parameters for vertical exchanges of air masses.

- **Ozone and water vapor are strongly variable.**

These marked spatial and chronological fluctuations have a decisive impact on the understanding of chemical and dynamic processes in the atmosphere. For example, they have a substantial influence on the hydroxyl radical OH. This radical plays a key role, as it determines how long many other trace substances may linger in the atmosphere.

- **The upper troposphere is much more humid than previously assumed.**

MOZAIC measurements show that water can be gaseous in the upper troposphere, even though it should take the shape of drops or ice crystals under the prevailing temperatures and pressures. Unlike the assumptions made in previous models, there is no thermodynamic equilibrium. This discovery means a significant advance for the understanding of the formation and development of vapor trails and cirrus clouds.

- **MOZAIC data deliver detailed vertical profiles above many cities and industrial belts. The profiles of nitric oxide and carbon monoxide concentrations are unique and not generated in this form by any other program.**

Among the most conspicuous results are the extremely high concentrations of carbon monoxide above eastern Asia. Even at cruising altitude, MOZAIC has at times recorded concentrations that in Europe exist only in urban areas. This extreme influence on the higher layers of the atmosphere from car exhaust gases and forest fires had been largely unknown until recently.

MOZAIC: 10 years en route in the service of atmospheric research

For more than ten years, climate-relevant trace gases have been measured daily at cruising altitude in the scope of the climate research project MOZAIC (Measurement of ozone, water vapor, carbon monoxide and nitrogen oxides aboard Airbus in-service aircraft). Five long-haul jets have been equipped with dedicated measuring equipment specifically for this purpose. The exhaustive data that have been generated through MOZAIC are the basis for a better understanding of the atmosphere's chemistry, and thus for more accurate prognoses of climatic change.

At cruising altitude, the measuring instruments record the concentrations of the greenhouse gases ozone and water vapor at four-second intervals, about once every kilometer flown. For the last four years, the concentrations of carbon monoxide and reactive nitric compounds have been measured as well. Over the past ten years, the MOZAIC flights have accumulated a wealth of data that is unique worldwide.

MOZAIC was launched in 1994 by groups of researchers in Germany, England and France, the European Union and the industry partners Airbus, Lufthansa, Air France, Austrian Airlines and Sabena. Its scientific leadership is the task of the Laboratoire d'Aérodologie in Toulouse. Currently, three of the five Airbus A340s collecting data for MOZAIC are operated by Lufthansa. Even though MOZAIC has not been supported by the EU since February 2004, the research institutes and airlines involved have decided to continue the project until 2007. By then, the basis for the long-term continuation of the measurements is to be created in the new European infrastructure project IAGOS (Integration of routine Aircraft measurements into a Global Observing System) within the framework of a worldwide observation system. The new project started on April 15, 2005 under the direction of the Research Center Jülich in Germany.



Average age of the Lufthansa Group's fleet

on 31.12.2004 (active fleet) change compared to 2003

Passenger Airline	8.4 years	- 0.3
Regional	6.7 years	+ 1.0
Leisure travel	7.2 years	+ 0.3
Cargo	5.7 years	- 4.0
Average	8.1 years	- 0.3
Average age IATA fleet on 31.12.2003	10.8 years	

Fleet

In 2004, a Lufthansa Group aircraft took off somewhere around the world every 45 seconds. The Company flew to more than 350 destinations in 90 countries. Worldwide, its crews were entrusted with more than 65 million passengers and 1.75 million tons of freight.

Modern aircraft are easier on the environment

In this Report, the Group's fleet encompasses all active aircraft across the Lufthansa Group. In the area of passenger transport, this means the fleets of the Lufthansa Passenger Airline, all regional partners and Thomas Cook AG. Emphasis should be given here to the special situation of the regional partners: This Report reflects data not only from Air Dolomiti and CityLine (majority shares) but also from Eurowings (minority share) and Augsburg Airways and Contact Air (partner carriers). Absolute values and values for freight also include data from Lufthansa Cargo's fleet.

In 2004, Lufthansa was able to reduce the average age of its total fleet from 8.4 to 8.1 years – one further step in the framework of its continuous fleet modernization. The acquisition of newer aircraft counteracted any increase in the fleet's average age.

The Group continues this strategic approach to maintain its top position in international competition into the future. Thus, a total of ten new Airbus A340-600s have joined the fleet. Of the ten A330-300s ordered, six have already entered revenue service. Delivery of the remaining four A330-300s in November 2005 will mark the completion of this program, launched in 2003 to modernize the intercontinental fleet.

The next major modernization initiative is approaching rapidly. Starting in 2007, the first of 15 wide-body Airbus A380-800s are to begin operations. Their arrival will once again reduce the average age of the passenger fleet. Yet today, the long-haul fleet in particular – with an average age of 5.5 years – already counts as one of the youngest by international comparison.

In the same vein, the cargo fleet was also rejuvenated. By now, Lufthansa Cargo has decommissioned all its Boeing 747-200s. These were replaced by five Boeing MD-11s, four of which are still being converted to Lufthansa standards. These aircraft are set to go into service in the course of 2005.

Lufthansa Passenger Airline



Boeing 737-500

26 aircraft, 103 seats, 2,500 km range



Boeing 737-300

33 aircraft, 123/133 seats, 2,600/2,200 km range



Airbus A319-100

13 aircraft, 126 seats, 3,500 km range



Airbus A320-200

34 aircraft, 150 seats, 3,500 km range



Airbus A321-100/200

24 aircraft, 182 seats, 2,900/4,100 km range



Airbus A300-600

13 aircraft, 280 seats, 3,400 km range



Airbus A330-200

2 aircraft, 229 seats, 11,000 km range



Airbus A330-300

6 aircraft, 221 seats, 10,000 km range



Airbus A340-300

30 aircraft, 247 seats*, 12,400 km range

*differing seat configurations in operation



Airbus A340-600

10 aircraft, 345 seats, 12,200 km range



Boeing 747-400

30 aircraft, 390 seats*, 12,500 km range

*differing seat configurations in operation

Lufthansa Regional



ATR 42-500

DLA: 8 aircraft, 46 seats, 900 km range

KIS: 9 aircraft, 44 seats, 900 km range



ATR 72-500

DLA: 8 aircraft, 64 seats, 900 km range

EWG: 15 aircraft, 68 seats, 900 km range

Lufthansa Regional**Avro RJ85**

CLH: 18 aircraft, 93 seats, 2,200 km range

**Bae 146-200**

EWG: 4 aircraft, 92 seats, 1,600 km range

**Bae 146-300**

EWG: 4 aircraft, 98 seats, 1,800 km range

**Canadair Jet 100/200**CLH: 43 aircraft, 50 seats, 2,000 km range
DLA: 5 aircraft, 50 seats, 2,000 km range
EWG: 12 aircraft, 50 seats, 2,000 km range**Canadair Jet 700**

CLH: 20 aircraft, 70 seats, 2,300 km range

**DHC8-300**

AUB: 5 aircraft, 50 seats, 900 km range

**DHC8-400**

AUB: 5 aircraft, 70 seats, 1,300 km range

Thomas Cook Airlines**Airbus A320-200**CFG: 12 aircraft, 174 seats, 4,630 km range
TCW: 5 aircraft, 180 seats, 5,600 km range
TCX: 5 aircraft, 180 seats, 4,900 km range**Boeing 757-200**CFG: 1 aircraft, 207/210 seats, 6,800 km range
TCX: 15 aircraft, 235 seats, 7,200 km range**Boeing 757-300**CFG: 13 aircraft, 252 seats, 5,370 km range
TCX: 2 aircraft, 280 seats, 6,300 km range**Airbus A330-200**

TCX: 2 aircraft, 354 seats, 12,500 km range

**Boeing 767-300**

CFG: 9 aircraft, 269 seats, 10,550 km range

**Boeing MD-11**15 aircraft, 455 m³/90.5 t, 6,900 km range**Lufthansa Cargo**

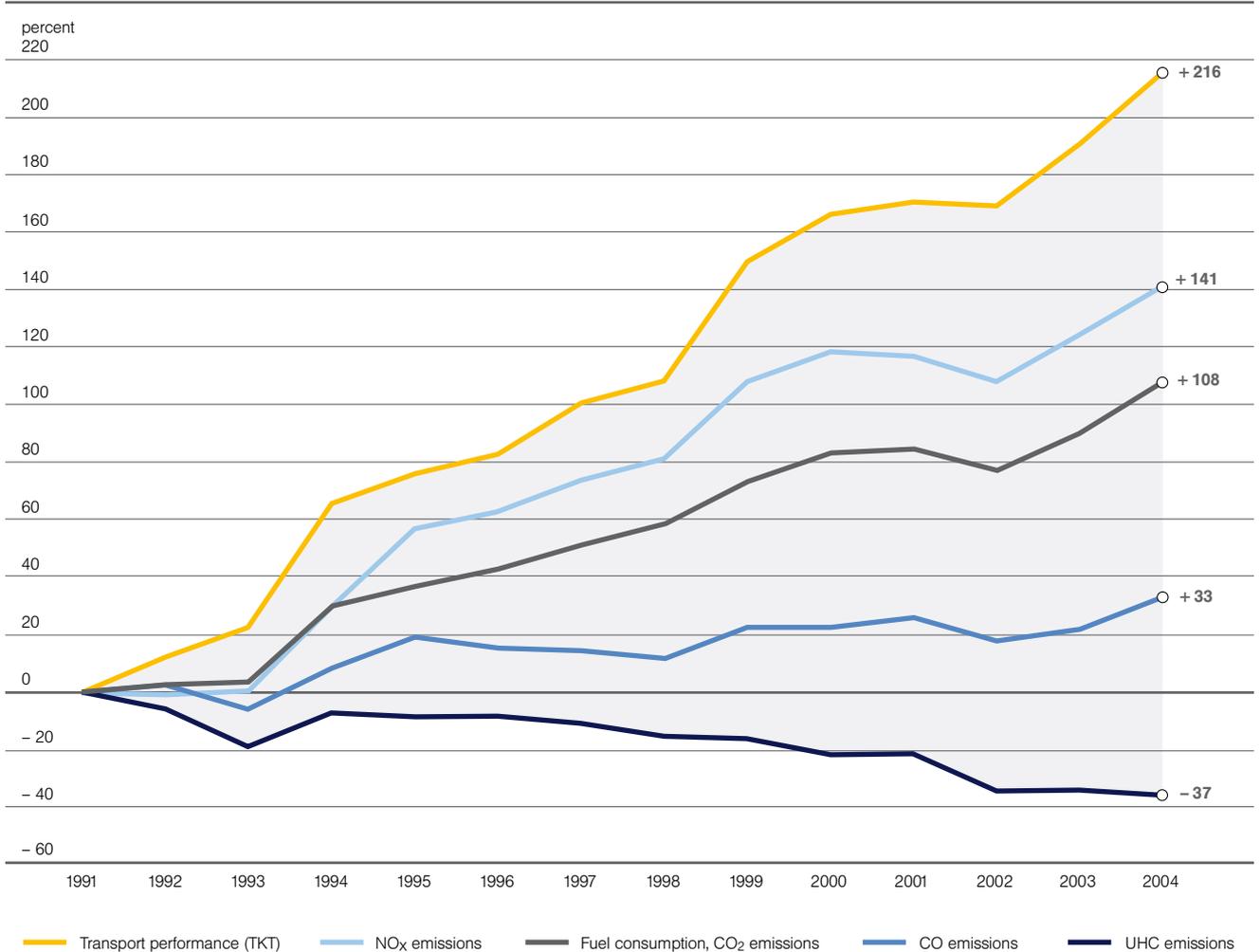
Balance

Increased transport performance does not necessarily mean increased environmental burden

Lufthansa's efforts to increase efficiency by continuously modernizing its fleet and optimizing aircraft utilization lead to an ongoing improvement of all environmentally relevant facets of flight operations. Therefore, an increase in transport performance does not necessarily come at the price of an equal increase in environmental burden. The truth is that more than half of the growth in transport performance at Lufthansa in the last 14 years has been achieved with no increase in either kerosene consumption or CO₂ emissions. Emissions of unburned hydrocarbons have even declined – despite strongly increased transport volumes.

Decoupling of transport performance and environmental burden

Change compared with 1991 in percent, values for the fleet of the Lufthansa Group



**Transport performance
passenger transport**

change compared to 2003

Passengers	65,324,238	+ 16.2 %
Performance offered SKO	181,926 million pkm	+ 11.9 %
Performance achieved PKT	150,228 million pkm	+ 12.6 %
Seat load factor	82.6 percent	+ 0.5 PP

**Transport performance
freight transport**

change compared to 2003

Freight carried	1,750,000 tons	+ 11.0 %
Performance offered FTKO	11,293 million tkm	+ 3.1 %
Performance achieved FTKT	7,411 million tkm	+ 0.8 %
Freight load factor	65.6 percent	- 1.5 PP

**Transport performance
total**

change compared to 2003

Flights	706,560	+ 25.0 %
Performance offered TKO	29,033 million tkm	+ 8.4 %
Performance achieved TKT	22,233 million tkm	+ 8.5 %
Payload factor	76.6 percent	+ 0.1 PP

Transport performance

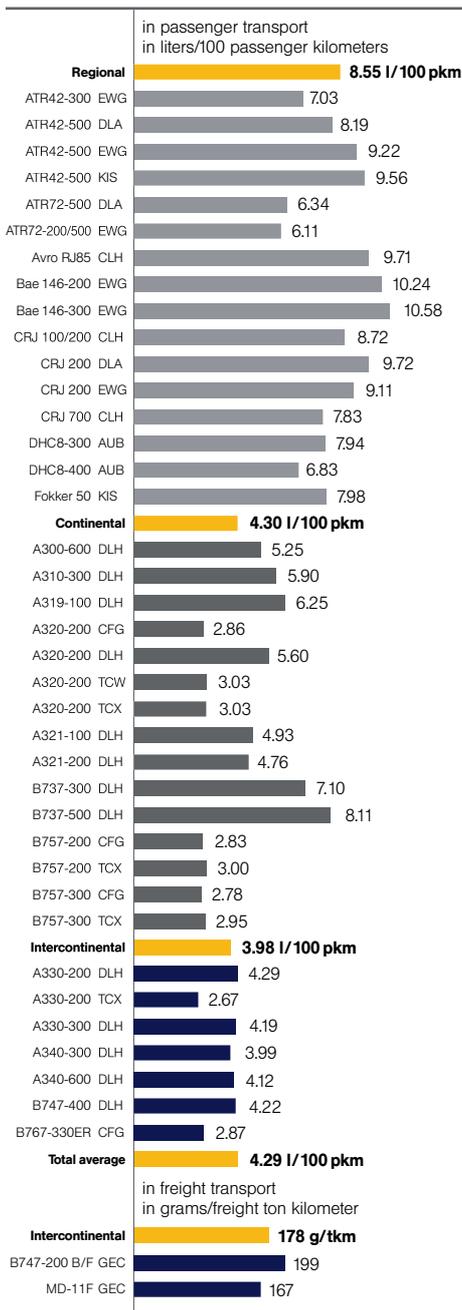
Compared with the air transport industry as a whole, the Lufthansa Group benefited at above-average levels from the upswing in the world economy and a perceptible increase in demand. Double-digit growth rates in both performance offered and performance sold strengthened the favorable position of the Lufthansa Group vis-à-vis its competitors. Despite massive increases in the price of oil – in October 2004 the price of jet fuel climbed over the previously established “sound barrier” of US\$ 50 per barrel – and a related weakening of demand, Lufthansa was able to increase its passenger transport capacity by almost 12 percent to 182 billion SKO (seat kilometers offered). It also managed to increase the average utilization of its aircraft once again, this time by half a percentage point to more than 82 percent.

Moreover, the 4,800 tons of freight flying every day aboard the aircraft of Lufthansa Cargo, or as so-called “belly freight” in the cargo holds of the passenger fleet, added up to a total of 1.75 million tons of freight and mail in 2004.

In combined freight and passenger transport, the Lufthansa fleet achieved a total performance of more than 22 billion ton kilometers, an increase of 8.5 percent over the preceding year. A total of 706,560 flights were operated. Taken together, Lufthansa’s aircraft flew a distance of 948 million kilometers. This is more than six times the average distance between the Earth and the sun.

Kerosene

Specific fuel consumption by type of aircraft Lufthansa Group fleet (operational in 2004)



AUB = Augsburg Airways
 CFG = Condor
 CLH = Lufthansa CityLine
 DLA = Air Dolomiti
 DLH = Lufthansa Passenger Airline
 EWG = Eurowings
 GEC = Lufthansa Cargo
 KIS = Contact Air
 TCW = Thomas Cook Belgium
 TCX = Thomas Cook UK

Fuel consumption dropped below 4.3 liters/100 pkm

The expansion of the Group's transport offer affected its kerosene consumption. Overall, this figure increased by 9.6 percent to 6.5 million tons. The distribution of consumption shares remained virtually stable, at 79 percent for passenger transport and 21 percent for freight transport. By contrast, specific consumption values continued to decline, especially thanks to increased seat load factors in passenger transport and further improvements in aircraft fuel efficiency all round. In passenger transport, specific kerosene consumption declined to 4.29 l/100 pkm, compared with 4.31 l/100 pkm the year before. If we consider the developments over the past 14 years, we have achieved a reduction in specific fuel consumption of close to 2 l/100 pkm, or more than 30 percent. Even greater advances have been achieved in the specific consumption values of freight transport: Since 1991, they have fallen by more than 37 percent to currently 185 g/tkm.

Delays on approach and militarily restricted areas cost fuel

Despite all the efforts undertaken by the Lufthansa Group to optimize the kerosene consumption of its fleet and especially to push down its specific consumption values further, certain external factors – over which an airline has little or no control – affect overall consumption. These include delays during the approach phase and the necessity – binding for all airlines – of flying around areas restricted by the military.

Strain on air space leads to delays on approach

Last year, the permanent overload experienced in the air space around Frankfurt Airport had its price. This is where the highest number of holding patterns were flown. That is just one of the reasons why Deutsche Lufthansa AG advocates the expansion of the local infrastructure, in particular the construction of an additional runway. Worldwide, delays in flight added up to 673,863 minutes – that is, 11,231 hours or 468 days – for the Lufthansa Passenger Airline alone.

In 2004, the aircraft operated by the Lufthansa Passenger Airline burned an additional 39,300 tons of kerosene (+18.4 percent) while flying in holding patterns. At 53 percent, continental traffic accounts for the larger share of this burden. To illustrate: This is enough fuel to fly 234,000 leisure travelers a year in aircraft like the Airbus A300-600 from Frankfurt to Malta and back home – a distance of about 4,000 kilometers. Were it possible to avoid these delays during the approach phase, the environment could be spared the burden of 124,000 tons of CO₂ emissions. Almost just as high is the additional fuel consumed by flying faster to catch up with the delays caused by overburdened air space or inadequate infrastructure. As thrust is increased, the engines can no longer work at optimum efficiency levels. And fuel consumption increases disproportionately.

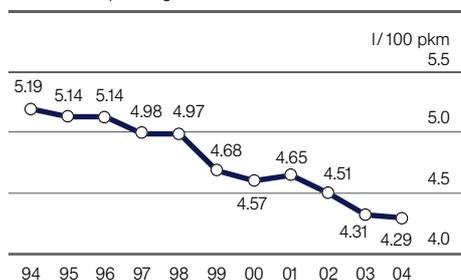
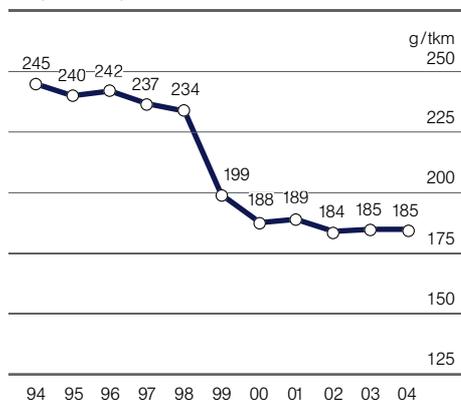
Limit militarily restricted areas in a sensible manner

The potentials for optimizing air routes are by no means restricted to far-flung destinations served by intercontinental connections. Savings and advances can also be realized in the busy skies over Europe, and especially over Germany. Extensive militarily restricted areas in Germany, though seldom used, block air space all year round. Currently, Deutsche Lufthansa AG is cooperating with German Air Navigation Services (DFS) and the military authorities to develop a concept for the utilization of these restricted areas. As a first step, there are plans to divide this air space into blocks. Such a

Fuel consumption absolute

changes compared to 2003

Kerosene passengers	5,151,098 tons	+ 12.0 %
Kerosene freight	1,373,720 tons	+ 1.3 %
Kerosene total	6,524,818 tons	+ 9.6 %

Specific fuel consumption in passenger transport
in liters/100 passenger kilometers**Specific fuel consumption in freight transport**
in grams/freight ton kilometer**Fuel dumps**

changes compared to 2003

Events, total	19	- 13
Quantity, total	692.2 tons	- 21.4 %
Medical reasons	5	- 10
Technical reasons	11	- 5
Other reasons	3	+ 2

division would allow improved flight planning and favor keeping a safe distance from blocks used for military purposes. Depending on specific requirements, the military could temporarily book one or more blocks for its purposes. Air space not thus reserved could be used by civil aviation. The savings potential of this measure cannot yet be determined. Primarily, it will make air traffic flow more smoothly and thus contribute clearly to safety and punctuality.

