Austrian Ministry
for Transport,
Innovation and Technology

ACTION PLAN OF AUSTRIA ON CO_2 EMISSIONS REDUCTION

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1. INTRODUCTION

a) Austria is a member of the European Union and of the European Civil Aviation Conference (ECAC). ECAC is an intergovernmental organisation covering the widest grouping of Member States[1] of any European organisation dealing with civil aviation. It is currently composed of 44 Member States, and was created in 1955.

b) ECAC States share the view that environmental concerns represent a potential constraint on the future development of the international aviation sector, and together they fully support ICAO's ongoing efforts to address the full range of these concerns, including the key strategic challenge posed by climate change, for the sustainable development of international air transport.

c) Austria, like all of ECAC's forty-four States, is fully committed to and involved in the fight against climate change, and works towards a resource-efficient, competitive and sustainable multimodal transport system.

d) Austria recognises the value of each State preparing and submitting to ICAO a State Action Plan on emissions reductions, as an important step towards the achievement of the global collective goals agreed at the 37th Session of the ICAO Assembly in 2010.

e) In that context, it is the intention that all ECAC States submit to ICAO an Action Plan[2], regardless of whether or not the 1% de mimimis threshold is met, thus going beyond the agreement of ICAO Assembly Resolution A/37-19. This is the Action Plan of Austria.

f) Austria shares the view of all ECAC States that a comprehensive approach to reducing aviation emissions is necessary, and that this should include:

   i. emission reductions at source, including European support to CAEP work

   ii. research and development on emission reductions technologies, including public-private partnerships

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1 Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine, and the United Kingdom

2 ICAO Assembly Resolution A37-19 also encourages States to submit an annual reporting on international aviation CO2 emissions. This is considered by Europe an important task, but one which is different in nature and purpose to the Action Plans, which are strategic in their nature. For that reason, the reporting to ICAO on international aviation CO2 emissions referred to at paragraph 9 of ICAO Resolution A37/19 is not part of this Action Plan, nor of those submitted by other Member States of ECAC. This information will be provided to ICAO separately.

iii. the development and deployment of low-carbon sustainable alternative fuels, including research and operational initiatives undertaken jointly with stakeholders

iv. the optimisation and improvement of Air Traffic Management, and infrastructure use within Europe, in particular through the Single European Sky ATM Research (SESAR), and also beyond European borders, through the Atlantic Initiative for the Reduction of Emissions (AIRE) in cooperation with the US FAA.

v. Market-based measures, such as open emission trading schemes (ETS), which allow the sector to continue to grow in a sustainable and efficient manner, recognising that the measures at (i) to (iv) above cannot, even in aggregate, deliver in time the emissions reductions necessary to meet the global goals. This growth becomes possible through the purchase under an ETS of CO_2 allowances from other sectors of the economy, where abatement costs are lower than within the aviation sector.

g) In Europe, many of the actions which are undertaken within the framework of this comprehensive approach are in practice taken at a supra-national level, most of them led by the EU. They are reported in Chapter 3 of this Action Plan, where Austria's involvement in them is described, as well as that of stakeholders.

h) In Austria a number of actions are undertaken at the national level, including by stakeholders, in addition to those of a supra-national nature. These national actions are reported in Chapter 4 of this Plan.

i) In relation to actions which are taken at a supranational level, it is important to note that:

i. The extent of participation will vary from one State and another, reflecting the priorities and circumstances of each State (economic situation, size of its aviation market, historical and institutional context, such as EU/ non EU). The ECAC States are thus involved to different degrees and on different timelines in the delivery of these common actions. When an additional State joins a collective action, including at a later stage, this broadens the effect of the measure, thus increasing the European contribution to meeting the global goals.

ii. Nonetheless, acting together, the ECAC States have undertaken to reduce the region's emissions through a comprehensive approach which uses each of the pillars of that approach. Some of the component measures, although implemented by some but not all of ECAC's 44 States, nonetheless yield emission reduction benefits across the whole of the region (thus for example research, ETS).

2. CURRENT STATE OF AVIATION IN AUSTRIA

Zivil aircraft fleet in Austria

(Source: Statistik Austria)

Category	2006	2007	2008	2009	2010
Single-engine aircraft below 2.000 kg	616	608	623	639	654
Single-engine aircraft 2.000 kg to 5.700 kg	8	7	9	10	12
Multi-engine aircraft below 5.700 kg	89	100	144	150	153
Aircraft 5.700 kg to 14.000 kg	57	60	91	97	96
Aircraft 14.000 kg to 20.000 kg	16	20	37	39	36
Aircraft over 20.000 kg	155	162	180	189	185
Rotorcraft (helicopter)	151	153	168	175	174
Ultralight	111	115	107	102	97
Powered gliders	215	210	199	195	188
Aircraft in total	1.418	1.435	1.558	1.596	1.595

Austria's most important air carriers

In 2010, a total of 81 air carriers were registered in Austria, of these, 63 were categorised as fixed-wing carriers and 18 as helicopter carriers. The largest Austrian air carriers in terms of passengers were Austrian Airlines Group (Austrian Airlines / Tyrolean / Lauda Air) and Fly Niki (Niki Luftfahrt GmbH). Since September 2009, Austrian Airlines Group has been part of the Lufthansa group. German airline Air Berlin owns a stake in Fly Niki. Other than the two abovementioned airlines, there are a number of other air carriers providing regularly scheduled service and/or charter services; such companies are particularly important for regional airports.

Passenger volume of home carriers

(Data source: "Linienunternehmen" 2010)

Carrier	Passengers
Austrian Airlines Group	10,9 million
Fly Niki	3,4 million

Intersky	210.000
Air Alps Aviation	85.700
Welcome Air	34.100
Robin Hood	Data unavailable
People’s Viennaline	Operational since 2011

Ownership structure of domestic airports

In Austria there are six airports served by both Austrian and foreign carriers:

- Graz Thalerhof (Ownership structure of Flughafen Graz Betriebs GmbH: 99.9% Graz AG, 0.1% Gesellschaft für Strategische Unternehmensberatung-GmbH)
- Innsbruck-Kranebitten (Ownership structure of Tiroler Flughafenbetriebsges.m.b.H.: 51% Innsbrucker Kommunalbetriebe AG, 24.5% Federal State of Tyrol, 24.5% City of Innsbruck)
- Klagenfurt-Wörthersee (Ownership structure of Kärntner Betriebs GesmbH: 80% Kärntner Landesholding, 20% City of Klagenfurt)
- Linz-Hörsching (Ownership structure of Flughafen Linz GesmbH: 50% OÖ Verkehrsholding GmbH, 50% City of Linz)
- Salzburg Airport W. A. Mozart (Ownership structure of Salzburger Flughafen GmbH: 75% Salzburger Beteiligungsverwaltungs GmbH, 25% Stadt Salzburg Beteiligungs GmbH)
- Vienna International Airport (Ownership structure of Flughafen Wien AG: 20% Federal State of Lower Austria, 20% City of Vienna, 10% private employee participation foundation, 50% private shareholders)

Transport connections at the six Austrian Airports
(Data source: Airports)

Airport	Motorway	Local rail	Regional and long-distance rail	Bus
Vienna	***	***	***	***

Salzburg	***	***	***	***
Innsbruck	***	***	***	***
Graz	***	***	***	***
Linz	***	***	***	***
Klagenfurt	***	***	***	***

Very good ***   good ***   fair ***   absent ***

Market shares at Vienna International Airport
(Source: Flughafen Wien AG 2011)

In 2010, Austrian Airlines Group claimed 51,5% of regular-service passenger volume. Other important airlines at this Austrian air transport hub were Fly Niki (10,1%), Air Berlin (7,3%) and Lufthansa (4,9%). All other airlines came in below the 3%-mark. Over a 5-year period, this represents an increase in market share for Fly Niki (2005: 4,1%) and Air Berlin (2005: 6,3%) and a loss in market share for Austrian Airlines Group (2005: 56,0%) and Lufthansa (2005: 5,9%). The entire Lufthansa group (including Austrian Airlines Group, Brussels Airlines, British Midland, Germanwings, SunExpress and Swiss) thus claimed a market share of 62,6% in 2010, with the combined market share of Air Berlin and Fly Niki amounting to 17,4% .

Airlines' shares of passenger volume in regular service (Vienna)
(Source: Flughafen Wien AG 2011)

Airline	Passenger volume (%)
Austrian Airlines Group	51,5
Fly Niki	10,1
Air Berlin	7,3
Lufthansa	4,9

An increasing number of aircraft
(see Statistik Austria 2010, Austro Control GmbH 2011)

In 2010 there were 1,597 registered civilian aircraft in Austria (this represents growth of 23% since 2000). Of these, 818 were in the category of general aviation and 317 in the commercial aviation sector (regular and charter service). The rest were distributed among other, smaller segments (e.g. 157 rotary-wing aircraft, 98 ultra-light aircraft and 188 motor gliders).