Can only be influenced to limited extent: Fuel dumps

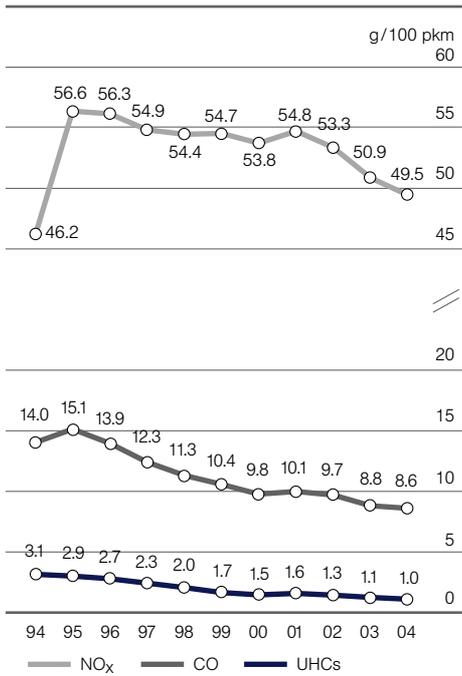
Even if such events occur exceedingly rarely in flight operations, fuel dumping – or the jettisoning of kerosene in flight – receives much attention from a public increasingly sensitive to environmental effects. To guarantee safety, fuel dumps can unfortunately not be avoided. On occasion, a flight must be aborted due to technical reasons or a medical emergency on board. The aircraft flies to the nearest airport or returns to the airport where it took off. In such cases, the fuel tanks have to be emptied until the aircraft's highest permitted landing weight has been reached. The quantity of fuel dumped varies, depending on the distance already covered and the type of aircraft.

Fuel dumps, however, are only required for long-haul aircraft. Short and medium-haul aircraft do not require this procedure, as their total weight allows them to land even at full payload and with a full tank.

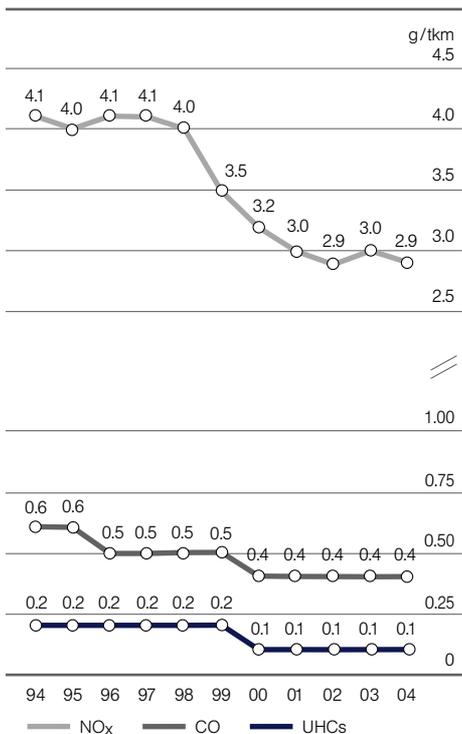
When pilots are forced to reduce the weight of their aircraft by dumping kerosene, they must adhere to precise procedures. Fuel must be dumped over mostly unpopulated areas, at a speed of 500 km/h and at a minimum altitude of 1,500 meters. In addition, the aircraft may not fly full circles during the fuel dump. This elaborate set of procedures and the nozzle used for jettisoning the kerosene guarantee that it is finely distributed. As a result, the largest part evaporates in the air, while only very small quantities reach the ground. The burden on the soil is harmless and far less than that caused by ordinary car traffic.

No airline is safe from the events that can cause a fuel dump. However, flight terminations due to technical problems can be largely avoided by ensuring high levels of maintenance across the fleet. So it can be taken as a positive sign that only 19 of the 706,560 flights operated by the Lufthansa Group last year had to be aborted, five of these for medical reasons. All told, that was 13 less than during the previous year. The quantity of kerosene dumped came to about 692 tons, a decrease of 21 percent.

Specific emissions in passenger transport
in grams/100 passenger kilometers



Specific emissions in freight transport
in grams/freight ton kilometer

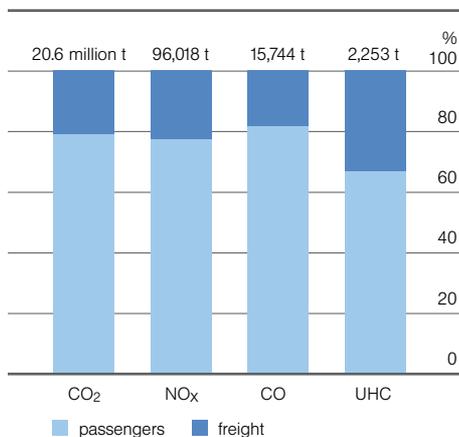


Emissions

Analogous to the fuel consumption of the Lufthansa fleet, the absolute emissions of carbon dioxide, nitric oxides and carbon monoxide increased by about 9 percent each in 2004. More exactly, they came to 20.6 million tons of CO₂, 96,018 tons of NO_x and 15,744 tons of CO. By contrast, the emissions of unburned hydrocarbons (UHCs), which are mainly generated by incomplete combustion processes within the turbine, decreased slightly in absolute terms to 2,253 tons. Calculated separately for passenger and freight transport, the specific emissions values show the same slight decline on the previous year as those for specific kerosene consumption. The specific emissions values of the passenger fleet fell to 10,815 g/100 pkm of carbon dioxide, 8.6 g/100 pkm of carbon monoxide, 49.5 g/100 pkm of nitric oxides and 1 g/100 pkm of UHCs. A similar development emerged in freight transport. While the absolute values increased slightly, the low level of the specific values – measured here in g/tkm – could be stabilized.

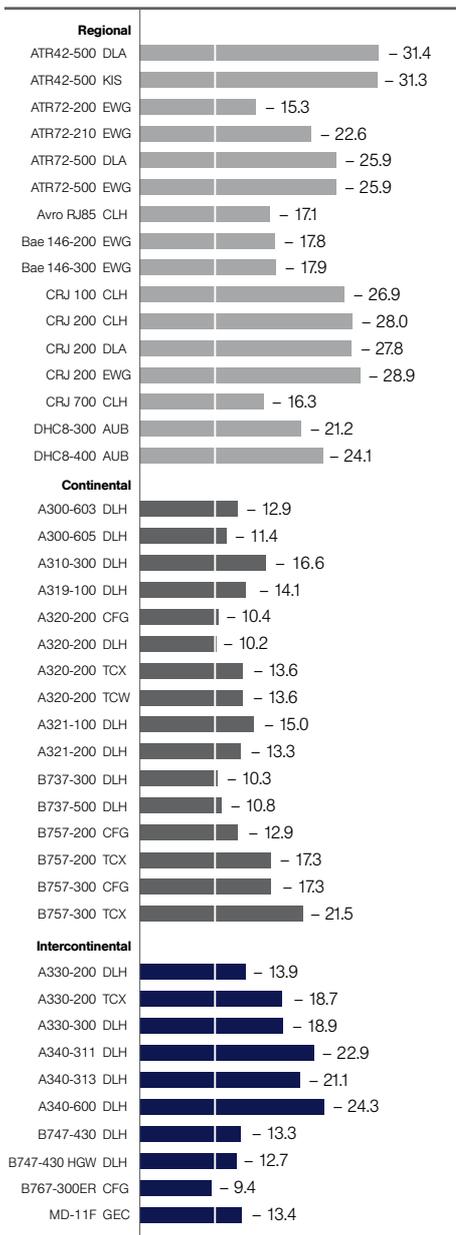
Emissions from flight operations

Shares of passenger and freight transport, in percent



Margins below the noise limits of ICAO Chapter 3*

Lufthansa Group fleet on 31.12.2004 (active fleet) in EPNdB



* new limits according to ICAO Chapter 4, binding from 2006 for new aircraft: -10.0 EPNdB compared with Chapter 3

AUB = Augsburg Airways
 CFG = Condor
 CLH = Lufthansa CityLine
 DLA = Air Dolomiti
 DLH = Lufthansa Passenger Airline
 EWG = Eurowings
 GEC = Lufthansa Cargo
 KIS = Contact Air
 TCW = Thomas Cook Belgium
 TCX = Thomas Cook UK

Noise

Energy savings and noise reduction go hand in hand

The fact that the Group operates one of the most modern fleets in the world also has a positive effect on its noise emissions. Today, over 90 percent of all Lufthansa aircraft already fly more quietly than the newest noise limits (Chapter 4) ratified by the ICAO, which are another 10 decibels quieter than current standards and will apply to new aircraft from 2006. And the aircraft the Group has on order give ample reason to expect further improvements in noise reduction.

But cutting back noise emissions is not just a task for engineers and engine designers. As the burdens relevant for people and the environment are mainly generated during takeoffs and landings, departure and approach procedures are also scrutinized for their optimization potentials. Deutsche Lufthansa AG has been actively involved in research concerning the sources and causes of aircraft noise for many years and plays a significant part in the development of take-off and approach procedures optimized according to environmental criteria.

Upon closer examination, even tried-and-tested procedures introduced a long time ago still hold potential for improvements. One example is the setting of flaps during approach: Set at a sharp angle, the flaps increase the aircraft's air resistance and thus have a braking effect. Yet this also requires more thrust and produces more noise. A landing performed with the flaps set at flatter angles, the so-called "low drag/low power" or Frankfurt Procedure, means less air resistance and thus a longer distance on the runway for aircraft to come to a stop. Both variations have been standard practice for a long time. As so many factors – including weather conditions, the aircraft's landing weight and the airport's special situation – play a role in selecting an appropriate landing procedure, the rule is that it is left to the pilots' discretion which one they select. Deutsche Lufthansa AG favors the latter procedure for several reasons. Such landings are not only quieter, but they also conserve fuel. With more than 700,000 landings a year for the Lufthansa fleet alone, even a small savings can have a substantial effect.

In addition, Lufthansa supports the approach with a continuous descent rate (Continuous Descent Approach, CDA), especially for night flights. This procedure significantly reduces noise emissions in the greater area surrounding an airport.



Lufthansa Passenger Airline

The Lufthansa Passenger Airline, as a separate unit within the Lufthansa Group, operates the scheduled passenger services. It belongs to the small circle of the world's leading airlines and flies one of the most modern and most environmentally compatible fleets. Last year, its 221 aircraft, with seating capacities between 100 and 400 seats, carried 39.3 million passengers.

Fuel efficiency stable as transport performance increases

Lufthansa's transport performance solid grew by 13.3 percent to nearly 106 billion passenger kilometers, despite a reduction in the size of its fleet. As seven Airbus A319s were grounded or decommissioned and a number of older aircraft models continued to be taken out of service, the total number of aircraft in the operational fleet fell from 232 to 221. The number of employees remained almost constant at 29,115, which indicates a significant rise in productivity. The increase in kerosene consumption for passenger transport, at 12.9 percent, was lower than the growth in transport performance. Thus, specific fuel consumption – which has been at low levels for many years – was reduced once again. It now stands at 4.52 l/100 pkm. The effects of Lufthansa's efforts to increase fuel efficiency, which it has pursued since 1991 for both environmental and competitive reasons, are illustrated by the following figures: In 1991, 1 ton of kerosene allowed us to cover 18,825 passenger kilometers on average. In 2004, this rose to 27,655 pkm, or about 47 percent more.

As more kerosene is burned, the related emissions increase. This cause-and-effect relationship is indissoluble. Accordingly, the absolute volume of CO₂ emissions increased by 13.4 percent to 13.8 million tons. Yet these figures do little to illustrate the advances that have been made in engine technology over the last 15 years. The picture becomes clearer when one considers the emissions values for those environmental pollutants primarily resulting from incomplete combustion processes in the turbine – toxic carbon monoxide and unburned hydrocarbons (UHCs). Since 1991, CO emitted in passenger transport has declined from 9,722 to 9,493 tons, while the values for UHCs actually fell from 2,755 to 1,270 tons. Over the same period, however, transport performance has increased by 160 percent. This decoupling of environmental burden and transport performance is reflected in the development of all specific values. A look at the last 14 years yields an impressive picture: Measured in g/100 pkm, emissions of carbon monoxide have fallen by 62.2 percent over this period, nitric oxides (NO_x) by 23.7 percent and unburned hydrocarbons by 82.1 percent.

Optimization potentials also exploited in flight operations

The high energy efficiency of modern aircraft is the result of persistent research and intense progress in the areas of engine technology and aerodynamics. But just as in automobile traffic, where road conditions, traffic density, tire pressures, individual driving styles, route planning or unnecessary ballast can mean higher or lower fuel consumption, fuel efficiency in flight operations can be influenced by a broad range of measures.

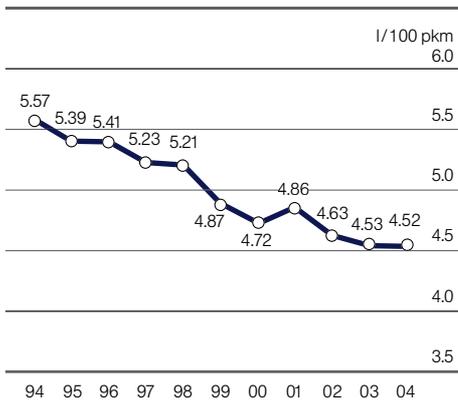
In principle, every flight challenges an airline's planning and flying personnel to find an optimum compromise between the parameters of time, costs and fuel consumption. For example, it can make sense to fly around congested air space, which poses a risk of delays, and thus to accept a slightly longer

At a glance changes compared to 2003

Employees	29,115		-0.4 %
annual average			
Transport performance	105.7 billion pkm		+13.3 %
PKT			
Fleet	13 Airbus A300-600		-2
on 31.12.2004	0 Airbus A310-300		-6
(active fleet)	13 Airbus A319		-7
	34 Airbus A320-200		+3
	24 Airbus A321		-2
	2 Airbus A330-200		-3
	6 Airbus A330-300		+6
	0 Airbus A340-200		-1
	30 Airbus A340-300		±0
	10 Airbus A340-600		+6
	33 Boeing 737-300		-2
	26 Boeing 737-500		-3
	30 Boeing 747-400		±0
Fuel consumption	4,385,214 tons		+13.4 %
passengers and freight, absolute			
Fuel consumption	4.52 liters/100 pkm		-0.2 %
passengers, specific			
Emissions from flight operations	CO ₂ 13,830,966 tons		+13.4 %
passengers and freight, absolute	CO 10,587 tons		+6.2 %
	NO _x 67,440 tons		+12.2 %
	UHCs 1,434 tons		+3.0 %
Energy consumption			
Location Frankfurt			
Electricity:	39,023 MWh		-5.7 %
Remote heating:	28,807 MWh		+1.4 %
Freshwater:	86,809 m ³		-19.9 %
Headquarters Cologne			
Electricity:	8,136 MWh		-8.7 %
Remote heating:	6,944 MWh		+21.4 %
Freshwater:	23,029 m ³		+39.2 %

→ www.lufthansa.com

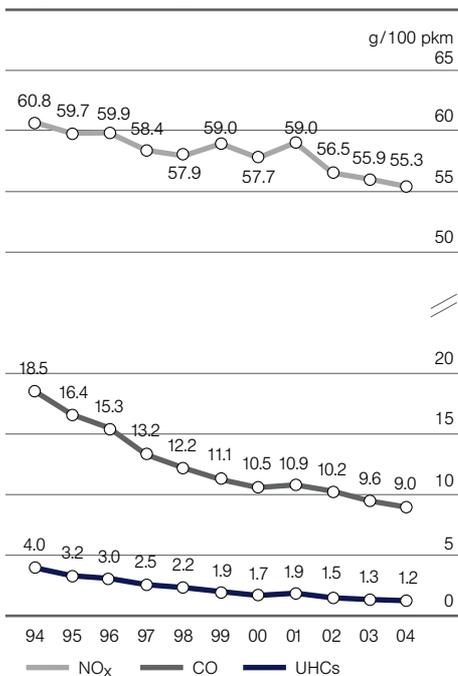
Specific fuel consumption of Lufthansa Passenger Airline
in liters/100 passenger kilometers



distance. When pilots increase an aircraft's cruising speed to make up for delays on the ground, fuel consumption and emissions increase as well. Consuming more kerosene entails higher costs, but not necessarily higher total costs, as delays also cost money. This is why Lufthansa recommends the so-called "minimum fuel tracking" as a way to increase efficiency. This means selecting a route that minimizes fuel consumption without negatively influencing the parameters of time and cost.

It is a well known fact that flying "detours" does not always cost more time and kerosene. At high altitudes in particular, aircraft encounter strong winds, so-called "jet streams," which can be an advantage or a hindrance depending on the direction they are blowing. When jet streams occur as headwinds, one tries to avoid them even if doing so increases the total flight distance. But when they occur as tail winds, they increase an aircraft's cruising speed, thus cutting flying time and fuel consumption. Owing to their constancy, the areas where strong winds prevail can be calculated more or less accurately and integrated into route planning. But winds that result from suddenly changing meteorological constellations are a different matter. And yet, these air movements can be used to advantage as well. For this reason, Lufthansa is currently testing, on long-haul flights, a method that involves reacting to such winds with variable flying speeds and thus exploiting them better. The goal here is annual fuel savings of 50,000 tons of kerosene, which would correspond to a cut in CO₂ emissions of 158,000 tons.

Specific emissions of Lufthansa Passenger Airline
in grams/100 passenger kilometers



Optimizing routes and avoiding ballast

In 2004, routing improvements in Asia were at the top of the agenda for Lufthansa's planners. On those routes that have since been shifted, not only have flying times been reduced, but fuel consumption and emissions have also been cut by 1 percent on average. The complexity of this task became especially evident during work to optimize the Hong Kong route. Beyond economic efficiency, many, sometimes divergent factors have to be taken into account when planning long-haul routes. For example, extended route segments that can be flown at high altitudes increase the efficiency of aircraft operations. However, as the mandatory oxygen supply on board increases in relation to altitude and the number of passengers, the aircraft's available payload decreases proportionally. Alternative airports that can be reached safely are another, exceedingly important criterion for routings. In a nutshell: internal safety standards, legal requirements and territorial guidelines all have to be adhered to here. For the new, more direct Hong Kong route, Lufthansa was able to meet all these requirements. A time saving of 15 to 20 minutes per flight has been achieved, along with an annual reduction in fuel consumption of 1,800 tons. This corresponds to an avoidance in CO₂ emissions of 5,670 tons.

An optimized approach route for Hong Kong is still being coordinated. Different types of air space adjoin each other over the Pearl River Delta. Four airports – the Chek Lap Kok International Airport in Hong Kong, two in Guangdong and one in Macao – vie for scarce air space. So far, this has meant wide-spaced approach routes to these airports involving lengthy detours above the sea. This costs time and fuel, and also increases the environmental burden of emissions. Therefore, Lufthansa is cooperating with the Chinese authorities to find ways to improve these approach routes.