Increase in flight movements

Austro Control recorded 1.141.991 flight movements in 2010, representing an increase of 38,8% since 2000. There were 320.409 commercial flight movements at Austrian airports in 2010, representing an increase of 18,5% since 2000. The total number of commercial flight movements in 2010 can be broken down as follows:

Vienna – 245.992
Salzburg – 20.159
Graz – 17.313
Innsbruck – 15.347
Linz – 13.688
Klagenfurt – 7.910

Passenger statistics of Austrian airports

(Data source: Statistics Austria)

	Passengers	
Airport	1999	2010
Vienna	11.924.514	19.682.590
Salzburg	1.260.711	1.625.842
Innsbruck	680.620	1.033.512
Graz	752.496	989.959
Linz	746.929	692.039
Klagenfurt	235.348	426.935

Rising passenger figures

In 2010, a total of 24,5 million passengers were transported. This represents an increase of 56,7% in comparison with 2000. Approximately 90% of passengers used regular-service airlines and about 10% used charter-service airlines. Of the total number of transported passengers in 2010, 19,7 million were handled at Vienna International Airport, followed by Salzburg (1.6 million), Innsbruck (1 million) and Graz (1 million).

Higher freight volume

2010 saw Austria's six airports handle approximately 245.944 tonnes of freight and 12.495 tonnes of mail. In 2007, Austria ranked 9th among the EU-27 in terms of loaded and unloaded tonnes of freight and mail; Vienna International Airport and Linz Airport made the most significant contributions to this statistic. Among the EU-27, Vienna International Airport ranked 16th in terms of tonnes of handled freight. Over a ten year period, freight volume at Austria's six airports demonstrated continuous growth (except during the market collapses of 2001/2002 and 2008/2009) which ultimately totalled 83,4%.

General aviation

Statistics Austria defines general aviation as private flights, training flights, work-related flights, test flights, governmental flights, military flights and other types of flights. Non-scheduled commercial motorised flight movements have grown in significance over the past few years. While the number of such flight movements rose by 13% between 2004 and 2008, this figure fell back to around 2004 levels in 2009.

3. SUPRA-NATIONAL ACTIONS, INCLUDING THOSE LED BY THE EU

3.1 AIRCRAFT RELATED TECHNOLOGY DEVELOPMENT

Aircraft emissions standards

European states fully support the ongoing work in ICAO's Committee on Aviation Environmental Protection (CAEP) to develop an aircraft CO_2 standard. Assembly Resolution A37-19 requests the Council to develop a global CO_2 standard for aircraft aiming for 2013. It is recognised that this is an ambitious timeframe for the development of a completely new ICAO standard. Europe is contributing to this task notably through the European Aviation Safety Agency providing the co-rapporteurship of the CO_2 task group within CAEP's Working Group 3.

In the event that a standard, comprising certification requirement and regulatory level, is adopted in 2013, it is likely to have an applicability date set some years in the future. The contribution that such a standard will make towards the global aspirational goals will of course depend on the regulatory level that is set, but it seems unlikely that an aircraft CO_2 standard could have any significant effect on the fuel efficiency of the global in-service fleet until well after 2020.

Research and development

Clean Sky is an EU **Joint Technology Initiative** (JTI) that aims to develop and mature breakthrough "clean technologies" for air transport. By accelerating their deployment, the JTI will contribute to Europe's strategic environmental and social priorities, and simultaneously promote competitiveness and sustainable economic growth.

Joint Technology Initiatives are specific large scale EU research projects created by the European Commission within the 7th Framework Programme (FP7) in order to allow the achievement of ambitious and complex research goals. Set up as a Public Private Partnership between the European Commission and the European aeronautical industry, Clean Sky will pull together the research and technology resources of the European Union in a coherent, 7-year, €1.6bn programme, and contribute significantly to the 'greening' of aviation.

The Clean Sky goal is to identify, develop and validate the key technologies necessary to achieve major steps towards the Advisory Council for Aeronautics Research in Europe (ACARE) environmental goals for 2020 when compared to 2000 levels:

- Fuel consumption and carbon dioxide (CO_2) emissions reduced by 50%
- Nitrous oxides (NO_X) emissions reduced by 80%
- Perceived external noise reduction of 50%
- Improved environmental impact of the lifecycle of aircraft and related products.

Three complementary instruments are used by Clean Sky in meeting these goals:

Technologies.

These are selected, developed and monitored in terms of maturity, or "technology readiness level" (TRL). A detailed list of more than one hundred key technologies has been set. The technologies developed by Clean Sky will cover all major segments of commercial aircraft.

Concept Aircraft.

These are design studies dedicated to integrating technologies into a viable conceptual configuration, and assessing their potential and relevance. They cover a broad range of aircraft: business jets, regional and large commercial aircraft, as well as rotorcraft. They have been grouped and categorised in order to represent the major future aircraft families. Clean Sky's environmental results will be measured and reported upon principally by Concept Aircraft.

Demonstration Programmes.

Some technologies can be assessed during their development phase, but many key technologies need to be validated at an integrated vehicle or system level via dedicated demonstrators. These demonstrators pull together several technologies at a larger “system” or aircraft level. Airframe, Engine and Systems technologies are monitored through in-flight or large scale ground demonstrations. The aim is to validate the feasibility of these technologies in relevant (in-flight or operating) conditions. Their performance can then be predicted in areas such as mechanical or in-flight behaviour. This in turn will help determine the true potential of the technologies and enable a realistic environmental assessment. Demonstrations enable technologies to reach a higher level of maturity (or TRL: technology readiness level), which is the “raison d’être” of Clean Sky.

The environmental objectives of the programme are determined by evaluating the performance of concept aircraft in the global air transport system (when compared to 2000 level technology and to a "business as usual" evolution of technology). The ranges of environmental improvements result from the sum of technologies which are expected to reach TRL5-6 within the programme timeframe. While not all of these technologies will be developed directly through the Clean Sky programme, it is neither feasible nor relevant at this stage to isolate the benefits derived purely from Clean Sky technologies, as Clean Sky will achieve a significant synergy effect in European Aeronautics Research by maturing closely linked technologies to a materially higher TRL through demonstration and integration.

Clean Sky activities are performed within six “**Integrated Technology Demonstrators**” (ITDs) and a “**Technology Evaluator**”.

The three vehicle-based ITDs will develop, deliver and integrate technologies into concrete aircraft configurations. The two “transversal” ITDs are focused on propulsion and systems, and will deliver technologies, which will be integrated in various aircraft configurations by the vehicle ITDs. A further ITD will focus specifically on the life cycle assessment and 'eco-design' philosophy.

Smart Fixed Wing Aircraft (SFWA) – co-led by Airbus and SAAB - will deliver innovative wing technologies together with new aircraft configurations, covering large aircraft and business jets. Key enabling technologies from the transversal ITDs, for instance Contra Rotating Open Rotor, will be integrated into the demonstration programmes and concept aircraft.

Green Regional Aircraft (GRA) – co-led by Alenia and EADS CASA - will develop new technologies for the reduction of noise and emissions, in particular advanced low-weight & high performance structures, incorporation of all-electric systems, bleed-less engine architecture, low noise/high efficiency aerodynamics, and finally environmentally optimised mission and trajectory management.

Green Rotorcraft (GRC) – co-led by Agusta Westland and Eurocopter - will deliver innovative rotor blade technologies for reduction in rotor noise and power consumption, technologies for lower airframe drag, environmentally friendly flight paths, the integration of diesel engine technology, and advanced electrical systems for elimination of hydraulic fluids and for improved fuel consumption.

Sustainable and Green Engines (SAGE) - co-led by Rolls-Royce and Safran - will design and build five engine demonstrators to integrate technologies for low fuel consumption, whilst reducing noise levels and nitrous oxides. The 'Open Rotor' is the target of two demonstrators. The others address geared turbofan technology, low pressure stages of a three-shaft engine and a new turboshaft engine for helicopters.

Systems for Green Operations (SGO) - co-led by Liebherr and Thales - will focus on all electrical aircraft equipment and system architectures, thermal management, capabilities for environmentally-friendly trajectories and missions, and improved ground operations to give any aircraft the capability to fully exploit the benefits of the "Single European Sky".

Eco-Design - co-led by Dassault and Fraunhofer Gesellschaft - will support the ITDs with environmental impact analysis of the product life-cycle. Eco-Design will focus on environmentally-friendly design and production, withdrawal, and recycling of aircraft, by optimal use of raw materials and energies, thus improving the environmental impact of the entire aircraft life-cycle.

Complementing these six ITDs, the **Technology Evaluator (TE)** is a dedicated evaluation platform cross-positioned within the Clean Sky project structure. The TE is co-led by DLR and Thales, and includes the major European aeronautical research organisations. It will assess the environmental impact of the technologies developed by the ITDs and integrated into the Concept Aircraft. By doing this, the TE will enable Clean Sky to measure and report the level of success in achieving the environmental objectives, and in contributing towards the ACARE environmental goals. Besides a mission level analysis (aircraft level), the positive impact of the Clean Sky technologies will be shown at a relevant hub airport environment and across the global air transport system.

The first assessment by the Technology Evaluator on the way to meeting Clean Sky's environmental objectives is planned for the end of 2011. The ranges of potential performance improvement (reduction in CO_2, NO_X and Noise) will be narrowed or evolved during the life of the programme based on the results from the key technologies developed and validated through the demonstrations performed.