In addition to route length, wind directions and other meteorological conditions, another key parameter with an influence on fuel consumption is the

aircraft's weight. The rule is well known here, and not just for aircraft: Less weight requires less fuel. So it can also pay off to keep an eye on the consumable substances carried on flights. Even unspectacular measures can help realize important savings potentials. This has been the case since fall 2004 for the quantity of freshwater carried aboard long-haul flights. How much freshwater must be tanked before a flight takes off depends on the distance to be flown and the number of passengers to be carried. Without even touching the mandatory safety and service reserves, adapting the quantity of freshwater better to a flight's actual load factors, along with the resulting reduction in weight, can save about 1,500 tons of kerosene per year. This measure alone should help reduce CO₂ emissions by 4,700 tons in 2005.

When rail and air transport are complementary – AIRail

In 2004, more than 180,000 Lufthansa passengers took advantage of the option to travel by train instead of plane between Frankfurt Airport and Cologne or Stuttgart Main Station. With a total of 21 daily high-speed ICE rail connections from Frankfurt to Stuttgart and Cologne, these air-rail links continued at the previous year's level.



What makes routes viable for such air-rail links? Principally, two prerequisites must be met to interlink the two modes of transport, and thus replace short-haul flights. First, the hub airport involved must have a long-distance railway station. Second, travel time by ICE high-speed train should not exceed 75 minutes. Only when both of these conditions apply can the rail product be made attractive enough for a sufficient number of passengers to select the train. Beyond these criteria, however, demand and competition may require that Lufthansa have a presence at certain destinations, to offer feeder services to the Frankfurt hub. As the Munich hub does not yet have a long-distance train station, it is currently not suitable to be included in the AIRail network. For these reasons, the Lufthansa route network currently includes only two routes that meet these key criteria: Frankfurt–Cologne/Bonn and Frankfurt–Stuttgart.

Key environmental goals	Environmental measures	Degree of attainment	Status
Reduce specific fuel consumption by 35 percent below 1991 levels by 2008, and by 40 percent by 2012. Thereby, reduce specific emissions of pollutants.	Operation of fuel-efficient types of aircraft. Optimization of routings with support from the Future Air Navigation System (FANS). Use of new air traffic control systems. Associated reduction of fuel consumption and emissions.	From 1991 to 2004, the specific fuel consumption was reduced by 31.9 percent.	▶▶
	Optimization of flight planning with regard to alternative airports, aircraft weight and routing (horizontal and vertical) to reduce fuel consumption and emissions by the end of 2004.	Optimization procedure was implemented. Up to 8,000 tons of fuel and thus 25,000 tons of CO ₂ emissions a year can be saved in this way.	✓
	Use of variable flight speeds to take greater advantage of jet streams during long-haul flights.	About 50,000 tons of fuel and thus 158,000 tons of CO ₂ emissions a year are to be saved with this measure. Project launch in March 2005.	!
	Optimization of the quantities of freshwater carried on long-haul flights.	About 1,500 tons of fuel (corresponds to 4,700 tons of CO ₂ emissions) a year are to be saved.	!
	To reduce delays on arrival at Frankfurt Airport, peaks in traffic volume are slightly flattened.	See also: p. 10, "Key Group-wide Environmental Goals."	✓
Reduce noise emissions in the vicinity of airports.	Support for the use of the Continuous Descent Approach (CDA) to reduce noise emissions during nighttime hours.	The procedure is set to be implemented in Frankfurt in 2005.	▶▶
Reduce weather-related consumption of deicing fluid by 10 percent per aircraft by 2007 when compared with 2002/2003.	Use of a monitoring system developed in-house to reduce the consumption of deicing fluid (HUSKY).		!

 Goal reached
  Not reached
  Goal remains valid
  New goal



Lufthansa CityLine

Lufthansa CityLine is Europe's leading regional airline and one of the five partners in the Lufthansa Regional concept. The company considers environmental protection and quality mindedness to be inseparably linked. For many years, it has operated a certified environmental management system that covers all company locations.

Lufthansa CityLine specializes in short and medium routes across Europe. Together with its four partners in the Lufthansa Regional concept, which was founded in 2004, it provides direct connections between Europe's regions and feeder services to the Lufthansa hubs in Munich and Frankfurt. Frequently, the airline also opens up routes newly included in the Lufthansa timetable. As a rule, the aircraft of the regional partners are deployed whenever those of the Passenger Airline are too large for the expected number of passengers. By flexibly operating aircraft of different sizes, Lufthansa can ensure optimum passenger load factors. This reduces specific fuel consumption and thus benefits the environment.

Lufthansa CityLine operates a fleet of 81 aircraft with 50 to 93 seats, serving 84 destinations in 31 countries. The average age of the CityLine fleet is a mere 7 years. These aircraft are maintained in the airline's own technical operations in Munich, Hamburg and Cologne.

6.7 million passengers flew with Lufthansa CityLine in 2004. Thus, the company was able to maintain its position as Europe's leading regional airline. Transport performance increased by 13.1 percent to 4.3 billion passenger kilometers, while the total distance flown rose by 11.4 percent to 101 million kilometers. Kerosene consumption increased by 15 percent, somewhat more than transport performance. The reason for this is the disproportionately high increase in fuel-intensive takeoffs and landings (+19.3 percent, or more than 25,000 additional takeoffs and landings) in comparison with the total distance flown, which rose by only 11.4 percent. For the same reason, specific fuel consumption rose slightly (+1.6 percent) to 8.74 liters/100 pkm.

At a glance changes compared to 2003

Employees annual average	2,495	+ 0.8 %
Transport performance PKT	4.3 billion pkm	+ 13.1 %
Fleet on 31.12.2004 (active fleet)	18 Avro RJ85 43 CRJ 100/200 20 CRJ 700	±0 ±0 ±0
Fuel consumption passengers and freight, absolute	300,357 tons	+ 15.0 %
Fuel consumption passengers, specific	8.74 liters/100 pkm	+ 1.6 %
Emissions from flight operations passengers and freight, absolute	CO ₂ 947,327 tons CO 955 tons NO _x 2,168 tons UHCs 65 tons	+ 15.0 % + 20.0 % + 15.9 % + 14.8 %
Production performance all fleets	450 A-checks 57 C-checks	+ 11.1 % + 3.6 %

→ www.lufthansa-cityline.de

Awards for CityLine's environmental management

With its environmental management system, which encompasses all company areas and all three locations, Lufthansa CityLine has occupied a top position internationally for many years. It is still the only airline worldwide to be both validated according to the European eco-regulations EMAS and certified in accordance with ISO 14001. In 2003, CityLine introduced a comprehensive, process-oriented management system, which integrates environmental management as a "leadership process." This ensures that it is considered in all business processes as a multidisciplinary task.

Last year, Lufthansa CityLine received the German Chamber of Public Accountants' "Environmental Reporting Award 2003/2004" for its transparent and sound environmental report. In February 2004, the airline also received first prize in the category "Noise Reduction" from Amsterdam's Schiphol Airport for its exemplary efforts to reduce aircraft noise.

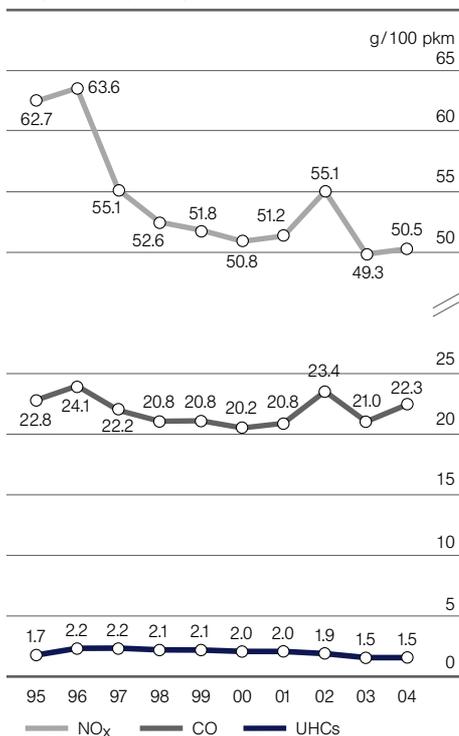
Specific fuel consumption of Lufthansa CityLine

in liters/100 passenger kilometers



Specific emissions of Lufthansa CityLine

in grams/100 passenger kilometers



Different approaches to avoiding noise

The Canadair Jets operated by CityLine are among the quietest commercial aircraft currently in use anywhere. Beyond an airport’s boundaries, they are usually no louder during takeoff than a car passing by in normal traffic. In addition, CityLine counts on improved takeoff performance to reduce noise – a technique also used on the Avro Jets. Computer-based take-off data calculations help to more accurately determine the engine’s thrust for the takeoff phase, thereby reducing it to the required minimum. This is easier on the engines and cuts back their noise level.

CityLine is also committed to avoiding aircraft noise on the ground. Ordinarily, an aircraft’s auxiliary power unit (APU) is experienced as especially loud. Though their use during the departure phase cannot be avoided, APUs can be replaced by environmentally friendlier ground power units (GPUs) while aircraft are parked. CityLine has cooperated with the airport authorities at the destinations it serves to ensure improved availability of GPUs. As their provision is very costly, however, the company has commissioned a detailed study of the environmental and economic criteria for an optimized use of APUs and GPUs. Comprehensive documentation is now available and is being used to develop a software that helps pilots decide when to request a GPU, particularly in the case of longer ground times.

Environmental care within the company and beyond

Exerting influence on suppliers and other contractual partners – be they airport authorities or the manufacturers of aircraft or office supplies – is an important aspect of CityLine’s environmental management. Following a feasibility study and extensive test runs, the company switched last fall to recycling paper at all its offices. Now, white paper is only available for special applications.

Another important building block in the company’s environmental strategy is environmental training for its employees and managers. Accordingly, pilots learn in their performance seminars how they can reduce fuel consumption and noise in flight. Likewise, flight attendants are familiarized with environmental care aboard aircraft in the course of their basic training. In 2004, CityLine’s MRO department launched its own training and continuing education program, which systematically includes environmental protection and occupational safety in its curricula.

At its headquarters in Cologne, Lufthansa CityLine supports a nature conservation project that aims at protecting the indigenous black poplar. On the “Wahner Heide,” the valuable sand and moor heathland that is home to Cologne/Bonn Airport, new habitats are to be created for this endangered tree species. Not only has CityLine supported a cultivation program for the pure wild variety of the black poplar: Last year, many CityLiners also joined forces with the heath’s forestry administration to lend a hand in planting the last 100 of a total of 1,000 black poplar saplings.

Key environmental goals	Environmental measures	Degree of attainment	Status
Reduce emissions of pollutants and noise.	Development of concept for the use of ground power units (GPUs) instead of auxiliary power units (APUs) with a view to environmental and economic aspects, in cooperation with the areas Flight Operations, Ground Operations and Maintenance (concept by 12/2003, implementation by 12/2004).	Software was developed that makes recommendations, based on given airport and preselected Estimated Turnaround Time (ETT), for the use of GPU or APU with regard to economic efficiency. In the next step, environmental performance indicators are to be integrated into this software.	▶▶
Reduce weight of onboard load.	Reduction of Lufthansa CityLine-influenced onboard load by 5 percent, compared to 2002, by December 2004.	By introducing a new galley concept, about 40 kg has been saved per flight since the introduction of the summer timetable 2004.	▶▶
Make consistent use of paper-free means of communications.	Creation of an appropriate IT infrastructure as an alternative to paper archiving, adherence hereto and control of processes (by 8/2005).	At CityLine's traffic center, all important processes, procedures and directives are no longer documented on paper, but stored "paperlessly" on the CityLine Information Terminal (CIT). In some company areas, laser printers with a second paper tray have been purchased, so that used paper (reverse side) can be used for internal printouts. Meeting minutes are no longer sent out on paper, but centralized on a server accessible for all employees.	▶▶
Replace white paper by recycling paper.	Feasibility study on the use of recycling paper for internal purposes (by 10/2003).	Following a decision by management, the entire company has been using recycling paper as a rule since fall 2004. White paper is only available for special applications.	✓
Improve waste management in technical areas.	Reorganization of processes and infrastructure. Definition of clear responsibilities (by 4/2004).	A master's thesis on this topic was assigned in fall 2004. The results of this work have been available since March 2005.	✓
Use organic produce at CityLine's canteen at Cologne/Bonn Airport.	Offer of at least one meal prepared from organic ingredients.	Given the difficulties of finding appropriate suppliers for organic produce, the launch of this project has been postponed until the second quarter 2005.	▶▶
Establish consumption benchmarks within the infrastructure. Develop performance indicators.	Concept study (10/2004).	Among other purposes, the data collected in the context of a master's thesis have been used to evaluate a new structure for electric meters in Cologne. This allows assigning energy consumption specifically to individual areas of a building. Furthermore, in cooperation with Lufthansa Technik, a benchmarking is being carried out in Cologne, Hamburg and Munich.	▶▶

✓ Goal reached
 ◀ Not reached
 ▶▶ Goal remains valid
 ! New goal



Air Dolomiti

Air Dolomiti, Italy's leading regional airline, has been wholly owned by the Lufthansa Group since April 2003. It is one of the five partner airlines in the Lufthansa Regional concept.

As a regional carrier, Air Dolomiti primarily ensures good links between Italy and the Star Alliance hubs in Germany. In addition, it offers direct services to other European regions. The carrier's route network comprises 23 destinations, and its home base is Verona, in northern Italy. Air Dolomiti carried more than 1 million passengers in 2004.

The Air Dolomiti fleet counts 16 turboprop aircraft from European manufacturer ATR and five Canadair CRJ 200 jets. The airline consumed a total of 31,635 tons of kerosene in 2004, a decrease of 27.5 percent over the previous year. This was caused by a 28.4-percent decline in transport performance when compared with 2003.

As the aircraft operated by Air Dolomiti range in capacity from 46 to 64 seats and are thus relatively small, their specific kerosene consumption per passenger kilometer is higher than that of the larger aircraft operated by the Lufthansa Passenger Airline. The fact that they fly medium and short-haul routes, on which fuel-intensive takeoffs and landings have a proportionately larger effect, is also reflected in their fuel consumption. Thanks to its modern fleet with a high share of turboprop aircraft, Air Dolomiti was able to keep its specific consumption below 8 liters. In 2004, the fleet consumed 7.9 liters of kerosene per 100 passenger kilometers. This is an increase of 1.2 percent over the preceding year, due above all to a 25-percent decline in average flight distance to 498 kilometers. At the same time, fuel consumption during takeoffs and landings remained steady.

Air Dolomiti's quality management has been certified in accordance with the ISO standard 9001 since 2000. In 2003, the airline received the "Regional Airline of the Year Award 2002" from Regional Airline World, a trade magazine published in Britain.

At a glance

changes compared to 2003

Employees annual average	541	- 4.4 %
Transport performance PKT	499 million pkm	- 28.4 %
Fleet on 31.12.2004 (active fleet)	8 ATR42-500 8 ATR72-500 5 CRJ 200	- 2 + 2 ± 0
Fuel consumption passengers and freight, absolute	31,635 tons	- 27.5 %
Fuel consumption passengers, specific	7.91 liters/100 pkm	+ 1.2 %
Emissions from flight operations	CO ₂ 99,776 tons CO 48 tons NO _x 84 tons absolute UHCs 5 tons	- 27.5 % - 12.8 % - 27.9 % - 12.8 %

→ www.airdolomiti.it

Key environmental goals

Adapt to Lufthansa's specific environmental standards.

Environmental measures

Collect and integrate detailed environmental data into the Group's Environmental Database by 2005.

Degree of attainment

Certain key data concerning the environment and consumption (e.g. fuel, wastes, energy and water consumption) have been integrated into the Group's Environmental Database. Additional detail data are planned.

Status



Goal reached



Not reached



Goal remains valid



New goal



Lufthansa Cargo

Lufthansa Cargo holds a top position in international scheduled airfreight transport. The company guarantees its customers accurately timed freight services and operates one of the world's most environmentally friendly freighter fleets – thanks to the introduction of the Boeing MD-11.

Lufthansa Cargo's route network extends to 450 destinations around the world. In 2004, the airline carried 1.75 million tons of freight, an increase of 11 percent over 2003. Its transport performance remained almost constant at 7.4 billion revenue freight ton kilometers (FTKT), as the average distance per consignment was shorter. Compared with 2003, Lufthansa Cargo used more capacities of the Lufthansa Passenger Airline – this share of transport performance increased by 18 percent to 2.93 billion FTKT. The freight airline generated 45 percent of its total transport performance with its own fleet. In addition, Lufthansa Cargo used capacities aboard the aircraft of other carriers, such as the partner airlines of the WOW Alliance. No details concerning fuel consumption and emissions can be given for these transport capacities, as such data are not gathered in a centralized system.

Lufthansa Cargo also transports freight by truck on the road and by train on the "rolling highway." The company intends to expand this environmentally friendly type of combination transport, which shifts the onward shipment of air cargo to the rails. Currently, 43 weekly rail connections are scheduled between Freiburg (southern Germany) and Novara (Italy), Wörgl (Austria) and Trento (Italy), and Wels (Austria) and Sopron, near Budapest (Hungary).

Specific fuel consumption virtually unchanged

In 2004, the freighters operated by Lufthansa Cargo consumed a total of 798,291 tons of kerosene, which is 7.5 percent less than during the previous year. The primary reasons are a 5-percent decline in the number of flights completed and the fact that the total flight distance fell off by 5 million kilometers. Aircraft utilization remained virtually unchanged at 73 percent, while specific fuel consumption rose very slightly by 0.6 percent to 178 grams per freight ton kilometer. Fluctuations within these limits are influenced by changes in fleet operations as well as external factors, such as weather and traffic conditions. Overall emissions declined: carbon dioxide emissions by 7.5 percent to 2.5 million tons, nitric oxides emissions by 9.1 percent to 12,483 tons, UHC emissions by 14.2 percent to 584 tons. Carbon monoxide emissions remained constant at 1,688 tons.

Fleet renewal saves fuel and reduces noise

Over the last few years, Lufthansa Cargo has progressively replaced its Boeing 747-200 freighters with Boeing MD-11s, which are particularly environmentally compatible. Five Boeing 747-200s had been sold by the end of 2004. Therefore, the positive effects of the new MD-11s on Cargo's environmental performance will only become apparent in the course of 2005. Compared with the Boeing 747-200s, these freighters consume about 16 percent less fuel. Their carbon monoxide emissions per ton kilometer are about 40 percent lower, nitric oxides emissions 50 percent lower and UHC emissions 67 percent lower.

At a glance changes compared to 2003

Employees annual average	4,985	- 2.8 %
Transported freight total fleet	1.75 million tons	+ 11.0 %
Transport performance FTKT, total fleet	7.4 billion tkm	+ 0.8 %
Fleet on 31.12.2004 (active fleet)	0 Boeing 747-200 F 15* Boeing MD-11	- 8 + 1

Number of destinations served

450

Locations and property

Frankfurt

Office surfaces:	approx. 24,900 m ²
Hangars and warehouses:	approx. 84,900 m ²
Cafeteria:	approx. 1,730 m ²
Outside surfaces:	approx. 175,900 m ²

Kelsterbach

Office building:	approx. 2,490 m ²
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Environmental data of flight operations

changes compared to 2003

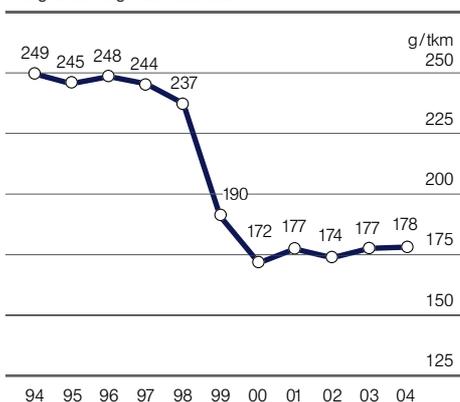
Fuel consumption Cargo fleet, absolute	798,291 tons	- 7.5 %
Fuel consumption Cargo fleet, specific	178 grams/tkm	+ 0.6 %
Emissions Cargo fleet, absolute	CO ₂ 2,517,812 tons CO 1,688 tons NO _x 12,483 tons UHCs 584 tons**	- 7.5 % ± 0 % - 9.1 % - 14.2 %

* Four additional aircraft will be put in service in the course of 2005.