Clean Sky is a 'living' programme: each year, Annual Implementation Plans are produced and agreed, and research priorities are (re-)calibrated based on results achieved. The best approach to progressing the technologies is pursued. The Clean Sky JU uses regular Calls for Proposals to engage with the wider aeronautical industry, research organisations and universities in order to bring the best talent on board and enable broad collaborative participation. A very significant share of the Clean Sky research programme is already being taken on by Europe's aerospace related SMEs, and by

September 2011 nine Calls for Proposals will have been completed, demonstrating the JU's commitment to involving all competent organisations in the European aeronautics research arena. In June 2011, a major and exciting milestone was reached with the 400th partner joining the Clean Sky programme.

3.2 ALTERNATIVE FUELS

European Advanced Biofuels Flightpath

In February 2009, the European Commission's Directorate General for Energy and Transport initiated the SWAFEA (Sustainable Ways for Alternative Fuels and Energy for Aviation) study to investigate the feasibility and the impact of the use of alternative fuels in aviation. The goal was to provide the European Commission with information and decision elements to support its future air transport policy, in the framework of the European commitment to promote renewable energy for the mitigation of climate change, security of supply and also to contribute to Europe's competitiveness and economic growth.

The study team involved 20 European and international organisations, representing all players in alternative aviation fuels: aircraft and engine manufacturing, air transport, oil industry, research and consulting organisations covering a large spectrum of expertise in the fields of fuel, combustion, environment as well as agriculture.

The SWAFEA final report was published in July 2011[3]. It provides a comprehensive analysis on the prospects for alternative fuels in aviation, including an integrated analysis of technical feasibility, environmental sustainability (based on the sustainability criteria of the EU Directive on renewable energy[4]) and economic aspects. It includes a number of recommendations on the steps that should be taken to promote the take-up of sustainable biofuels for aviation in Europe.

In March 2011, the European Commission published a White Paper on transport[5]. In the context of an overall goal of achieving a reduction of at least 60% in greenhouse gas emissions from transport by 2050 with respect to 1990, the White Paper established a goal of low-carbon sustainable fuels in aviation reaching 40% by 2050.

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[3] http://www.swafea.eu/LinkClick.aspx?fileticket=llISmYPFNxY%3D&tabid=38

[4] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[5] Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final

As a first step towards delivering this goal, in June the European Commission, in close coordination with Airbus, leading European airlines (Lufthansa, Air France/KLM, & British Airways) and key European biofuel producers (Choren Industries, Neste Oil, Biomass Technology Group and UOP), launched the European Advanced Biofuels Flightpath. This industry-wide initiative aims to speed up the commercialisation of aviation biofuels in Europe, with the objective of achieving the commercialisation of sustainably produced paraffinic biofuels in the aviation sector by reaching a 2 million tons consumption by 2020.

This initiative is a shared and voluntary commitment by its members to support and promote the production, storage and distribution of sustainably produced drop-in biofuels for use in aviation. It also targets establishing appropriate financial mechanisms to support the construction of industrial "first of a kind" advanced biofuel production plants. The Biofuels Flight path is explained in a technical paper, which sets out in more detail the challenges and required actions[6].

More specifically, the initiative focuses on the following:

1. Facilitate the development of standards for drop-in biofuels and their certification for use in commercial aircraft;
2. Work together with the full supply chain to further develop worldwide accepted sustainability certification frameworks
3. Agree on biofuel take-off arrangements over a defined period of time and at a reasonable cost;
4. Promote appropriate public and private actions to ensure the market uptake of paraffinic biofuels by the aviation sector;
5. Establish financing structures to facilitate the realisation of 2G biofuel projects;
6. Accelerate targeted research and innovation for advanced biofuel technologies, and especially algae.

Take concrete actions to inform the European citizen of the benefits of replacing kerosene by certified sustainable biofuels.

The following "Flight Path" provides an overview about the objectives, tasks, and milestones of the initiative.

Time horizons	**Action**	**Aim/Result**
Short-term	Announcement of action at	To mobilise all stakeholders

6 http://ec.europa.eu/energy/technology/initiatives/doc/20110622_biofuels_flight_path_technical_paper.pdf

(next 0-3 years)	International Paris Air Show	including Member States.
	High level workshop with financial institutions to address funding mechanisms.	To agree on a "Biofuel in Aviation Fund".
	> 1,000 tons of Fisher-Tropsch biofuel become available.	Verification of Fisher-Tropsch product quality. Significant volumes of synthetic biofuel become available for flight testing.
	Production of aviation class biofuels in the hydrotreated vegetable oil (HVO) plants from sustainable feedstock	Regular testing and eventually few regular flights with HVO biofuels from sustainable feedstock.
	Secure public and private financial and legislative mechanisms for industrial second generation biofuel plants.	To provide the financial means for investing in first of a kind plants and to permit use of aviation biofuel at economically acceptable conditions.
	Biofuel purchase agreement signed between aviation sector and biofuel producers.	To ensure a market for aviation biofuel production and facilitate investment in industrial 2G plants.
	Start construction of the first series of 2G plants.	Plants are operational by 2015-16.
	Identification of refineries & blenders which will take part in the first phase of the action.	Mobilise fuel suppliers and logistics along the supply chain.
Mid-term (4-7 years)	2000 tons of algal oils are becoming available.	First quantities of algal oils are used to produce aviation fuels.
	Supply of 1.0 M tons of hydrotreated sustainable oils and 0.2 tons of synthetic aviation biofuels in the aviation market.	1.2 M tons of biofuels are blended with kerosene.
	Start construction of the second series of 2G plants including algal biofuels and pyrolytic oils from residues.	Operational by 2020.

Long-term (up to 2020)	Supply of an additional 0.8 M tons of aviation biofuels based on synthetic biofuels, pyrolytic oils and algal biofuels.	2.0 M tons of biofuels are blended with kerosene.
	Further supply of biofuels for aviation, biofuels are used in most EU airports.	Commercialisation of aviation biofuels is achieved.

3.3 IMPROVED AIR TRAFFIC MANAGEMENT AND INFRASTRUCTURE USE

The EU's Single European Sky initiative and SESAR

The EU's Single European Sky initiative was originally launched by the European Commission in 1999. Its fundamental aim is to reform the architecture of European air traffic control to meet future capacity and safety needs. Its main principles are to reduce fragmentation in European air traffic management, between states, between civil and military, and between systems; to introduce new technology; and to establish a new regulatory framework built on closer synergy between the EU and Eurocontrol.

The first package of EU Single European Sky legislation was adopted by the Council and European Parliament in 2004. This was followed in 2009 by the Single European Sky II package of measures, which comprises five main pillars: performance, safety, technology, airport capacity and the human factor. The aim is to improve the performance of air navigation services by reducing the cost of flights, while improving the capacity and better preserving the environment, all having regard to the overriding safety objectives.

Reducing fragmentation in European air traffic management is expected to result in significant efficiency and environmental improvements. A core starting point is the reduction of the current surplus length of flights in Europe, estimated on average to be almost 50 km. The defragmentation of European airspace with new possibilities for more direct routing, and efforts to define a true pan European network of routes and to implement flexible use of airspace are expected to result in emission reductions of 2% per year.

SESAR

SESAR (Single European Sky ATM Research) is the technological component of the Single European Sky (SES). It is a €2.1bn Joint Undertaking, funded equally by the EU, Eurocontrol and industry (€700m EU, €700m Eurocontrol, €700m industry). Fifteen companies are members of the

SESAR JU: AENA, Airbus, Alenia Aeronautica, the DFS, the DSNA, ENAV, Frequentis, Honeywell, INDRA, NATMIG, NATS (En Route) Limited, NORACON, SEAC, SELEX Sistemi Integrati and Thales. The SESAR SJU includes an additional thirteen associate partners including non-European companies with different profiles and expertise.

SESAR aims to help create a "paradigm shift" by putting performance-based operations at the core of air traffic management's objectives, and will be supported by state-of-the-art and innovative technology capable of ensuring the safety, sustainability and fluidity of air transport worldwide over the next 30 years. It is composed of three phases:

- The Definition phase (2004-2008) delivered the ATM master plan defining the content, the development and deployment plans of the next generation of ATM systems. This definition phase was led by Eurocontrol, and co-funded by the European Commission under the Trans European Network-Transport programme and executed by a large consortium of all air transport stakeholders.
- The Development phase (2008-2013) will produce the required new generation of technological systems, components and operational procedures as defined in the SESAR ATM Master Plan and Work Programme.
- The Deployment phase (2014-2020) will see the large scale production and implementation of the new air traffic management infrastructure, composed of fully harmonised and interoperable components guaranteeing high performance air transport activities in Europe.

Implementation of SESAR in general will facilitate the following:

- Moving from airspace to trajectory based operations, so that each aircraft achieves its agreed route and time of arrival and air and ground systems share a common system view.
- Collaborative planning so that all parties involved in flight management from departure gate to arrival gate can strategically and tactically plan their business activities based on the performance the system will deliver.
- An information rich ATM environment where partners share information through system wide information management.
- A globally agreed 4D trajectory definition and exchange format at the core of the ATM system where time is the 4th dimension providing a synchronised "time" reference for all partners.
- Airspace users and aircraft fully integrated as essential constituents and nodes of the ATM system.
- Dynamic airspace management and integrated co-ordination between civil and military authorities optimising the available airspace.
- Network planning focused on the arrival time as opposed to today's departure based system with Airport airside and turn-around fully integrated into ATM.