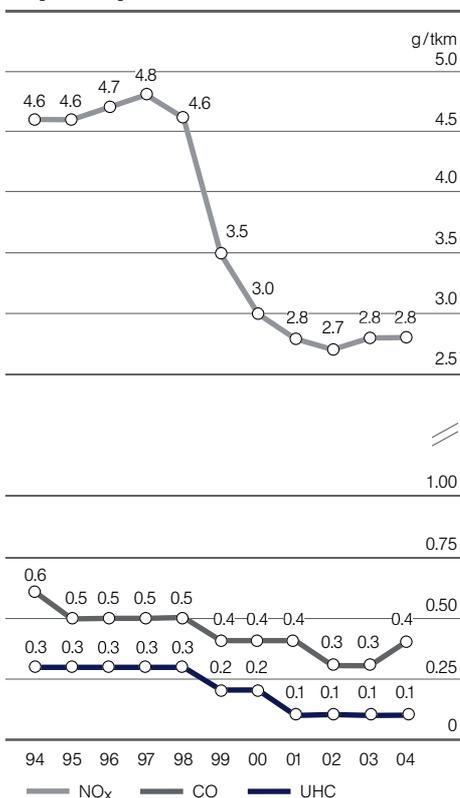
** Plus 130 tons resulting from 3 fuel dumps.

→ www.lufthansa-cargo.de

Specific fuel consumption of the Lufthansa Cargo fleet
in grams/freight ton kilometer



Specific emissions of the Lufthansa Cargo fleet
in grams/freight ton kilometer



Another environmental advantage: The 85-dB(A) noise footprint of the MD-11 measures only 9.4 square kilometers, about one-third smaller than that of the Boeing 747-200. To test additional technical options to reduce noise, Lufthansa has conducted measuring flights with an MD-11 in cooperation with researchers from the German Aerospace Center (DLR). These measurements were part of the interdisciplinary research network “Quiet Traffic.” One of the goals here was to identify sources of aerodynamic noise by means of an acoustic camera. In addition, the researchers investigated to what extent a shift in thrust distribution between the two engines under the MD-11’s wings and the single rear engine might help to reduce noise emissions during the approach phase.

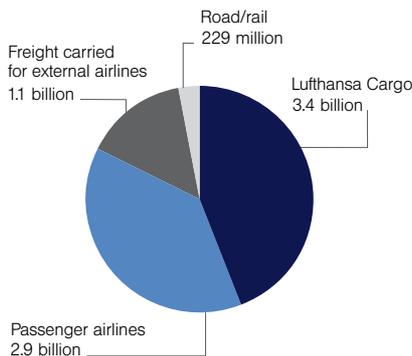
Quality management system includes environmental care and social responsibility

In 2001, Lufthansa Cargo introduced a company-wide management system guided by the model developed by the European Foundation for Quality Management (EFQM). Beyond economic indices, it also uses social and environmental performance indicators to measure business success. Lufthansa Cargo has integrated its activities concerning environmental care and social responsibility in a “Corporate Social Responsibility” (CSR) process. A steering group made up of representatives from various corporate areas is responsible for guiding and coordinating these activities. They ensure that the expectations and interests of the different stakeholders – in addition to customers and shareholders, this includes employees, people living close to airports, public authorities and animal welfare organizations – are systematically taken into account in all business activities.

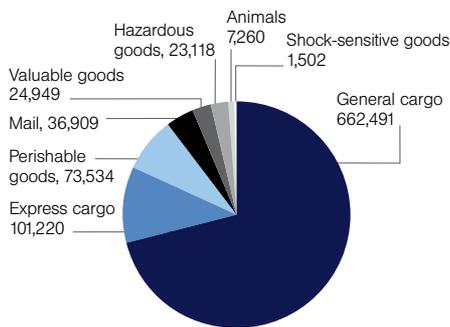
This ambitious goal demands openness and the willingness to establish a dialog with all stakeholder groups. For this purpose, Lufthansa Cargo launched a dialog project at Frankfurt Airport, its key hub, at the end of 2004. A project team from the Group-wide trainee program “Explorers” coordinated a mailing of 13,000 questionnaires to people living around the airport in the Rhine-Main area. The aim is to find out more about opinions concerning the air transport industry and the planned ban on night flights. In the project’s second phase, launched in April 2005, Lufthansa Cargo offers people from the Rhine-Main area the opportunity to take guided tours of the Cargo Center. This gives them personal insight into the work of a cargo airline and thus generates more understanding of the challenges Lufthansa Cargo faces in the international market.

In order to learn from other leading corporations in the area of “corporate citizenship,” Lufthansa Cargo also became involved at the beginning of the year in a benchmarking group initiated by the EFQM. In this context, the approaches and strategies of a number of European companies considered to be exemplary in the area of CSR were presented and discussed.

Distribution of transport performance
2004, in freight ton kilometers



Distribution of freight carried
2004, in tons



Animal protection is standard procedure

Lufthansa Cargo carries animals only if strict conditions are met. Since 2001, the airline has not accepted any shipments involving animals caught in the wild to be transported for commercial purposes. Whales, dolphins and animals covered by the Washington animal protection convention, CITES, are excluded from transportation as a rule. In all cases, an animal's legal origin must be proved before shipment. Sometimes, however, animal transport can contribute to the protection of a species. This was the case for a female rhinoceros named Hama, who traveled aboard Lufthansa Cargo free of charge in May 2004 from the Frankfurt zoo to South Africa, where she was released in the wild.

In the area of animal protection, Lufthansa Cargo cooperates closely with Pro Wildlife, the Dolphin Conservation Society, the WWF and the national and international zoo associations. In this dialog with the animal welfare organizations, the company has gained know-how and developed standards for animal shipments under optimum conditions to ensure that travel is as gentle on animals as possible. Lufthansa Cargo makes this know-how available on an international basis.

Environmental care at the business locations

Lufthansa Cargo emphasizes systematic environmental care, both in its flight operations and on the ground. The key goals here are a careful use of resources and the avoidance of wastes. Accordingly, the waste recycling rate at the Frankfurt location could be maintained at the high level of 80 percent. At the Cargo main administration building at Frankfurt Airport, all sanitary facilities were fitted with water-conserving equipment in 2004. As a next step, the building's lighting equipment is to be modernized as well.

Key environmental goals	Environmental measures	Degree of attainment	Status
Reduce specific fuel consumption by 3 percent below 2000 levels by 2004.	Increase utilization, phase out Boeing 747-200s.	By the end of 2004, specific fuel consumption had risen by 3.5 percent. The Boeing 747-200 was phased out completely and replaced by modern MD-11s.	◀
Reduce specific fuel consumption by 3 percent below 2000 levels by the end of 2005.	Increase utilization.		!
Expand the combined rail-and-road transport.	Add further routes.	Since January 2003, Cargo has used 43 scheduled rail services a week between Freiburg (southern Germany) and Novara (Italy), between Wörgl (Austria) and Trento (Italy) and between Wels (Austria) and Sopron, near Budapest (Hungary).	▶▶
Develop and implement a strategy for corporate citizenship.	Set up a steering group, implement direct links with strategic processes.	Measure implemented.	✓



Lufthansa Technik

Lufthansa Technik is one of the world's largest civil providers of aviation-related MRO services. Improving corporate environmental care continuously is an important goal for the company. All of its German locations have operated a certified environmental management system since 1996.

Lufthansa Technik specializes in maintaining, repairing and overhauling aircraft, as well as engines, equipment and components. Within the Lufthansa Group, the company is responsible for securing the technical safety, reliability and sustained value of the Group fleet. In addition, more than 500 airlines and operators of civil aircraft from around the world entrust the maintenance of their airplanes, engines or components to Lufthansa Technik or have cabins fitted according to their desired specifications.

At a glance changes compared to 2003

Employees annual average	10,550	- 0.5 %
Energy		
Electricity consumption	118,259 MWh	+ 1.3 %
Heat	204,428 MWh	- 0.1 %
Remote heating	71,236 MWh	
Gas	133,192 MWh	
Water		
Freshwater consumption	232,496 m ³	- 20.1 %
Rainwater consumption	6,700 m ³	- 24.8 %
Industrial wastewater	75,885 m ³	- 11.8 %
Waste total	7,645 tons	+ 9.3 %
for disposal	2,321 tons	+ 6.1 %
for recycling	5,324 tons	+ 10.8 %
recycling ratio	69.6 percent	+ 0.9 PP
Emissions		
absolute		
CO ₂	38,280 tons	- 3.5 %
NO _x	100.5 tons	- 7.8 %
UHCs	9.4 tons	- 2.1 %
solvents (VOCs)	122 tons	- 3.2 %

→ www.lufthansa-technik.de

Lufthansa Technik places great value on the high standards of its environmental care measures. In 1996, as the world's first aircraft maintenance company to do so, Lufthansa Technik introduced an environmental management system examined by external auditors at its German locations. This validation in accordance with the European eco-audit regulations was complemented in 1999, when the company was certified according to the worldwide environmental standard ISO 14001.

Last year, Lufthansa Technik prepared the inclusion of its environmental management system into a process-oriented, integrated quality management system. This integration will depict environment-related requirements – together with those for occupational safety, quality and aviation law – in a process-oriented way. This implies a significant improvement in orientation within the framework of regulations and thus improved process safety for all employees. In the area of aircraft maintenance, this process-oriented quality management system has been implemented since May 2005; the other areas at Lufthansa Technik are set to follow by the end of 2006.

Using industrial wastewater reduces freshwater consumption

Last year, Lufthansa Technik reduced the freshwater consumption at its German locations by 20 percent. An especially significant effect was achieved by its water treatment plant in Hamburg. It ensures that about half of the industrial wastewater from technical operations can be reused. In addition, about 6,700 cubic meters of rainwater were used in Hamburg in 2004 – enough to cover about 40 percent of the water consumption in the paint shop. And consistent wash water management made a contribution to cutting the quantity of wastewater by 12 percent.

Dry aircraft cleanings, introduced in 2001, also helped to conserve water. While dry washes cannot replace wet washes entirely, 81 of the 385 aircraft washes in Frankfurt in 2004 were carried out only using special cleaning agents and mops. This saved 746,000 liters of precious freshwater. However, this environmental advantage comes at the price of increased VOC emissions, due to the dry-wash procedure.

High standards for handling hazardous substances

In 2003, Lufthansa Technik adopted a company-wide policy on hazardous substances, which ensures a standardized way of handling substances that pose risks to health or the environment. It also defines the use of more environmentally compatible replacement substances, whose certification Lufthansa

Technik specifically promotes. Information on the properties and correct ways of handling hazardous substances in daily operations are stored in the electronic information system “eGIS,” which all employees at Lufthansa Technik can access via the intranet.

Environmentally compatible paint jobs

As the water-based paints used by the automobile industry are unsuitable for painting aircraft exteriors, the company is working on finding other ways to reduce emissions of environmentally polluting solvents (VOCs). In 2004, the use of solvents at Lufthansa Technik declined by 3 percent to 122 tons. Other emissions (CO₂, CO, NO_x and UHCs) also declined.

In 2005, a new, fully enclosed facility for cleaning spray paint pistols is to be built in Hamburg. This facility collects the spray mist from the pistols and then feeds the reclaimed solution back into the cleaning cycle. In addition, the use of solvent-free paints for aircraft cabin applications is currently being evaluated.

For many years, Lufthansa Technik has not used chemicals to remove old paint from aircraft surfaces, but rather biodegradable soaking substances. Paint can then be removed with rubber scrapers and water.

Key environmental goals	Environmental measures	Degree of attainment	Status
Improve environmental management processes.	Integrate the environmental management system into a process-oriented, integrated quality management system.	Implementation in aircraft maintenance by May 2005. Other areas of Lufthansa Technik to follow by the end of 2006.	▶▶
Reduce emissions.	Evaluate the acquisition of vehicles driven by natural gas.	Ongoing, but no need for replacement so far.	▶▶
	Equip the vehicles of aircraft maintenance operations in Frankfurt with solar-driven systems to recharge their batteries.		!
	Introduce a water-based washing procedure at the engine cleaning shop in Frankfurt. This is to replace procedures using blown-in coke particles, which require the engine to be run at the idle setting. With the new method, cleaning would take place using water pressure and pressurized air.		!
Reduce emissions of solvents.	Replace diesel-driven lift working platforms and similar equipment with electrically-operated models step by step at aircraft maintenance operations in Frankfurt (long-term).		!
	Use non-VOC solvents for cleaning spray paint pistols and change methods for cleaning surfaces.	Evaluation showed that this measure cannot be implemented in its current form; therefore, modification of measure (see below).	◀
	Acquire a fully-enclosed facility for the cleaning of spray pistols in the paint shop of the aircraft overhaul area.		!
	Develop a concept for reducing the use of VOCs in cleaning facilities.	Reduction plan has been drawn up, technical planning for replacement procedure has begun.	▶▶
	Use solvent-free paint for applications in aircraft cabins (Airbus) in context of aircraft maintenance.		!
Reduce quantities of waste materials.	Reduce energy consumption by renovating glazing in parts of the engine workshop.	Project study.	!
	Investigate the possibility of extending the life span of cooling lubricants on metalworking machines.	Evaluation showed that the potential has already been exhausted, no other measured intended.	◀



Condor / Cargo Technik

As a subsidiary of Lufthansa Technik, Condor/Cargo Technik is responsible for maintaining the Boeing 757s and 767s in the Condor fleet, as well as the Boeing MD-11 freighters flown by Lufthansa Cargo.

In addition, the company serves customers outside the Lufthansa Group and offers its services worldwide in cooperation with Lufthansa Technik. As the number of Boeing 757-200s in the Condor fleet has been reduced, the composition of the fleet maintained by Condor/Cargo Technik has changed as well. As a result, the number of A-checks declined in 2004. At the same time, customers required more C-checks, which are among the more complex maintenance events. Nevertheless, the company's electricity consumption came in at 3,666 megawatt hours last year, 0.4 percent lower than in 2003. Its consumption of heating energy increased by 4.2 percent. Freshwater consumption and wastewater volumes could be cut back by 5 percent from those for the previous year.

The quantity of wastes suitable for recycling declined by 6 percent. Here, the measures the company has taken to lower its paper consumption are paying off. Since 2003, Condor/Cargo Technik has provided maintenance documentation, procedural directives and other documents in digital format only. Customers receive these documents on paper only upon request. This measure already led to a cut in total paper consumption of 20 percent in 2004; in the documentation area, the company even used 67 percent less paper. As empty oil containers and toner cartridges have been included in the recycling system and fewer oil cans were disposed of, the volume of wastes for disposal declined by nearly 35 percent. In 2004, there was also no sludge to be disposed of after cleaning the subterranean collection receptacles, a procedure carried out every other year.

Condor/Cargo Technik also has positive results to show for its efforts to reduce operating materials. Today, the plastic inner wrappings used to pack items to be shipped have been largely replaced by recycling paper. Produced in-house, this alternative is not only more environmentally friendly but also economically advantageous. The production is less expensive than purchasing plastic materials. As packages are now more lightweight, the company also saves on shipping costs.

At a glance changes compared to 2003

Employees	613	-5.7
annual average		
Fleet maintained		
Boeing 757-200	2	-7
Boeing 757-300	13	+2
Boeing 767-300	9	±0
Boeing MD-11	15	+1
Production performance		
302 A-checks		-7.6 %
22 C-checks		+10.0 %

Environmental data changes compared to 2003

Energy		
Electricity consumption	3,666 MWh	-0.4 %
Heat consumption	8,055 MWh	+4.2 %
Water		
Freshwater consumption	5,991 m ³	-5.0 %
Waste		
for disposal	19 tons	-34.7 %
for recycling	223 tons	-6.1 %
Recycling rate	92.1 percent	+3.1 PP
Emissions		
absolute	CO ₂ 1,119 tons	
	CO 3.4 tons	
	NO _x 7 tons	
	UHCs 784 kilograms	

→ www.lufthansa-technik.com

Key environmental goals	Environmental measures	Degree of attainment	Status
Develop and introduce an environmental management system by 2006.	Certification according to ISO 14001.	Taking into account the further development of CCT, certification is to be completed in 2006/07, after the move into the new hangar.	▶▶
Reduce waste quantities.	Switch from small to large containers of hydraulic fluid.	Wastes declined by 11 percent compared with the previous year.	▶▶
	Reduce paper consumption, save photocopies by scanning invoices, introduce job cards, switch to recycling paper.	By digitalizing documents, a 20-percent reduction in paper consumption could be achieved. In the area of documentation alone, the savings was 67 percent. The digitalization of paper documents will be sped up.	▶▶
Reduce freshwater consumption.	Test dry cleaning process for aircraft.	The project has been abandoned for the Boeing 757/767, as the procedure did not produce the desired result. Further tests are being run for the MD-11.	▶▶
Reduce consumption of operating materials.	Own production of inner packaging from recycling paper to reduce and replace other types of materials used for this purpose.	Inner packaging materials made from recycling paper now largely replace bubble foil and plastic fleece packaging.	✓
Reduce use of hazardous substances by improving information on more environmentally compatible replacement substances.	Create an IT-based inventory of hazardous substances.	63 percent of the data sheets have been captured digitally. The evaluation of results is envisaged for 2005/2006.	▶▶



LSG Sky Chefs Germany

At a glance

changes compared to 2003

Employees	6,712	- 11.4 %
Locations	20	
Meals prepared	80.4 million	+ 18.1 %
Flights catered	476,472	- 5.0 %
Passengers served	45.12 million	± 0 %
Vehicle fleet		
Forklifts	37	- 125
Lift trucks	311	+ 17
Trucks	41	- 19
Passenger cars	122	± 0

Environmental data

Energy

Electricity consumption	49,286 MWh	+ 2.8 %
Gas consumption	24,920 MWh	- 25.9 %
Heating oil consumption	366 MWh	- 10.3 %
District heating and cooling	24,961 MWh	- 3.7 %
Fuel	13,657 MWh	+ 4.8 %
Total	113,190 MWh	- 6.4 %
Energy per meal	1.41 kWh/meal	- 20.7 %

Water

Freshwater consumption	412,988 m ³	+ 1.3 %
Freshwater per meal	5.13 l/meal	- 14.4 %
Wastewater	371,689 m ³	+ 1.3 %

Detergent and cleaning agent consumption	641.7 tons	+ 2.0 %
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Wastes

Total quantity	35,153 tons	- 1.7 %
Wastes for disposal	17,586 tons	+ 4.7 %
Wastes for recycling	17,568 tons	- 7.3 %
Recycling rate	50.0 percent	- 3.0 PP
Waste per meal	437 g/meal	- 16.8 %

→ www.lsg-skychefs.com

LSG Sky Chefs

LSG Sky Chefs provides airline passengers worldwide with high-quality meals, all prepared with the utmost care. By offering the highest levels of quality and good value, the company has been able to defend its position as the largest player in the highly competitive airline catering market.

Unlike Lufthansa's passenger and cargo businesses, the catering market has only shown hesitant signs of following the upswing in world economic recovery. Unrelenting pressures on fares, an expression of intense competition, meant that some airlines abandoned in-flight service completely, under the "no-frills" banner. Many other carriers made far-reaching cuts. LSG Sky Chefs has not been able to avoid this generalized tendency entirely. Therefore, fundamental restructuring measures have been initiated at all levels. Unprofitable flight kitchens were closed where necessary, operations were combined, and excess capacities cut. In this way, the company has been able not only to defend its market position, but also to cut the loss incurred in the previous year by 80 percent.

Airline catering continues to account for close to 90 percent of the company's revenues. About 20 percent of the revenues generated in 2004 resulted from the business within the Lufthansa Group. LSG's general contract with Lufthansa and its agreement with Thomas Cook have since been extended. And business with new customers has been expanded. LSG Sky Chefs' German locations head the list of country operations considered in this report with 80.4 million meals prepared, or more than 50 percent of the company's total output in 2004.

Recycling rates only partially comparable

Since last year's Environmental Report, six more countries have joined the scope of reporting. In addition, organizational changes have meant that countries are now grouped in "regions," which in turn influences the scope of consolidation. The number of locations covered by the environmental data base and their consumption figures have also changed. For example, while last year's report showed Great Britain with a single location in Manchester, this issue also includes locations in London Gatwick and East Midlands. Such changes, which cannot be deduced from the figures alone, make this year's environmental data only partially comparable with last year's. Therefore, this report depicts no values for the previous year for operations outside of Germany.