- New Communication, Navigation & Surveillance (CNS) technologies providing for more accurate airborne navigation and spacing between aircraft to maximise airspace and airport efficiency, improve communication and surveillance.
- Central role for the human widely supported by automation and advanced tools ensuring safe working without undue pressure.

Within the SESAR programme most of the almost 300 projects include environmental aspects of aviation. They concern aircraft noise management and mitigation, aircraft fuel use and emissions management etc. throughout all of SESAR's 16 work packages. The Joint Undertaking's role is to establish environmental sustainability as an integral aspect of broader ATM development and operating processes.

SESAR aims at reducing the environmental impact per flight by 10% without compromising on safety but with clear capacity and cost efficiency targets in mind. More specifically, in addressing environmental issues, SESAR will:

1. Achieve emission improvements through the optimisation of air traffic management services. The SESAR target for 2020 is to enable 10% fuel savings per flight as a result of ATM improvements alone, leading to a 10% reduction of CO_2 emissions per flight;

2. Improve the management of noise emissions and their impacts through better flight paths, or optimised climb and descent solutions;

3. Improve the role of ATM in enforcing local environmental rules by ensuring that flight operations fully comply with aircraft type restrictions, night movement bans, noise routes, noise quotas, etc.;

4. Improve the role of ATM in developing environmental rules by assessing the ecological impact of ATM constraints, and, following this assessment, adopting the best alternative solutions from a European sustainability perspective.

5. Accompany the development of new procedures and targets with an effective regulatory framework in close cooperation with the European Commission;

6. Implement more effective two-way community relations and communications capabilities at local and regional levels including a commonly agreed environmental strategy and vision.

By 2012 SESAR is expected to deliver fuel burn reductions of approximately 2% (compared with a baseline 2010), to demonstrate environmental benefits on city pairs connecting 8 European airports, and to have airspace users signing up to the SESAR business case (including the environment case) for time-based operations.

<u>Operational improvements: AIRE</u>

The Atlantic Interoperability Initiative to Reduce Emissions (AIRE) is a programme designed to improve energy efficiency and lower engine emissions and aircraft noise in cooperation with the US FAA. The SESAR JU is responsible for its management from a European perspective.

Under this initiative ATM stakeholders work collaboratively to perform integrated flight trials and demonstrations validating solutions for the reduction of CO_2 emissions for surface, terminal and oceanic operations to substantially accelerate the pace of change.

AIRE has demonstrated in 2009, with 1,152 trials performed, that significant savings can be achieved using existing technology. CO_2 savings per flight ranged from 90kg to 1250kg and the accumulated savings during trials were equivalent to 400 tons of CO_2. Another positive aspect is the human dimension - the AIRE projects boost crew and controller motivation to pioneer new ways of working together focusing on environmental aspects, and enabled cooperative decision-making towards a common goal.

The strategy is to produce constant step-based improvements, to be implemented by each partner in order to contribute to reaching the common objective. In 2010 demand for projects has more than doubled and a high transition rate from R&D to day-to-day operations, estimated at 80%, from AIRE 2009 projects was observed (expected to further increase with time). Everyone sees the "AIRE way of working together" as an absolute win-win to implement change before the implementation of more technology intensive ATM advancements expected for the period 2013 onward. A concrete example of the progress achieved is that, due to AIRE, both FAA and NAV Portugal offer lateral optimisation over the transatlantic routes to any user upon request. In July 2010, the SESAR JU launched a new call for tender and had an excellent response - 18 projects were selected involving 40 airlines, airport, air navigation service providers and industry partners. More than 5,000 trials are expected to take place.

3.4 ECONOMIC / MARKET-BASED MEASURES

<u>The EU Emissions Trading System</u>

The EU Emissions Trading System (EU ETS) is a cornerstone of the European Union's policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. Being the first and biggest international scheme for the trading of greenhouse gas emission allowances, the EU ETS currently covers some 11,000 power stations and industrial plants in 30 countries.

Launched in 2005, the EU ETS works on the "cap and trade" principle. This means there is a "cap", or limit, on the total amount of certain greenhouse gases that can be emitted by the factories, power plants and other installations in the system. Within this cap, companies receive emission allowances which they can sell to or buy from one another as needed. The limit on the total number of allowances available provides certainty that the environmental objective is achieved and ensures that the allowances have a market value.