When comparing country-specific data, it is the extreme differences in the recycling rates that stand out the most. However, these are only partially comparable. The recycling rate – which expresses the share of reused wastes as a proportion of total waste – is an indicator that essentially fits the situation in Germany. As a yardstick for comparing the environmental efficiency of operations, however, it is only suitable when juxtaposed with rates for countries whose recycling systems have structures and goals similar to those of the German system. Yet significant regional and national particularities have to be taken into account even across Europe, whereas entirely different rules apply to countries such as South Africa or Russia. Furthermore, the general economic setups, varying differentiations in sorting materials and marked differences in prices for disposal and recycling all play important roles.

At a glance	Belgium	Switzerland	Denmark	Spain	France	Italy
Employees	309	100	785	792	811	829
Locations	1	1	1	6	1	3
Meals prepared	5.72 million	920,427	6.24 million	7.13 million	4.60 million	8.27 million
Flights catered	42,071	8,604	67,929	104,506	32,867	71,531
Passengers served	5.72 million	711,447	5.18 million	6.34 million	2.62 million	6.92 million
Vehicle fleet						
Forklifts	15	n.a.	1	4	5	14
Lift trucks	35	n.a.	28	51	36	54
Trucks	46	n.a.	9	68	22	16
Passenger cars	11	n.a.	3	1	30	22

Environmental data

Energy						
Electricity consumption	6,161 MWh	729 MWh	4,244 MWh	4,616 MWh	5,003 MWh	8,918 MWh
Gas consumption	–	1,282 MWh	2,503 MWh	4,227 MWh	2,418 MWh	7,126 MWh
Heating oil consumption	–	–	–	–	–	499 MWh
District heating and cooling	478 MWh	–	3,027 MWh	–	–	0 MWh
Fuel	1,865 MWh	340 MWh	1,016 MWh	2,520 MWh	1,841 MWh	625 MWh
Total	8,504 MWh	2,351 MWh	10,790 MWh	11,363 MWh	9,262 MWh	17,168 MWh
Energy per meal	1.49 kWh/meal	2.55 kWh/meal	1.73 kWh/meal	1.59 kWh/meal	2.01 kWh/meal	2.08 kWh/meal
Water						
Freshwater consumption	27,696 m ³	7,440 m ³	40,019 m ³	70,418 m ³	59,965 m ³	324,340 m ³
Freshwater per meal	4.84 l/meal	8.08 l/meal	6.42 l/meal	9.87 l/meal	13.04 l/meal	39.22 l/meal
Wastewater	24,926 m ³	6,696 m ³	36,017 m ³	63,376 m ³	53,969 m ³	291,906 m ³
Detergent and cleaning agent consumption						
	54.4 tons	10.1 tons	67.1 tons	44.5 tons	24.1 tons	41.0 tons
Wastes						
Total quantity	1,732 tons	369 tons	3,891 tons	1,717 tons	3,468 tons	5,650 tons
Wastes for disposal	1,495 tons	292 tons	2,515 tons	239 tons	2,871 tons	5,339 tons
Wastes for recycling	237 tons	77 tons	1,376 tons	1,478 tons	597 tons	311 tons
Recycling rate	13.7 percent	20.7 percent	35.4 percent	86.1 percent	17.2 percent	5.5 percent
Waste per meal	303 g/meal	401 g/meal	624 g/meal	241 g/meal	754 g/meal	683 g/meal

The Scandinavian countries are a good example of how lower recycling rates are not necessarily synonymous with lower environmental efficiency. These countries rely on environmentally friendly energy generation by burning wastes in thermal power stations, which fulfill the most stringent emissions standards. This approach conserves nonrenewable energies, while giving less priority to feeding recyclable materials back into the production cycle.

Despite being only partially comparable for all these reasons, the environmental data presented in this report reflect the continuous efforts of LSG Sky Chefs around the world to optimize the use of resources and limit the consumption of environmentally relevant goods to an indispensable minimum. Just how successful these efforts are is underscored by the status of several key environmental goals: Originally slated for attainment in 2005, they were already accomplished in 2004.

At a glance	Norway	Portugal	Russia	Sweden	South Africa	Great Britain
Employees	236	589	1,100	693	838	1,669
Locations	2	1	1	4	3	3
Meals prepared	2.11 million	5.96 million	9.00 million	5.27 million	5.88 million	14.57 million
Flights catered	41,608	36,276	46,000	98,153	39,470	26,543
Passengers served	4.55 million	n.a.	8.51 million	8.19 million	4.13 million	3.63 million
Vehicle fleet						
Forklifts	4	6	2	31	2	9
Lift trucks	13	18	32	26	34	62
Trucks	2	16	4	5	23	31
Passenger cars	4	1	12	12	7	2

Environmental data

Energy

Electricity consumption	2,695 MWh	4,717 MWh	9,591 MWh	5,131 MWh	7,494 MWh	11,080 MWh
Gas consumption	-	1,489 MWh	-	-	-	3,684 MWh
Heating oil consumption	-	-	51 MWh	94 MWh	-	-
District heating and cooling	642 MWh	-	284 MWh	428 MWh	-	-
Fuel	975 MWh	1,047 MWh	571 MWh	275 MWh	5,592 MWh	417 MWh
Total	4,312 MWh	7,253 MWh	10,497 MWh	5,927 MWh	13,086 MWh	15,181 MWh
Energy per meal	2.04 kWh/meal	1.22 kWh/meal	1.17 kWh/meal	1.12 kWh/meal	2.23 kWh/meal	1.04 kWh/meal

Water

Freshwater consumption	11,069 m ³	58,375 m ³	103,905 m ³	29,272 m ³	70,813 m ³	118,223 m ³
Freshwater per meal	5.24 l/meal	9.79 l/meal	11.55 l/meal	5.56 l/meal	12.04 l/meal	8.11 l/meal
Wastewater	9,962 m ³	52,538 m ³	93,515 m ³	26,345 m ³	63,732 m ³	106,401 m ³

Detergent and cleaning agent consumption

	18.2 tons	92.2 tons	n.a.	43.0 tons	4.5 tons	100.3 tons
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Wastes

Total quantity	661 tons	2,413 tons	6,367 tons	1,954 tons	2,724 tons	6,088 tons
Wastes for disposal	485 tons	1,532 tons	5,209 tons	1,637 tons	2,281 tons	5,103 tons
Wastes for recycling	176 tons	881 tons	1,158 tons	317 tons	443 tons	985 tons
Recycling rate	26.6 percent	36.5 percent	18.2 percent	16.2 percent	16.3 percent	16.2 percent
Waste per meal	313 g/meal	405 g/meal	707 g/meal	371 g/meal	463 g/meal	418 g/meal

New dishwasher reduces freshwater consumption

An example par excellence for the close interlinking of economic progress and improved environmental care is a new type of conveyor-belt dishwashing system, being tested in Brussels since early December 2004. It has been developed specifically for use in countries with scarce and thus expensive water resources.

This new model of dishwasher is the product of a close cooperation between the engineers of LSG Sky Chefs and the manufacturers Hobart and Ecolab. Not only does it work more economically than all other existing models. It also optimizes the dosages of dishwashing detergent and saves about 50 percent of freshwater by using an innovative system of water utilization. Compared with existing industrial dishwashers, whose entire water reserves must be renewed every eight hours, the water used for the initial washing cycles can remain in the new model for up to 14 days, thanks to continuous treatment. For hygienic reasons, however, the final rinse cycle is carried out with fresh-water.

→ Also see Magazine, page 36

LSG Sky Chefs Germany

Key environmental goals	Environmental measures	Degree of attainment	Status
Reduce the specific energy consumption per meal to 1.6 kWh by the end of 2005.	Increase utilization of catering operations. Conduct detailed monitoring of energy consumption at the individual locations.	The specific energy consumption per meal could be reduced by about 21 percent compared with the previous year, to an average of 1.41 kWh per meal. The planned goal of 1.6 kWh was thus achieved ahead of schedule and even exceeded. An intranet-based measuring and optimization program for LSG's large-scale dishwashers, developed in-house and successfully deployed at several locations, made a significant contribution to this success. Absolute energy consumption could thus be reduced by about 3,500 MWh on average in 2004.	
Reduce the specific water consumption per meal to 5.95 liters by the end of 2005.	Increase utilization of catering operations. Conduct detailed monitoring of water consumption at the individual locations.	The specific water consumption per meal could be reduced by about 14.4 percent compared with the previous year, to an average of 5.13 liters per meal. The planned goal of 5.95 liters was thus achieved ahead of schedule and even exceeded. An intranet-based measuring and optimization program (see above) made a significant contribution to this success. Absolute water consumption could thus be reduced by about 58,000 m ³ on average in 2004.	

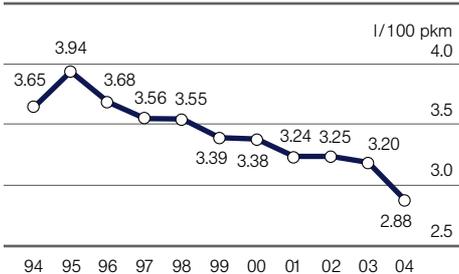
LSG Europe / Africa

Key environmental goals	Environmental measures	Degree of attainment	Status
Establish a corporate environmental information system at LSG Scandinavia.	Create an environmental database by 2006.	Goal attained ahead of schedule. Environmentally relevant indicators are captured, integrated into LSG's environmental database (ENVI) and analyzed. If required, corrective measures are triggered.	
Improve monitoring of corporate environmental care successively at all LSG locations in Europe and Africa.	Extend the company's environmental information system (ENVI) to other LSG locations.	Environmentally relevant indicators have been captured since 2000. The capturing and analysis procedure is being further systematized and expanded.	
Reduce the specific energy consumption per meal at European locations from 1.47 kWh to 1.42 kWh on average by the end of 2007.	Increase utilization of catering operations. Conduct detailed monitoring of energy consumption at the individual locations.		
Reduce the specific water consumption per meal at European locations from 8.55 liters to 7.8 liters on average by the end of 2007.	Increase utilization of catering operations. Conduct detailed monitoring of water consumption at the individual locations. Develop and implement new, highly resource-efficient dishwashing procedures in cooperation with a dishwasher manufacturer.	New dishwasher was put into operation at LSG's Brussels location. Operation at other locations is planned.	 

 Goal reached
  Not reached
  Goal remains valid
  New goal



Specific fuel consumption of the Thomas Cook fleets
in liters/100 passenger kilometers



Condor At a glance changes compared to 2003

Employees annual average	2,657	- 11.4 %
Transport performance PKT	21.2 billion pkm	+ 5.8 %
Fleet on 31.12. 2004 (active fleet)	1 Boeing 757-200 13 Boeing 757-300 9 Boeing 767-300 12 Airbus A320-200	- 12 ± 0 - 2 ± 0
Fuel consumption passengers and freight, absolute	489,883 tons	- 11.0 %
Fuel consumption passengers, specific	2.84 liters/100 pkm	- 16.0 %
Emissions from flight operations passengers and freight, absolute	CO ₂ 1,545 million tons CO 1,096 tons NO _x 7,432 tons UHCs 96 tons	- 11.0 % - 8.2 % - 9.9 % - 12.5 %

→ www.thomas-cook.de

Thomas Cook Airlines

Thomas Cook AG is one of the world's largest leisure groups. The company comprises five airlines, which are based in Germany, Great Britain, Belgium and Turkey. Of these, Condor, Thomas Cook Airlines UK and Thomas Cook Airlines Belgium are wholly-owned subsidiaries. With an average fuel consumption of only 2.88 liters per 100 passenger kilometers, they turned in the top performance in this area across the Lufthansa Group.

Thomas Cook AG is owned in equal parts by Deutsche Lufthansa AG and KarstadtQuelle AG. After the industry experienced two years of crisis and Thomas Cook AG also saw its revenues decline, the company underwent a restructuring program. In 2004, Thomas Cook AG was able to record increasing customer numbers again. The tourism group has compiled the environmental data of its wholly-owned airline subsidiaries, which are presented in this Environmental Report.

Condor

Operating in Germany, Condor Flugdienst and its subsidiary Condor Berlin form the largest of the airlines in the Thomas Cook Group. In 2004, 75 million passengers, an increase of 15.7 percent over the previous year, flew with Condor to destinations in Europe, Asia, Africa and America. The company also restructured its fleet and phased out 12 Boeing 757-200s. Environmental performance benefited from this move. The core of the fleet, which has an average age of 7.2 years, is now the fuel-efficient Boeing 757-300, whose design and environmental performance Condor influenced significantly in its role as launching customer. As a result, the Boeing 757-300 features engines with a particularly low emissions profile. This is clearly reflected in the positive trend for emissions, which continued again last year.

While transport performance increased by nearly 6 percent in 2004, the Condor fleet's absolute fuel consumption declined by 11 percent to almost 490,000 tons. Specific fuel consumption even fell by 16 percent – and thus markedly below the level of 3 liters envisaged as an environmental goal – to 2.84 liters per 100 passenger kilometers. With this value, the Condor fleet achieved the highest level of fuel efficiency within the Lufthansa Group fleet in 2004. Seat occupancy, which rose by 2 percentage points to 86.1 percent, plays an important role in this context.

Key environmental goals	Environmental measures	Degree of attainment	Status
Condor Make the Boeing 767-300s conform to noise category Chapter 4 (new IACO noise standard, valid from 2006).	Modification of the aircraft.	The modification has been completed, certifications should be concluded by the end of 2005.	

Thomas Cook Airlines UK

At a glance		changes compared to 2003	
Employees annual average	1,530		- 10.0 %
Transport performance PKT	14.4 billion pkm		+ 8.1 %
Fleet on 31.12. 2004 (active fleet)	15 Boeing 757-200 2 Boeing 757-300 5 Airbus A320-200 2 Airbus A330-200		
Fuel consumption passengers and freight, absolute	338,650 tons		+ 9.2 %
Fuel consumption passengers, specific	2.93 liters/100 pkm		+ 0.7 %
Emissions from flight operations passengers and freight, absolute	CO ₂ 1,068,102 tons CO 692 tons NO _x 4,727 tons UHCs 32 tons		+ 9.2 % + 12.5 % + 4.4 % - 60.8 %

Thomas Cook Airlines Belgium

At a glance		changes compared to 2003	
Employees annual average	194		- 11.8 %
Transport performance PKT	2.3 billion pkm		+ 2.7 %
Fleet on 31.12. 2004 (active fleet)	5 Airbus A320-200		
Fuel consumption passengers and freight, absolute	55,986 tons		- 3.9 %
Fuel consumption passengers, specific	3.03 liters/100 pkm		- 6.2 %
Emissions from flight operations passengers and freight, absolute	CO ₂ 176,580 tons CO 97 tons NO _x 1,013 tons UHCs 11 tons		- 3.9 % - 2.3 % - 3.8 % - 0.9 %

Thomas Cook Airlines UK

Thomas Cook Airlines UK arose in 1999 from the merger of the two charter carriers Flying Colours and Caledonian. Flying from Great Britain to destinations in 23 countries, it carried 5.6 million passengers in 2004, an increase of 12.7 percent over the previous year.

With a specific fuel consumption of 2.93 liters per 100 passenger kilometers, Thomas Cook Airlines UK has also attained the goal of 3 liters/100 pkm and thus joined the Lufthansa Group's front-runners in terms of environmental efficiency. The minimal increase in fuel consumption by 0.7 percent over the previous year is within the natural breadth of fluctuation influenced by external factors such as weather conditions and traffic volumes. The airline's transport performance increased by 8 percent in 2004, to 14.4 billion passenger kilometers. Absolute fuel consumption increased by about 9 percent to 338,650 tons. Utilization improved by 1.3 percentage points to 91.4 percent.

Thomas Cook Airlines Belgium

Founded in 2002, Thomas Cook Airlines Belgium operates five modern Airbus A320s. Last year, it carried a total of 1.1 million passengers – matching its 2003 performance – from Belgium and the Netherlands to holiday destinations around the Mediterranean Sea. In 2004, Thomas Cook Airlines Belgium was voted that country's favorite airline and increased its transport performance by 2.7 percent to 2.3 billion passenger kilometers. At the same time, absolute fuel consumption fell by almost 4 percent to 55,986 tons, while seat occupancy increased by 1.7 percentage points to 84.9 percent. As a result, specific fuel consumption declined by more than 6 percent to just over 3 liters per 100 passenger kilometers.

Key environmental goals**Environmental measures****Degree of attainment****Status****All Thomas Cook fleets**

Reduce specific fuel consumption to less than 3.0 liters/100 pkm by 2005.

Optimize structural weights of aircraft and increase utilization.

Specific fuel consumption fell to 2.88 liters/100 pkm in 2004.



Goal reached



Not reached



Goal remains valid



New goal

Lufthansa Systems



Lufthansa Systems is one of the world's leading IT service providers in the air transport industry. Over the past years, the company has successfully established itself as a competent partner in other industries as well.

The IT services and products offered by Lufthansa Systems aim at optimizing all business processes, especially in the air transport and aviation industry. Consequently, the range of corporate functions for which Lufthansa Systems offers made-to-measure IT and integrated systems solutions is quite broad. They range from schedule planning, market and competition data, reservations and check-in to logistics applications and aircraft maintenance. In addition to Lufthansa, more than 110 international airline and aviation companies are customers of the Lufthansa Systems Group. Beyond Germany, the company maintains a presence in 17 countries, with a total of 19 locations.

At a glance changes compared to 2003

Employees annual average	3,174	+ 3.9 %
Number of processor transactions	18,656,980,000	+ 8.8 %
Processor capacity	9,620 MIPS* 1,074,799 SPEC**	- 0.4 % + 69.3 %
Locations examined	7	
Floor space		
Offices	26,921 m ²	+ 15.8 %
Data center	6,800 m ²	

* Million Instructions per Second

** System performance evaluation corporation

Environmental data changes compared to 2003

Energy		
Electricity consumption	45,468 MWh	+ 3.5 %
District heating and cooling	2,753 MWh	+ 11.9 %
Energy per transaction	2.4 Wh/TA	- 4.9 %
Water		
Freshwater consumption	59,569 m ³	+ 5.4 %
Wastewater	35,352 m ³	+ 5.3 %
Waste		
Wastes for disposal	128 tons	
Wastes for recycling	49.6 tons	

→ www.lufthansa-systems.de

The central environmental impact from the company's activities is in the form of electricity consumption, primarily due to operating mainframe computers. Lufthansa Systems runs one of Europe's largest, most modern data centers in Kelsterbach, near Frankfurt. Here, high-performance mainframes operate around the clock. They are linked by a complex high-speed network to more than 30,000 users around the world.

Today, rising demand for client/server solutions and technological advances means that Lufthansa Systems complements its mainframes with more and more mid-range systems. This move has led to a rise in the number of computers and a related rise in energy consumption. This higher consumption is mainly due to the fact that more energy is needed to cool the equipment, an increase of almost 12 percent in 2004. In contrast, electricity consumption only rose by 3.5 percent. At the same time, the total computing performance increased significantly, the number of transactions rose by almost 9 percent, and productivity in the mid-range area even increased by more than 69 percent. Yet the specific energy consumption per transaction fell by almost 5 percent compared with the previous year. Thus, performance and energy consumption have clearly been decoupled.

Concerning the disposal of electronic waste materials, comparisons between individual years are only partially possible as waste quantities tend to be concentrated during particular phases, depending on when equipment needs to be replaced. In 2004, there were 10.75 tons of electronic waste materials. Lufthansa Systems sold this waste to dealers, so that many of these units could be reused as far as possible.

Key environmental goals	Environmental measures	Degree of attainment	Status
Reduce the volume of mixed paper wastes by 5 percent below 2004 levels by 2005.	Switch from paper-based to electronically-based work flows.		!

Lufthansa Flight Training



Lufthansa Flight Training enjoys a worldwide reputation as a top-quality instruction facility for cockpit and cabin crews. Service, safety, economic efficiency and aviation-related measures to protect the environment are all part of the curriculum here.

Today, this wholly-owned Lufthansa Group subsidiary counts more than 100 airlines from all around the world among its customers. Alongside classic pilot training and service training for cabin crews, the portfolio at Lufthansa Flight Training GmbH (LFT) includes instruction in emergencies management, communication skills and team work. In addition, LFT offers courses for the various ground services related to flight operations and training sessions for managers from other industries, for instance, in the area of intercultural communications.

By using state-of-the-art flight simulators, aircraft mock-ups and computer-based training programs, LFT offers practice-oriented instruction that is both efficient and environmentally friendly. Studies by Lufthansa Flight Training Berlin have shown that 135 simulator hours consume on average the same energy as a single hour of actual flight. However, pilots in training must fly a minimum of hours under real-life weather and air traffic conditions to meet the current legal requirements. LFT operates several types of aircraft for this purpose.

Environmental aspects also play an important role in pilot training. Consequently, course participants are familiarized with aeronautical procedures that help keep fuel consumption and noise emissions to a minimum.

LFT achieved a considerable increase in revenue from simulator training for customers outside the Lufthansa Group. In 2004, the company acquired five new simulators, which means that it now operates a fleet of 32 units. At the LFT locations in Frankfurt, Bremen and Berlin, these simulators clocked up a total of 110,412 hours of operation.

The fleet of aircraft was reduced by 15 to 47 airplanes. The consumption of aviation gasoline (AVGAS) fell by almost 9 percent to 1,240 tons. The increase in kerosene consumption is due to the replacing of Seneca aircraft with Piper Cheyennes, which correspond better to LFT's high training standards.

At a glance changes compared to 2003

Employees annual average	528	+ 1.0 %
Locations	Bremen, Frankfurt, Phoenix / Arizona, Berlin	
Training		
Flight hours	38,094 hours	- 17.4 %
Simulator hours	110,412 hours	- 3.2 %
Theory hours	15,511 hours	
Human Factors Training	10,378 days	
Fleet on 31.12.2004 (active fleet)	0 PA-34 Seneca 4 PA-42 Cheyenne 10 PA-28 Archer 27 F 33 Bonanza 6 Grob G120	- 1 ± 0 - 14 ± 0 ± 0
Fuel consumption		
AVGAS	1,240 tons	- 8.7 %
Kerosene	1,131 tons	+ 11.4 %

→ www.lufthansa-flightraining.de

Key environmental goals	Environmental measures	Degree of attainment	Status
Carry out a comprehensive analysis of environmentally relevant processes. Improve the company's environmental care program continuously.	Have regular environmental audits carried out at the LFT locations in Bremen and Frankfurt by Lufthansa Technik.	Environmental audit was carried out in 2004.	✓
	Implement the measures derived from the audits in Bremen and Frankfurt.	Measures resulting from audits 2003 and 2004 were implemented. New catalog of measures was drawn up for 2005.	▶▶
	Carry out regular environmental trainings in corporate environmental care at LFT locations in Bremen and Frankfurt.		!
Set up a comprehensive collection system for environmental data by year-end 2004.	Develop a company waste management concept and a waste balance sheet for LFT's locations in Bremen and Frankfurt.	Following evaluation and analysis of the waste-related environmental data for LFT's Bremen location, the results were depicted in the form of a waste balance sheet. For Frankfurt, a balance sheet is to follow by June 2005.	▶▶



Social responsibility within the Company

As an employer, Lufthansa has a special responsibility for the people who work in the Company and thus associate their future perspectives with it. The Aviation Group attaches great importance to a corporate culture that fosters the individual abilities of its employees and gives their interests a place.

Qualified and motivated employees are a company's most important resource. Therefore, Lufthansa considers a caring, responsible attitude as an employer to be an integral part of successful corporate management. As a globally active service company, Lufthansa follows a personnel strategy that is based on the values of respect, fairness and quality and builds on the diversity of experience and competence as well as the diversity of culture and perspective among the people who work for the Company.

At a glance* changes compared to 2003

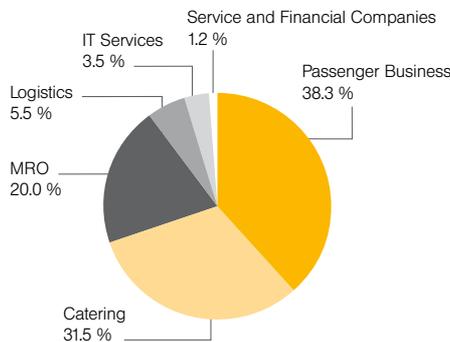
Employees		
total, Lufthansa Group	90,673	- 2.8 %
of which in Germany	59,396 (65.5 %)	
of which outside Germany	31,277 (34.5 %)	
Staff costs	4,813 million euros	+ 4.4 %
Revenue/employee	182,900 euros	+ 8.7 %
Staff costs / revenue	28.4 percent	- 1.7 %

* The reporting date for all figures presented in this chapter is December 31, 2004. Group figures are calculated on the basis of the scope of consolidation used in the Annual Report 2004.

Employment policy based on partnership

An employment policy designed to safeguard jobs can only succeed when all parties concerned do their part, thus allowing the Company to secure its competitiveness even during periods of economic difficulty. In these past years of economic crisis, Lufthansa has managed repeatedly to develop feasible solutions in agreement with the codetermination committees. This has allowed the Company to adapt to important shifts in market situations and thus to avoid operations-related layoffs as far as possible. At the end of 2004, a concerted action involving all social partners meant that Deutsche Lufthansa AG was again able to live up to its expectation of being "a living and breathing corporation." The goal here was to make personnel costs more competitive as a means to counteract the current market pressure on fares. The pay settlement signed in December for cockpit crews and ground personnel in Germany includes a freeze on salary increases, increases in productivity and improvements of flexibility. The collective agreement signed in May 2005 for cabin personnel provides for pay raises from 2007. In this context, variable remunerations dependent on the Company's business success are also being reformulated. At the same time, the Executive Board has promised job security until 2008.

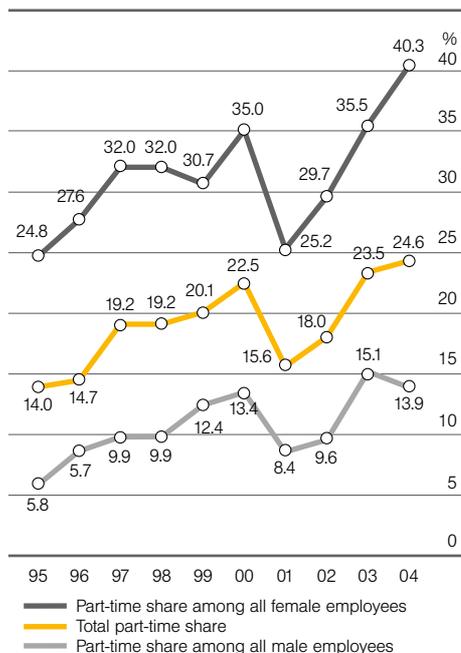
Distribution of employees within the Lufthansa Group
2004, in percent



In 2004, the total number of employees decreased in certain Business Segments of the Group. One of the reasons for this decline was the sale of participations, such as Chef Solutions in the Catering Segment. However, in the Passenger Business, the Group's largest Segment, the number of employees increased by 0.4 percent over the previous year. The opening of the Lufthansa First Class Terminal at Frankfurt Airport created 160 new jobs. And in the German state of Thuringia, "N3 Engine Overhaul Services," a joint venture between Lufthansa Technik and Rolls-Royce, is set to create 500 highly-qualified jobs.

Lufthansa does its utmost to "keep its staff on board" and help those employees who must reorient their careers as a result of restructurings and rationalizations to find new employment within the Company. In 2004 Lufthansa added a new chapter to its 10-year job agency tradition. It implemented a clearing system that secures a privileged availability of new vacancies to those employees who have lost their old occupation. In a single year the new system – with its operative procedures established and controlled by the small unit "JobChange" – has developed to a matter of course which is broadly accepted within the Lufthansa Group.

Part-time employment at the Lufthansa Group
in percent



Flexible work times create additional room to maneuver

A decisive instrument for a “living and breathing corporation” is flexible work hours. Employees also benefit from such models as they gain greater freedom to coordinate professional and private interests – particularly those related to family life. Lufthansa offers numerous work-time models. They include different part-time variants, flexible work time, flexible use of positive time balances, as well as sabbaticals, telework and job-sharing models. Today, almost one-quarter of all Lufthansa employees take advantage of part-time models. This is an increase of more than 10 percentage points since 1995. The share of part-timers is nearly three times as high among female employees (40.3 percent) as among male employees (14 percent). Yet the share of men among total part-timers has increased significantly over the last ten years and currently stands at almost 34 percent (1996: 22.7 percent). Especially popular – with a share of more than 40 percent – is the individually reduced work time for flying personnel and staff working in operational areas on the ground.

In addition to the latest pay settlements, Lufthansa implemented new measures to make work time more flexible in 2004. Thus, a “Work-time Database” is now used to publish best-practice examples from all areas of the Group, which are designed to inspire the development of individual models. A new organizational concept also gives the Company’s executives and Human Resource managers an improved decision basis and guidelines for implementing part-time offers and work-time reductions.

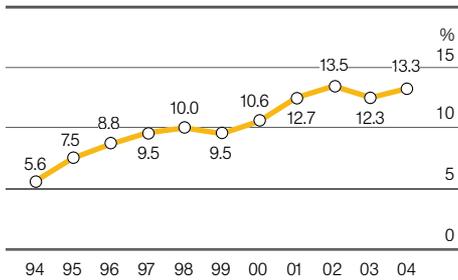
Diversity as a guiding principle

More than 90,600 men and women from about 150 nations work for the Lufthansa Group worldwide. They speak different languages and have different cultural backgrounds and ways of looking at things. Lufthansa sees its strength in this diversity: Different perspectives generate new, sometimes surprising insights, which can be of great advantage in the international market where Lufthansa is a player. But this is not the only reason that esteem for all employees – independent of gender, origin, age, sexual orientation or physical abilities – is a fundamental concern for Lufthansa. The guiding principle of “diversity” stands for open-mindedness and tolerance – values that are pivotal to the Aviation Group’s identity.

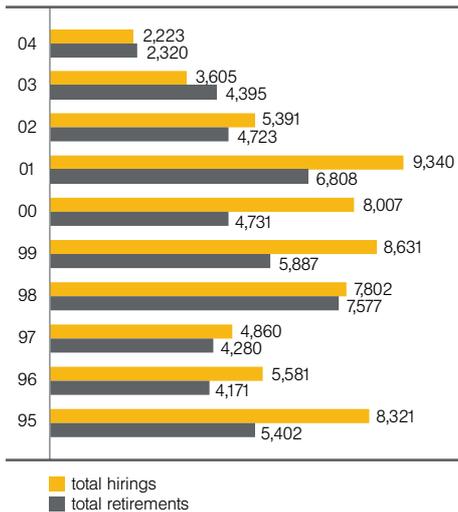
Diversity Management aims at utilizing fully the creative potential that lies in integrating different experiences and perspectives. This approach is complementary to the anti-discrimination law currently being debated in Germany, which counts on legal pressure to avoid disadvantages. The task of Lufthansa’s centralized department “Change Management and Diversity” is to develop – in cooperation with the Group companies, corporate departments and codetermination committees – concepts for Human Resource policy that foster the inclusion of all employees and help convince managers to bring diversity to life in daily work.

Cultivating intercultural competence: For Lufthansa, intercultural competence is a key qualification and thus has a high priority in vocational training and personnel development. It creates the basis for productive collaboration between colleagues of different origins – both within the Company and in international airline cooperations such as the Star Alliance. Moreover, it is an indispensable condition for understanding the needs of Lufthansa customers all around the world.

Women in management positions at the Lufthansa Group
in percent



Employment at the Lufthansa Group
number of employees



Since the Group's restructuring in 1995, more than 13,000 new jobs have been created. The difficult economic situation over the past two years led to a decrease in personnel. This chart does not include LSG companies outside of Germany.

Good opportunities for women: Lufthansa does not want to do without the potential of qualified female employees. For economic reasons alone, it makes good sense for the Aviation Group to support equal opportunities for men and women. A full 40 percent of Lufthansa employees are women. Their share in senior management positions has increased more than sixfold since 1990 and currently stands at more than 13 percent. The number of women participating in programs for junior managers increased by 10 percent compared with 2003. The Company's efforts to recruit young women for pilot training are also successful. Today, 3.4 percent of our employees working in the cockpit are women, and the trend points upward. This is significantly more than the worldwide average of 2.5 percent. Last year, 13 percent of the 120 new pilots in training were female.

On "Girls' Day 2004," a Germany-wide initiative that aims at opening doors for women in work areas that are seen as classically "male" professions, Lufthansa Technik and Lufthansa Cargo hosted almost 250 female high-school students. They took advantage of the opportunity to gather information about career options in technical, IT and logistics areas at the Aviation Group. They also had a chance to talk to female pilots and trainees from a variety of specializations.

Family-friendly options: For many parents, the birth of a child marks the beginning of a struggle to balance the conflicting demands of family and career. Lufthansa is doing its best to make reentry into professional life following parental leave easier for male and female employees alike. While on parental leave, employees can participate in voluntary personnel development courses. Computer-supported "eLearning" opens up new opportunities in this area by enabling employees to participate without being physically present. Another popular model to maintain contact with the Company is "alternating telework": This allows Lufthansa employees to perform an individually agreed part of their work time at home, the rest at the Company. Custom-made reentry programs are also offered for flying personnel on parental leave, allowing them to renew the licenses required to work aboard aircraft.

All employees in Germany looking after family members or partners in need of care can take advantage of "Lufthansa Family Time," which grants special unpaid leave of up to a year. At Lufthansa, this option complements the three-year parental leave in Germany. For more than 12 years, the Company has been a contractual partner of the external "Family Service," which helps mothers and fathers find the right kind of care for their children. Employees seeking care for older family members can also use this service ("Elder Care"). Lufthansa bears the cost of consultations and placements. Moreover, the Company participates in the ad-hoc child care facility "FLUGGI-LAND," located near Frankfurt Airport. It takes over when an employee's regular child-minder is unexpectedly unavailable or when unplanned appointments have to be kept. Lufthansa covers the largest part of the child care costs. Ad-hoc child care has been available in ten additional cities in Germany since May 2005.

Integration of people with disabilities: At Lufthansa, people with severe disabilities are employed in ways that allow them to apply their abilities in an optimal fashion. Beyond the measures required by law, Lufthansa runs its own programs to improve the integration of people with handicaps. In this spirit, 2004 saw the start of the second generation of a mentoring program which Lufthansa initiated in 2003 on the occasion of the European Year of People with Disabilities. It brings together ten disabled "mentorees" and ten managers.

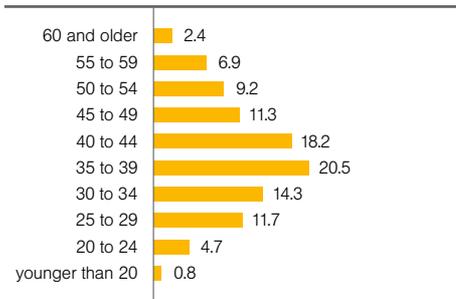
The goal of this 12-month program is to reduce both groups' anxieties in dealing with each other and thus create the basis for a natural way of interacting.

At Lufthansa Technik in Hamburg, three more deaf young people started apprenticeships as tool mechanics in August 2004. This training project, which is accompanied by sign language interpreters, is to be renewed every two years.

In 2004, the Group-wide average share of employees with disabilities was just over 3 percent in Germany. Individual Lufthansa companies – such as Lufthansa Revenue Services or LSG Sky Chefs, with significantly more than 5 percent – exceed the legally required quota.

Cooperation between young and old: Demographic shifts also create new challenges for Lufthansa. While the average age of the Group's employees has remained almost constant over the last few years – in 2004 it was 39.6 years – more than 19 percent of all employees are 50 years of age or older. With their experience and know-how, these "senior professionals" make an indispensable contribution to daily work. Therefore, Lufthansa promotes a balanced age structure in its staffing, which enables old and young, experience and new ideas, to complement each other fully.

Age structure at the Lufthansa Group
distribution in percent



Apprenticeships at Lufthansa are much sought-after: 30 classic apprentice professions can be learned here.

A broad spectrum of training options

Lufthansa is known for the high standards of its in-house vocational training and personnel development. In 2004, the Company invested 105 million euros in this area. A total of 40 professional qualifications can be obtained at Lufthansa, including 30 in Germany's dual apprenticeship mode. In 2004, 450 young people started an officially recognized apprenticeship with the Lufthansa Group. The year before, there were 588 new apprentices. This decline is due in part to the continued economic insecurity across the industry, and in part to the high numbers of trainees from previous years, which led to a certain saturation effect. More than 560 apprentices – 18.3 percent more than in 2003 – completed their training at the Lufthansa Group. In 2004, almost 1,700 young men and women were taking part in an officially recognized vocational training program at Lufthansa, 264 of these outside of Germany.

Last year, a city-supported qualification project for high school graduates in Hamburg took place for the second time. In the scope of this program, six young people completed a half-year practical work experience at Lufthansa Technik. In fall 2004, all of them transferred to regular apprenticeship positions.

Increasing demand in the air transport market meant that more flight attendants, ground staff or "Service Professionals," were trained in 2004; the number of participants in basic training courses rose by 10 percent to 565. In addition, 118 pilots at the commercial flight academy can count on being assigned to flight duty as soon as they obtain their licenses for a particular type of aircraft.



Practice is not everything: Only by promoting the consistent training and qualifying of our employees can we ensure Lufthansa's high level of quality standards.

Close links between university studies and professional practice

Today, many courses of study at the university level increasingly stress that students have contacts with professional practice early on. At the same time, there is an increasing need to deepen practical knowledge acquired on the job through academic study. Lufthansa currently offers nine training courses based on this close link between university studies and professional training. Especially successful has been a complementary course of study offered since 1996 at the "Berufsakademie Stuttgart" (University of Cooperative Education) for participants in Lufthansa's apprenticeship for "Airline Professionals." These graduates obtain a double diploma – in Business Management (BA) and as an Airline Professional. Since 2003, it has also been possible to earn a degree in Mechanical Engineering with Aviation as a major subject from the Darmstadt Technical University. Also new is a degree course in Information Technology (BA) with an emphasis on Business, which Lufthansa Systems offers in cooperation with the "Berufsakademie Mannheim" (University of Cooperative Education).

Moreover, Lufthansa maintains various types of cooperations with selected universities. To make it easier for university graduates and students to start their professional careers, it offers internships, dissertations and other programs. Thus, the "Study and Intensive Practice" program (st.i.p.) gives students of Aviation Management at the University of Applied Science in Bad Honnef the option of completing all their required practical training blocks at Lufthansa. The "Pro Team" program for junior managers is designed to attract highly qualified university graduates. Over a period of 12 to 18 months, these participants gain experience in different areas of the Company.

Lufthansa School of Business – Personnel development and continuing education under one roof

The Lufthansa School of Business (LHSB) is Germany's oldest corporate university and considered one of the most prestigious worldwide. It has received numerous awards, most recently in 2004 in Orlando, Florida, where it received the "Excellence and Innovation in Corporate Learning" prize for its innovative links between management development and corporate strategy. This prize is given annually by the Corporate University Xchange in cooperation with Fortune Magazine. LHSB offers a varied program for qualifying and developing the airline's executives and supporting its talented junior managers. Since 2001, the LHSB has also offered its Corporate College, an additional segment of personnel development below the management level. This program features a broad range of interdisciplinary seminars, which are



Optimum health care options for Lufthansa employees: In addition to care from physicians specialized in aviation and tropical medicine, Lufthansa employees can also participate in courses on health protection. More than 3,800 employees took advantage of free flu vaccinations in 2004.

open to all employees. Another option is to participate in personnel development courses outside of regular working hours. Or employees can even earn an apprenticeship diploma at the Corporate College in an officially recognized profession in their spare time. In 2004, more than 9,000 Lufthansa employees took advantage of the LHSB's educational courses.

Preventative health care for globetrotters

Beyond the legally required scope of job safety and health protection measures, Lufthansa's Medical Service offers a number of consultation and medical services. Experienced physicians with particular expertise in aviation and tropical medicine are available to globetrotting Lufthansa employees. Consultations, presentations and training sessions give employees and corporate committees the opportunity to learn about preventative measures that protect the health of our employees. The intranet also features a dedicated section on health protection and healthy lifestyles. These regular offerings are complemented by specific measures and information campaigns. Thus, the Medical Service offered free flu vaccinations at the Frankfurt, Munich and Hamburg locations at the end of 2004. More than 3,800 employees from all Group companies took advantage of this preventative measure.

Counseling options in conflict situations and personal crises

Wherever people work together, tensions and disturbances can occur. Lufthansa's Social Counseling aims to provide support that helps those concerned solve conflict situations and maintain a working climate that promotes the enthusiasm for work and the willingness to perform. The goal of such counseling is to improve the communication skills, ability to take action and social competencies of employees and managers. For example, Lufthansa employees can make appointments for confidential one-on-one counseling sessions, where they may talk about job-related conflicts or personal crisis situations. Social Counseling also moderates group sessions involving employees and their supervisors or colleagues in an effort to improve cooperation.

Employees' ideas and opinions are requested

As a rule, Deutsche Lufthansa AG and other Group companies conduct comprehensive employee surveys every two years. These surveys give employees an opportunity to evaluate their jobs, working environment, cooperation with colleagues and supervisors, and Lufthansa's corporate strategy. About half of the Company's 30,000 employees participated in the last Employee Feedback Management (EFM) at Deutsche Lufthansa AG, which was concluded in October 2004. Despite the difficult economic situation, this survey showed a positive mood overall. The general satisfaction index was 2.61 (2.58 in November 2002) based on a scale from 1 (very satisfied) to 5 (very dissatisfied) and was thus maintained at a good level. Almost 80 percent of all employees would again decide in favor of Lufthansa as an employer if they had to make such a choice. Our employees gave the Company an above-average positive grade – with a value of 2.26 (2.27 in November 2002) – for its way of assuming social responsibility (environmental care, social and political commitment). Immediately following the survey, an intensive evaluation and communication process took place at the department level. Here, employees and managers jointly identified areas for improvement and agreed on an action plan with improvement measures for the next two years.



Employee satisfaction has many facets. A corporate climate where employees' needs are taken seriously and their individual abilities are promoted plays an important role.

For many years, Lufthansa's Ideas Management has successfully tapped the self-initiative of creative employees. The program aims to systematically gather and implement innovative suggestions from employees for the improvement of operational processes. Under its new name "Lufthansa Impulses," ideas management became more streamlined and efficient in 2004. One move was the creation of an ideas portal on the intranet, where employees can enter their suggestions directly and follow up on their status. Last year, 2,300 suggestions from all business segments were received by the ideas management program. One-quarter of these ideas were implemented. The related potential for savings comes to about 10 million euros – for the first year of utilization alone.



“Its” crane is of particular concern for Lufthansa: The airline supports a number of environmental initiatives working to protect and conserve the crane’s breeding and resting grounds. It is also a partner of the International Crane Foundation.

Corporate Citizenship – Taking an active part in society

Companies are part of society and thus help shape social development. As an international corporation, Lufthansa recognizes fully its responsibility to conserve nature and foster mutual understanding in an increasingly globalized world. These are basic concerns for all the people at Lufthansa. Here is an overview of some exemplary development projects in the areas of environmental, cultural and social issues.

Protecting biodiversity and conserving endangered natural and cultural landscapes are key goals of Lufthansa’s Environmental Sponsoring. For many years, the Company has supported the work of German and international environmental protection organizations.

Working for the bird in our corporate logo

Lufthansa’s engagement for the bird in its corporate logo, the crane, has a long-standing tradition. Accordingly, the Company is a partner of the International Crane Foundation and actively supports the working group Crane Protection Germany, led by Naturschutzbund (Nabu) and WWF Deutschland. This initiative works to conserve the breeding and resting grounds of the endangered migratory birds and supports scientific research into their behavior. Lufthansa also supports the Johannesburg-based South African Crane Working Group (SACWG), which works to protect those crane species that are endangered in South Africa. At the beginning of 2005, Lufthansa Environmental Sponsoring published as a special edition the comprehensive standard work entitled “The Magic of the Crane,” featuring fascinating photographs by crane researcher Carl-Albrecht von Treuenfels.

→ www.kraniche.de

→ www.savingcranes.org

Network “Living Lakes”

Today, 39 regions surrounding lakes worldwide make up the international lake network “Living Lakes.” Founded in 1998 by Deutsche Umwelthilfe and the Global Nature Fund, it has been supported by Lufthansa from the start. The network’s goal is to preserve the Earth’s large freshwater lakes, which serve as irreplaceable habitats for many animal and plant species and drinking water reservoirs for millions of people.

→ www.livinglakes.org

Protecting natural diversity

Through the foundation Euronatur, Lufthansa supports numerous nature conservation projects, including in Spain and Israel. In addition, the Aviation Group supports a Euronatur-led pilot project which aims at reforesting areas of cleared rain forest. Planting nature-like forests, in whose shade the abaca shrub grows, creates habitats for threatened animal and plant species. At the same time, the local population gains a source of income from processing the highly elastic and industrially usable abaca fiber.

Since fall 2003 Lufthansa has given the concern of protecting endangered species a highly visible platform aboard its aircraft: Since then the airline has featured the video “Living Planet – Fascination Nature” in the in-flight entertainment program on all long-haul flights. Produced in cooperation with Euronatur and Germany’s Federal Agency for Nature Conservation, this film aims to promote a sensitive, responsible way of dealing with nature.

→ www.euronatur.de



Musical highlights: Topflight musicians from around the world appear every year in early summer at the Lufthansa Festival of Baroque Music in London, which attracts music lovers from near and far.

Masterpieces of ancient music:

The Lufthansa Festival of Baroque Music

For more than 20 years, Lufthansa has sponsored one of Europe's most renowned festivals for ancient music: Every year, in early summer, the Lufthansa Festival of Baroque Music takes place in London, where its topflight concerts attract music lovers from near and far. The festival was founded in 1984 by the vicar of St. James's Church, near Piccadilly Circus. Lufthansa was signed up as a partner the following year. Since then, the Lufthansa Festival of Baroque Music has evolved into one of London's musical highlights. Many of the world's finest ensembles for ancient music perform here alongside internationally known soloists and singers.

→ www.lufthansafestival.org.uk

HelpAlliance: Employees get involved around the world

In 1999, Lufthansa employees founded the HelpAlliance. Today, this registered association is the umbrella organization for about a dozen development aid projects, which are looked after by Lufthansa employees in a number of countries. The HelpAlliance ensures a presence for these projects within the Company and beyond, and organizes joint fundraisers. Lufthansa supports the association with funds and organizational means. The airline's passengers are familiar with the HelpAlliance above all through its "Small Change for Big Help" campaign: Here, coins and bank notes of any currency which passengers carry back from trips abroad have been collected on all Lufthansa long-haul flights since 2001, and on all Condor and Thomas Cook flights since 2002. Almost 250,000 euros were collected in this way in 2004.

When catastrophes strike, the HelpAlliance also organizes swift and unbureaucratic aid. Following the tsunami catastrophe in southeast Asia at the end of 2004, it launched an initiative in cooperation with the Company's management encouraging Lufthansa employees to donate one hour of their work time. The value thus donated was matched and increased by the Company. The HelpAlliance uses these funds to support projects designed to help children in the affected regions in India, Sri Lanka and Thailand. Lufthansa Cargo has also carried a large volume of aid supplies free of charge or at cost to the areas struck by the catastrophe. Taken together, all these measures for immediate aid add up to more than 2 million euros.

The HelpAlliance supports these projects, among others:

- a village development and training project in the Tibetan settlement of Dhondenling, in southern India
- bush hospitals in Kaloleni, Kenia and Obizi, Nigeria
- boarding schools in rural areas in central India
- orphanages in Nigeria and Brazil
- infrastructure and training projects in Djougou, Benin, and Saint-Louis, Senegal
- street kid projects in Thailand, India, Germany and the former CIS states

www.help-alliance.com



Building bridges between the Arab world and Europe

As an airline, Lufthansa connects people from many different countries. This makes the dialog between cultures a special concern for the Company. Thus, Lufthansa sponsors the UNESCO project "Euro-Arab Neighborhood: Students Build Bridges," whose goal it is to create partnerships between European and Arab schools via the medium of school magazines. This effort aims to help reduce prejudices, build a better mutual understanding and foster peaceful coexistence. The first results of shared school magazine projects were presented by high-school students from Lebanon, Jordan, Tunisia and Germany during the Frankfurt Book Fair 2004.

→ www.students-build-bridges.net



Press conference on December 13, 2004: After a preparatory phase of three years, the CARIBIC laboratory container takes off on its inaugural flight to Buenos Aires. Also aboard: Germany's Minister for Research Jürgen Trittin (*left*), on his way to the world climate conference there.

Research at Lufthansa

Making objective assessments of the effects of air transport on the environment and identifying the right approaches to minimize environmental burdens require target-oriented, often cost-intensive research. For this reason, Lufthansa supports numerous scientific projects. They help create the basis for the Aviation Group's effective environmental care.

EU program AERONET

Coordination of European research projects on aviation issues

The AERONET program gathers together important players in European aviation. These include the aircraft industry, airlines and airport operators as well as research institutions, public administrations and political representatives. The project's goal is to facilitate the exchange of experience and knowledge, and to show options for the competitive and environmentally compatible development of Europe's aerospace industry. Particular emphasis is placed on lowering the emissions of CO₂ and other pollutants from air transport by implementing advances in aircraft and engine technology as well as traffic-related measures. AERONET III is based on the "Vision 2020 for European Aviation" and the subsequent "Strategic Research Agenda" of the ACARE council (Advisory Council for Aeronautics Research in Europe). These documents formulate concrete reduction targets: CO₂ emissions are to be cut by 50 percent by 2020, and nitrogen oxide emissions by 80 percent.

→ www.aero-net.org

EU research program MOZAIC

Atmospheric research on long-haul flights

Every day, five long-haul Airbus A340-300s – three of which are operated by Lufthansa – fly in the service of the EU research program MOZAIC (Measurement of ozone, water vapor, carbon monoxide and nitrogen oxides aboard Airbus in-service aircraft). Sensitive instruments have been installed aboard these aircraft to make continuous measurements of the concentrations of ozone, water vapor, carbon monoxide and nitrogen oxides in the atmosphere. The project's results help significantly to improve the accuracy of global climatic models, which are in turn used to calculate climate changes. About 2,300 flights a year have taken place since 1994. Ten years after the project's launch, the EU's financial support ran out at the beginning of 2004. The airlines and research institutes participating in MOZAIC decided to continue the measurements under their own financing until 2007, given the program's pivotal role for climate research.

→ www.fz-juelich.de

More about the research program MOZAIC in the Feature, page 17.

EU research program CARIBIC

Atmospheric measurement laboratory aboard the "Leverkusen"

Like MOZAIC, the European project CARIBIC (Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container) serves basic research on the atmosphere. Since December 2004, a container filled with scientific instruments flies once or twice a month in the cargo hold of the Lufthansa Airbus A340-600 "Leverkusen." During these flights, ambient air is fed to the container by means of a dedicated air inlet system on the aircraft's fuselage. Inside the container, the air is analyzed for numerous trace gases and aerosols.

→ www.caribic-atmospheric.com

More about the research program CARIBIC in the Feature, from page 14.



Global Compact
Project

Measuring the emissions of jet engines

Determining emissions characteristics over the long-term

To obtain accurate data on changes in emissions and the overall efficiency of engines – depending on hours of operation, maintenance and flight cycles – Lufthansa Technik and the Institute for Meteorology and Climate Research in Karlsruhe (imk-ifu) jointly launched a measuring program in 2001. For this purpose, emissions components were measured in the exhaust jets of specific engines on two Lufthansa Airbus A340-300s after every 1,000 hours of operation. The data allowed the formulation of emissions indexes that characterize the corresponding state of an engine. The project was concluded in 2004; the data analysis is set to be presented in the course of 2005.

→ <http://imk-ifu.fzk.de/>

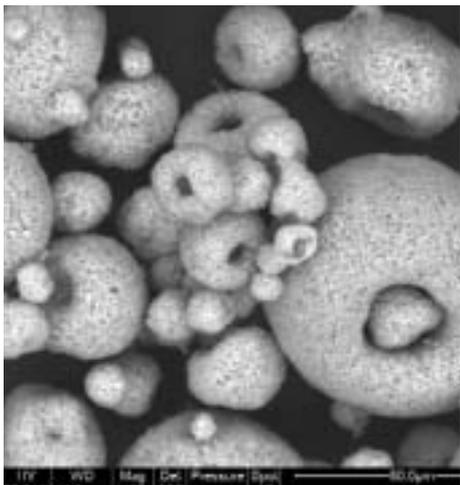


Image generated by a raster electron microscope of the newly developed micropowder for the ceramic protective coating of turbine fan blades and combustion chambers, using a plasma spray process.

EU research program TBCplus

Development of highly resistant ceramic coatings for engine combustion chambers

In cooperation with renowned European aviation institutions, Lufthansa Technik has developed an innovative ceramic protective coating for the combustion chambers and turbine fan blades of aircraft engines, which remains stable under extremely high temperatures. The currently used thermal barrier coatings (TBCs), which protect these components against overheating, have repeatedly undergone changes in the surface of the material in particularly hot areas. Such changes might decrease heat insulation properties or lead to flaking. The consortium expects that using the new-type TBCs will improve the component life span and performance of the engines in use today. Medium-term, the new process can be used in the design of new engine models and thus contribute to increasing efficiency and reducing emissions.

EU research program Consave 2050

Forecasts on growth and emissions in air transport

Consave 2050 aims to contribute to the sustainable, environmentally compatible growth of air transport in Europe and considers in particular the climatic effects that air traffic might have. The project has analyzed qualified scenarios for the development of air transport with three different time horizons: 2025, 2050 and 2100. Deutsche Lufthansa AG's Head of Group Environmental Concepts chairs a consulting panel of experts, which accompanies and appraises the project's work. The presentation of a final report, expected in the near future, will conclude this project.

→ www.dlr.de/consave

Interdisciplinary research network "Quiet Traffic"

Joint research projects to lower traffic-related noise emissions

Initiated by the German Aerospace Center (DLR), the interdisciplinary research network "Quiet Traffic" aims at intensifying the cooperation between industry, research institutions and traffic planners to achieve progress in reducing traffic-related noise emissions. Three working groups examine the specific issues from the areas of road, rail and aircraft noise. Two additional working groups analyze issues concerning all modes of transport, such as noise effects, traffic management, sound propagation and noise optimization.



During fly-over measurements, sound is analyzed via a vast array of microphones. To obtain accurate data, pilots must fly over the measuring point repeatedly under different flight conditions in a comprehensive measuring program.

The **program section “Aircraft Noise”** is led by the Head of Group Environmental Concepts at Deutsche Lufthansa AG. This working group coordinates the following projects:

- The **joint research project LEXMOS** works on quiet engine nozzle systems and advanced methods for the localization of noise sources. It is headed by Rolls-Royce Deutschland.
- In the **joint research project NASGeT** (Innovative active/passive systems for noise reduction on engines), headed by Dornier GmbH, new types of active and passive systems to cut noise at the engine are developed.
- The **joint research project FREQUENZ** (Research on reducing and determining the source noise on civil aircraft by experimental and numeric means) is headed by Lufthansa and works on three subprojects that follow one from the other. In a first step, new aero-acoustic calculation methods are developed, which are subsequently verified in wind-tunnel experiments and finally used for the development of exemplary retrofit measures to reduce noise at the source.

The project can build on existing work jointly conducted by Lufthansa, manufacturers, various authorities and the German Aerospace Center (DLR). This includes noise measuring flights with a Boeing MD-11 of Lufthansa Cargo and an Airbus A319 of the Lufthansa Passenger Airline, which allowed the aircraft-specific characteristics of noise sources to be recorded. These characteristics were used to deduce appropriate measures for noise reduction. These flights tested the so-called vortex generators, which underwent successful further development during the first year of the FREQUENZ project. Vortex generators help suppress annoying wailing sounds from the wings of the A320 family. Two improved models could be tested successfully in fly-over noise measurements conducted in the context of the project “Noise-optimized approach and departure procedures” (see below). To prepare certification, data have been exchanged with Airbus.

Other work units of this project are dedicated to developing noise reduction concepts for the wings’ leading edges. Furthermore, the insights previously attained concerning the thrust nozzle with a serrated rim (chevron nozzle) on the Airbus A319 are to be reevaluated in the light of results produced by the joint research project LEXMOS. The FREQUENZ consortium comprises Lufthansa and the DLR, as well as a number of universities and other companies from the airline industry.

While LEXMOS, NASGeT and FREQUENZ receive funding from Germany’s Federal Ministry of Economics and Labor, the research project “LAnAb” receives funds from the Federal Ministry of Education and Research.

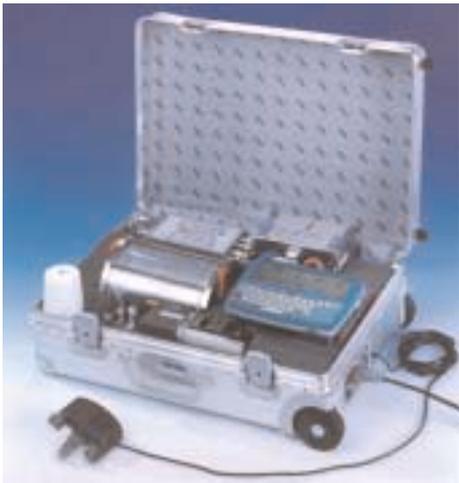
- **Joint research project LAnAb** (Noise-optimized approach and departure procedures)
Using approach procedures such as “low drag/low power” or the Continuous Descent Approach (CDA) can contribute significantly to reducing aircraft noise in the vicinity of airports. Building on these procedures, the joint research project LAnAb analyzes existing approach and departure procedures with the aim of determining additional improvement potentials. Advanced simulation methods are used to analyze an aircraft’s sound generation. In June 2004, a second set of fly-over measurements was recorded

with an A319 to enlarge and improve the database for the simulation. The project will be concluded at the end of 2006. In addition to Lufthansa, the LANAb consortium includes the German Air Navigation Services, seven different DLR institutes, the EADS Corporate Research Center and others.

EU research program SEFA

Investigation of possibilities to influence the tonality of aircraft noise

The goal of SEFA (Sound Engineering for Aircraft) is to develop design criteria for low-noise aircraft and provide instruments for the evaluation of these criteria. The project investigates which "noise signatures" in aircraft noise are perceived as least annoying. To do so, the researchers evaluate the influence of the sound spectrum and the direction in which noise is emitted. Deutsche Lufthansa AG's Head of Group Environmental Concepts is a member of a consulting panel of experts, which accompanies and appraises the project's work in a discerning manner.



The "flight case" has been installed on a Lufthansa Airbus A340. The system consists of a central detector (silver-colored cylinder, left), an electronic measuring system (above the detector), a climate sensor for temperature and air pressure (white cylinder, far left) and a micro-computer (right) for data capture. As an option, it can also be connected to a GPS antenna (front).

EU research program DOSMAX

Measurement of radiation at cruising altitude

Scientists hope that DOSMAX (Dosimetry of Aircrew Exposure to Radiation during Solar Maximum) will yield data to describe "solar particle events," which have been measured only rarely to date. Difficult to forecast, these events can lead to short-term increases in radiation doses at cruising altitude as a result of eruptions on the sun's surface. As with the predecessor project ACREM (Air Crew Radiation Exposure Monitoring), Lufthansa again installed measuring instruments of the German Federal Physio-Technical Institution in Braunschweig and the Austrian Research Center Seibersdorf aboard its aircraft. While ACREM measurements were only conducted on selected flights, the DOSMAX instruments continuously recorded data aboard two Airbus A340s over one year, ending in fall 2004. Scientific institutes from different European countries participated in this research project supported by the EU.

→ www.ptb.de

Epidemiological study of cosmic radiation

Continuation of a research project concerning possible mortality risks for cockpit and cabin crews

In 1997, epidemiologists at Bielefeld University investigated whether cosmic radiation has measurable health effects on flying personnel. For this purpose, they analyzed cases of death among all flying personnel working for Lufthansa or LTU between 1960 and 1997. The study concluded that there were no indications that work-related increased exposure to cosmic radiation leads to a general significantly increased mortality risk due to diseases associated with radiation. To further increase the validity of this study, in which the German Cancer Research Center and the Professional Association of Vehicle Operators were cooperation partners, the investigation period will be extended in a follow-up project to the year 2003. The project's scientific supervision is shared by Bielefeld and Mainz Universities. Initial results are to be presented in 2007.

Independent Auditors' Report

Independent Assurance Statement to management of Lufthansa

Introduction

We have reviewed environmental aspects of the Lufthansa Balance Facts and Figures Report 2004/2005 (hereafter referred to as the "Report"), and of the underlying systems, structures and processes. These subject matters are the responsibility of the Lufthansa Management, with whom the objective and terms of the engagement were agreed. We are responsible for expressing our conclusions based on the engagement.

We have based our approach on emerging best practice for independent assurance on sustainability reporting, including ISAE 3000 ("Assurance Engagements other than Audits or Reviews of Historical Financial Information"), issued by the International Auditing and Assurance Standards Board (IAASB).

Subject matter

The subject matter is the evaluation of:

The procedures and practice, as described in "About the Report," for the annual collection, compilation and validation of 2004 environmental data from reporting units, applied at Lufthansa Group level and at the three group companies Lufthansa Passenger Airline, Lufthansa Cargo and LSG Sky Chefs, all in Frankfurt; in this context, the Group-wide Environmental Database with its clearly defined reporting processes and responsibilities plays a central role.

The process that Lufthansa at Group level has established for the preparation of the Report as well as the appropriate reflection of the collected environmental data in the report chapters "About this report," "Flight operations" (pages 21-25), "Passenger Business" (pages 27-30), "Logistics" and "Catering."

Procedures

Our objective was to achieve limited assurance. Based on an assessment of materiality and risk we have gathered and evaluated evidence supporting the conformity with criteria for the subject matters described. This work included analytical procedures and interviews with management representatives and employees at Lufthansa headquarters in Frankfurt and at the head office of the three group companies in Frankfurt, on a sample basis, as we deemed necessary in the circumstance, but no substantial testing. Therefore, the assurance that we obtained from our evidence gathering procedures is limited. We believe that our work provides an appropriate basis for our conclusion.

Conclusions

In conclusion, in all material respects, nothing has come to our attention that causes us not to believe that:

Lufthansa at Group level and at the three group companies mentioned above has applied detailed and systematic procedures for the purpose of collecting, compiling, aggregating and validating 2004 environmental data from reporting units, as specified in the Report.

Lufthansa at Group level has used detailed and systematic process for the preparation of the Report in order to achieve its reporting objective, as described in the Report; and the collected environmental data has been appropriately reflected in the Report.

Frankfurt, June 3, 2005
DELOITTE Statsautoriseret Revisionsaktieselskab

Preben J Soerensen
Authorized Public Accountant (Denmark)
Environment & Sustainability Services

The Deloitte logo, consisting of the word "Deloitte" in a bold, blue, sans-serif font, followed by a small green square icon.

Environmental ABCs Key terms and abbreviations frequently used in aviation

ACARE (Advisory Council for Aeronautics Research in Europe) • Created in 2001, the ACARE council consists of representatives from the EU member states, EU Commission, Euro-control, EU aerospace industry, EU research institutions and others. Its main task is to develop and implement the strategic research agenda (SRA) for Europe's aerospace sector. → www.acare4europe.org

A-check, C-check • Maintenance event involving routine checks of the main technical systems important for an aircraft's operation plus a thorough touch-up of the cabin. Depending on the type of aircraft, an A-check is required every 350 to 650 flight hours, or about every two months.

A C-check is an in-depth inspection of the aircraft's structure and a thorough testing of all systems, which involves the partial removal of paneling for detailed examinations. Depending on the type of aircraft, a C-check takes place every 15 to 18 months.

AEA • Association of European Airlines, with headquarters in Brussels.

APU • Auxiliary Power Unit, ensures an aircraft's energy supply and air conditioning when no power source is available on the ground. In addition, it provides pressurized air for starting the engines.

Atmosphere • The whole mass of air surrounding the Earth. It is divided into various layers, distinguished from one another by distinct differences in vertical bands of temperature. For air traffic, the two lower layers are of importance: the troposphere and the stratosphere, which lies above that.

The troposphere's upper boundaries vary depending on season and latitude. Above the equator, they lie at altitudes of 16 to 18 kilometers above sea level, and above the poles at 8 to 12 kilometers. The temperature in the tropopause, the transition layer between troposphere and stratosphere, measures at only about minus 60 degrees Celsius. In the stratosphere it rises again. There, the concentration of water vapor is extremely low.

Also in the stratosphere, we find the so-called ozone layer at altitudes of about 25 to 30 kilometers. Today's commercial aircraft fly at cruising altitudes of between 8 and 13 kilometers. According to the latest research, air traffic emissions do not have a direct impact on the ozone layer.

Block time • In Lufthansa's traffic statistics, this term refers to the time from the moment an aircraft leaves its parking position under its own or other power to taxi to the runway for takeoff ("off-blocks time") to the moment it comes to a complete standstill after a flight has been completed successfully ("on-blocks time"). Though frequently used, the term "flying hour" is not

clearly defined as it can signify either flight time or block time.

CAEP • Committee on Aviation Environmental Protection. Environmental workgroup of the International Civil Aviation Organization (ICAO), founded in 1983.

Carbon dioxide (CO₂) • Gas resulting in nature from the burning or decomposition of organic masses (e.g. plant material) and from the breathing process of humans and animals. CO₂ is an important greenhouse gas in the atmosphere, where it remains for about 100 years. Scientists attribute the increase of atmospheric CO₂ over the last 100 years to the burning of fossil fuels (e.g. coal, oil, natural gas) by humans. Per ton of fuel, 3.154 tons of CO₂ result from the combustion process. Currently, about 2 percent of man-made CO₂ emissions are due to air traffic.

Carbon monoxide (CO) • Chemical compound consisting of one carbon and one oxygen atom. It forms in the combustion process, mainly as the result of incomplete combustion. For aircraft engines, the level of CO emissions depends greatly on the thrust level: At the idle setting, while taxiing and during approach the emissions per kilogram of fuel burned are higher than during takeoff and in the climbing phase.

Catering • Internationally used term for the supplies loaded aboard an aircraft, including in-flight meals and service items.

CFCs • Fully halogenated chlorofluorocarbons. In the past, they were used as cooling agents in refrigerators, freezers and air conditioning units. They were also used as a cleaning agent in the area of electronics. CFCs are regarded as the most important cause for the destruction of the ozone layer which scientists have been observing for some years now. CFCs are also highly active greenhouse gases. Over the past years, Lufthansa has replaced CFCs in its operations with substitutes (e.g. partially halogenated CFCs, which have little or no potential for ozone destruction).

Chapter 3 aircraft • Aircraft that meet the regulations of the strictest noise protection standard currently in force. The maximum noise emission values for aircraft were introduced by the ICAO under Annex 16 to the convention on international civil aviation.

All new commercial aircraft marketed today must meet the regulations of Chapter 3 of Annex 16. Noise levels are measured at three measuring points: at 6,500 meters from the beginning of the runway (takeoff) and 450 meters to the side of the runway for takeoffs (sideline), and at 2,000 meters in front of the runway threshold (approach) for landings. The latter corresponds to a flyover altitude of about 120 meters.

The permitted values depend on the aircraft's maximum take-off weight and number of engines.

In September 2001, the environmental committee (CAEP) of the ICAO reached agreement on the more stringent Chapter 4 noise standard. It prescribes a cumulative reduction of 10 decibels (dB) compared to the maximum values now permitted under Chapter 3.

Chlorinated hydrocarbons • Organic compounds whose hydrogen atoms have been replaced by chlorine atoms. They are excellent solvents and were previously used as grease solvents in metal processing. Considered problematic both from an environmental and occupational safety point of view, chlorinated hydrocarbons are no longer used at Lufthansa.

Condensation trails (contrails) • Under certain meteorological conditions, water vapor and particle emissions from aircraft engines can cause the formation of contrails, whose life span can occasionally reach several hours. Theoretically, contrails influence the Earth's radiation budget by hindering the reflection of heat into space.

Additional high-altitude cloud cover caused by line-shaped contrails reaches 0.5 percent above western and central Europe and 1.3 percent above the United States. Based on regional observations, projections indicate a worldwide average of approximately 0.07 percent. According to calculations by the German Aerospace Center (DLR), this implies a small climatic effect compared to that of CO₂ emissions.

In model calculations, the DLR found that the impact of contrails on the radiative forcing is lower by a factor of about 5 than that estimated by the IPCC in 1999. This makes it lower by a factor of 5 than the impact of aviation-related CO₂ emissions. The radiative forcing determines the temperatures prevalent in the earth's atmosphere. In turn, these influence wind and precipitation, i.e. those parameters commonly referred to as weather or, over longer periods of time, as climate.

On occasion, contrails develop further into "natural" cirrus clouds, the so-called "contrail-cirrus clouds." The effect of this type of cloud on the radiation budget and climate is currently being researched.

Decibel (dB) • Measuring unit for the intensity and pressure of sound. The difference in intensity between the softest sound the human ear can perceive and the pain threshold is 1:10 billion. To depict this enormous range objectively, acoustics uses the logarithmic decibel scale. On this scale, the value "0" is assigned to the perception threshold (for a sound of 1,000 Hz) and the pain threshold at the value "130."

An increase of 10 dB corresponds to a tenfold increase in the sound's intensity. For the perceived volume, a difference of 10 dB corre-

sponds to half or double the volume. However, the human ear is not equally sensitive across the entire range of frequencies. Low and high sounds are not perceived as being equally loud even at the same intensity. For measurements, this difference is equalized and noted accordingly. The best known such notation is the "A value," marked by the index dB(A).

To measure aircraft noise, the EPNdB (Effective Perceived Noise Decibel) unit is used internationally.

Deicing • An aircraft cannot take off with ice and snow on its wings and horizontal stabilizers. Such accumulations alter the aerodynamics and thus imply an enormous safety risk. For this reason, aircraft are forbidden to take off when they are covered by hoarfrost, snow or ice. Under wintry weather conditions, an aircraft's critical surfaces must be deiced with a mixture of water, propylene glycol and alcohol, which also protects them from icing over again (deicing/anti-icing). On average, about 900 liters of deicing fluid are required to deice a Boeing 747 each time. By comparison, only 300 liters are needed for a Boeing 737. This deicing fluid is almost completely biodegradable and poses no danger for the environment.

On an average winter day, about 65,000 liters of deicing fluid are used at German airports. On dry days with freezing temperatures, this figure is significantly lower. It is even entirely possible that on dry days with very cold temperatures, such as those occurring at Russian airports, no deicing is required at all as no ice builds up due to the cold, precipitation-free weather conditions.

DLR • German Aerospace Center. The DLR serves scientific, economic and social purposes. It maintains 30 institutes, testing facilities and operational sites. Its goal is to help – using the means of aviation and space flight – to secure and shape the future. In its work, the DLR also seeks cooperation and allocation of research tasks among European partners. → www.dlr.de

EMAS • Environmental Management and Audit Scheme. European regulations concerning environmental management and certification.

Equivalent continuous sound pressure level

(Leq) • The L_{eq} is a measure for the energetic average of all sound pressure levels over a defined period of time. All sound events that differ in intensity and duration are summarized according to mathematical rules. The resulting average value is an accepted and proven measurement of the "noise quantity" occurring over an observed time interval.

FANS (Future Air Navigation System) •

New air traffic control system, based essentially on data exchanges between air traffic control and aircraft. In addition to numerous other

advantages, FANS enables the use of new, more fuel-efficient routings over remote areas without radar coverage.

Freight performance (FTKO/FTKT) • One distinguishes between an airline's offered freight performance (FTKO, freight ton kilometers offered) as part of its total performance offered and its sold freight performance (FTKT, freight ton kilometers transported) as part of its total performance sold. See also ton kilometers.

Fuel dumps • Dumping of fuel in-flight due to emergency situations. A procedure used on long-haul aircraft (Airbus A340, Airbus A330, Boeing 747, Boeing 767, MD-11) before unscheduled landings (e.g. in the event of technical problems or serious passenger illness) to decrease the aircraft's weight to the maximum permissible landing weight. In the event of a fuel dump, special airspace is assigned to the aircraft, if possible above unpopulated or thinly populated areas (e.g. North Sea).

Fuel is usually dumped at altitudes of 4–8 kilometers. A minimum altitude of 1,500 meters and a minimum speed of 500 km/h are required. The aircraft may not fly a fully closed circle. The dumped kerosene forms a fine mist in the turbulence behind the aircraft. Despite the use of highly sensitive methods of analysis, no contamination has been determined so far in plant or soil samples after fuel dumps.

Halogenated hydrocarbons • Chemical compound that – in addition to carbon and hydrogen – contains fluorine, bromine, chlorine or iodine. The group of halogenated hydrocarbons includes chlorinated hydrocarbons and CFCs.

Halon • Collective term for a group of chemical compounds that are used as efficient and reliable fire extinguishing agents. Chemically, they are related to the CFCs, very stable and in some cases characterized by a high potential for ozone destruction. They may only be used in cases where this is absolutely necessary for safety reasons. One of these exceptional cases is air transport, where they are currently the only certified fire extinguishing agent. For example, halon fire extinguishers are installed on aircraft in the engine areas, toilets and cargo compartments. Lufthansa participates intensely in the search for halon alternatives.

IATA • International Air Transport Association, the general organization of international commercial aviation with headquarters in Geneva.

ICAO • International Civil Aviation Organization, a United Nations agency with headquarters in Montreal. Develops internationally binding norms for civil aviation.

IPCC • Intergovernmental Panel on Climate Change. An international UN panel on climate change, founded in 1988 by the World Meteorological

Organization (WMO) and the United Nations Environmental Program (UNEP). → www.ipcc.ch

Kerosene • Fuel for jet and propeller engines that is chemically similar to petroleum. Like diesel fuel or gasoline, kerosene is produced by distilling crude oil; unlike these fuels, kerosene does not contain halogenated additives. Due to its manufacturing process, it does not contain benzene either. Since 2002, kerosene has been considered not only hazardous for health, but also hazardous for the environment (new), following an adaptation regulation issued by the European.

Worldwide, aircraft consume almost 170 million tons of kerosene per year. This represents about 5–6 percent of the world's total crude oil production. Military aviation has a share of 10–20 percent.

Nitric oxides (NO_x) • Chemical compounds consisting of one nitrogen and several oxygen atoms. NO_x is defined as the sum of NO and NO₂ compounds. Natural sources include lightning and microbes in the soil. Nitric oxides are also generated in combustion processes under high pressures and temperatures. Both of these parameters have been increased in modern aircraft engines to significantly reduce fuel consumption as well as emissions of carbon monoxide and unburned hydrocarbon. However, future combustion chambers of an advanced design could help reduce NO_x emissions by 85 percent.

Depending on the type of aircraft and operational conditions, this value varies between 6 and 20 kilos per ton of fuel burned. Air traffic has a share of 2–3 percent in man-made NO_x emissions. Climate models show that nitric oxides have increased the concentration of ozone at cruising altitudes by a few percentage points.

Ozone (O₃) • Molecule consisting of three oxygen atoms. Close to the ground, it is a component of "summer smog" and irritates the mucous membranes. In the stratosphere, ozone absorbs ultraviolet light (ozone layer). At current levels, nitric oxide emissions from air traffic at cruising altitudes cause an increase in atmospheric ozone, analogous to the generation of summer smog. For heavily-flown North Atlantic routes, scientists quote ozone increases of 3–4 percent.

Passenger kilometer (PKT) • Measure for the actual transport performance in passenger transport (number of passengers multiplied by distance flown). To determine this value, one uses not the actual length of the flown route – with its air traffic control related detours – but the great circle distance between the cities of origin and destination. One also distinguishes between available transport performance (PKO),

passenger kilometers offered) and actual transport performance (PKT, passenger kilometers transported). Another commonly used term for available transport performance is SKO (seat kilometers offered).

Payload • Capacity available on a flight segment (in kilograms) for the carriage of passengers, baggage, freight and mail.

Payload factor • Weight-related measure for the utilization of aircraft. It is the ratio of transported ton kilometers (TKT) to available ton kilometers (TKO).

Particulate matter (or PM10) • Particulate matter is defined as dust with a particle size of less than 10 micrometers. Thus, it is not perceptible to the naked eye. Particulate matter is primarily generated in combustion and production processes, by mechanical abrasion or vortices and by formation from gaseous components in the air. Main sources are traffic, industry and businesses.

Seat kilometer (SKO) • Measure for the transport capacity available (SKO, seat kilometers offered).

Seat load factor • Passenger-related measure of utilization in passenger transport. The ratio of transport performance (PKT, passenger kilometers transported) to capacity (PKO, passenger kilometers offered).

Slot • Designated point in time at which an airline may use an airport's runway for takeoff or landing. Slots are an important tool for distributing the limited capacity of today's airports among the airlines.

Stratosphere • Layer of air above the troposphere, at altitudes of about 12 to 50 kilometers. Troposphere and stratosphere are separated by the so-called tropopause (transition area).

Sulfur dioxide (SO₂) • Consists of one sulfur atom and two oxygen atoms. When burning fossil fuels, SO₂ is mainly generated from the sulfur contained in coal, oil and gas. It is converted in the atmosphere into sulfuric acid and sulfurous acid, and is one cause of acid rain. SO₂ is also an important generator of aerosols. These aerosols have a cooling effect on the atmosphere by scattering incoming sunlight.

If one assumes a maximum sulfur content in kerosene as defined by the current international norms (0.3 kilos per ton), then 0.5 kilos of sulfur compounds are generated per ton of fuel consumed. But the emissions from current operations should be significantly below this level, due to the higher quality levels of kerosene now available. For example, the DLR assumes a sulfur content of 0.03 kg/ton or less for kerosene from German refineries.

Sustainable development • The guiding principle of sustainable development gained worldwide visibility in 1987, when the World Commission for Development and the Environment (Brundtland Commission) presented its report entitled "Our Shared Future." It states: "Sustainable development is a form of development that meets the needs of today's generation without jeopardizing the abilities of future generations to satisfy their own needs." For businesses, this means acting in a responsible manner, not only in economic matters but also in environmental and social issues, in order to secure growth long-term. All three aspects – economic, ecological and social – must be kept in balance.

Ton kilometers (TKT) • Measure of transport performance (payload multiplied by distance). One distinguishes between available transport performance (TKO, ton kilometers offered) and the actual transport performance (TKT, ton kilometers transported). In calculating payloads, passengers are taken into account by means of a statistical average weight.

Trace gases • Gases of which there are only very small amounts present in the atmosphere (e.g. ozone, methane, nitrous oxide, etc.) but which are of great significance for the Earth's climate and the chemical processes in the atmosphere.

Tropopause • Transition layer between the troposphere and the stratosphere. Region of the lowest temperatures (about –60 degrees Celsius).

Troposphere • Lowest layer of the Earth's atmosphere and location of weather events. Depending on the season, the upper boundaries of the troposphere reach altitudes of 6–8 kilometers above the poles and 16–18 kilometers in tropical areas.

Unburned hydrocarbons (UHCs) • Mixture of hydrocarbons that results from the incomplete combustion of fuels containing hydrocarbons and from the evaporation of fuel.

Volatile Organic Compounds (VOCs) • Volatile organic substances that are characterized by high steam pressure and thus evaporate easily into the atmosphere at room temperature. VOCs are present in solvents, cleaning agents, fuels and other substances. In the presence of nitrogen oxides and intense sunlight, VOCs lead to the generation of ozone.

Water vapor • Even ahead of carbon dioxide, water vapor is the most important greenhouse gas. Without water vapor from natural sources, the Earth's surface would be around 22 degrees Celsius cooler. This makes water vapor responsible for two-thirds of the natural greenhouse effect of 33 degrees Celsius. Unlike carbon dioxide, man-made water vapor emissions

are too insignificant in comparison with natural sources (e.g. evaporation) to have an influence on the Earth's climate.

For each kilo of kerosene burned, 1,24 kilos of water vapor are released. Concerns that air traffic might increase the concentration of water vapor in the stratosphere and thus change the climate have been refuted by scientific research. The German Aerospace Center (DLR) concluded that even a one hundred-fold increase in the quantity of water vapor emitted by air traffic would not result in a detectable climatic signal.

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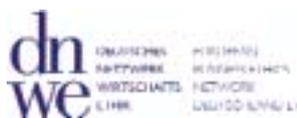
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