At the end of each year each company must surrender enough allowances to cover all its emissions, otherwise heavy fines are imposed. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or else sell them to another company that is short of allowances. The flexibility that trading brings ensures that emissions are cut where it costs least to do so. The number of allowances is reduced over time so that total emissions fall.

The EU ETS now operates in 30 countries (the 27 EU Member States plus Iceland, Liechtenstein and Norway). It currently covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. Between them, the installations currently in the scheme account for almost half of the EU's CO_2 emissions and 40% of its total greenhouse gas emissions.

The EU ETS will be further expanded to the petrochemicals, ammonia and aluminium industries and to additional gases (PFCs and N_2O) in 2013, when the third trading period starts. At the same time a series of important changes to the way the EU ETS works will take effect in order to strengthen the system.

The legislation to include aviation in the EU ETS was adopted in November 2008, and entered into force as Directive 2008/101/EC of the European Parliament and of the Council on 2 February 2009. The proposal to include aviation in the EU ETS, made by the European Commission in December 2006, was accompanied by a detailed impact assessment.

Under the EU ETS, the emissions cap is increased to accommodate the inclusion of aviation. This addition to the cap establishes the total quantity of allowances to be allocated to aircraft operators. This quantity is defined as a percentage of historical aviation emissions, which is defined as the mean average of the annual emissions in the calendar years 2004, 2005 and 2006 from aircraft performing an aviation activity falling within the scope of the legislation. In July 2011, it was decided that the historical aviation emissions are set at 221,420,279 tonnes of CO_2.

The additional cap to be added to the EU ETS in 2012, the first year of operation for aviation, will be set at 97% of the historical aviation emissions. For the period from 2013 to 2020 inclusive the additional cap will be set at 95% of the historical aviation emissions.

Aircraft operators flying to and from airports in 30 European states from 2012 will be required to surrender allowances in respect of their CO_2

emissions on an annual basis. The large majority of allowances will be allocated to individual aircraft operators free of charge, based on their respective aviation output (rather than emissions) in 2010, thus rewarding operators that have already invested in cleaner aircraft. In 2012, 85% of the total quantity of the additional allowances (or "cap") will be allocated free of charge according to this benchmarking methodology, while in the 2013-2020 trading period 82% of the additional allowances will be allocated free of charge in this way. In the 2013-2020 trading period, an additional 3% of the total additional allowances for aviation will be set aside for allocation free of charge via the special reserve, to new entrants and fast-growing airlines. The remaining 15% of allowances will be allocated each year by auction.

Aircraft operators that choose to emit more than their free allocation of allowances will be able to source allowances from other participants in the ETS (including those outside the aviation sector), from intermediaries who trade allowances, from Member States via auctions, or they can use specific quantities of international credits from emissions reduction projects in third countries (e.g. CDM credits and ERUs).

The system also includes a de minimis provision under which commercial aircraft operators with a low level of aviation activity in Europe are excluded from its scope. This is likely to mean that many aircraft operators from developing countries will be unaffected by the scheme and, indeed, over 90 ICAO states have no commercial aircraft operators included in the scope of the EU ETS.

The EU legislation foresees that, where a third country takes measures of its own to reduce the climate change impact of flights departing from its airports, the EU will consider options available in order to provide for optimal interaction between the EU scheme and that country's measures. In such a case, flights arriving from the third country could be excluded from the scope of the EU scheme. The EU therefore encourages other countries to adopt measures of their own and is ready to engage in bilateral discussions with any country that has done so.

The legislation also makes it clear that if there is agreement on global measures, the EU shall consider whether amendments to this Directive as it applies to aircraft operators are necessary.

Anticipated change in fuel consumption and/or CO_2 emissions

The environmental outcome of an emissions trading system is pre-determined through the setting of an emissions cap. In the case of the EU ETS, an addition to the overall cap is established for aviation emissions. However, aircraft operators are also able to use allowances allocated to other sectors to cover their emissions. It is therefore possible (indeed highly likely given traffic growth forecasts) that the absolute level of CO_2 emissions from aviation will exceed the number of allowances allocated to aviation. However, any aviation emissions will necessarily be offset by CO_2 emissions reductions elsewhere, either in other sectors within the EU that are subject to the EU ETS, or through emissions reduction projects in third countries. The "net" aviation emissions will however be the same as the number of allowances allocated to aviation under the EU ETS.

In terms of contribution towards the ICAO global goals, the states implementing the EU ETS will together deliver, in "net" terms, a 3% reduction below the 2005 level of aviation CO_2 emissions in 2012, and a 5% reduction below the 2005 level of aviation CO_2 emissions in the period 2013-2020.

Other emissions reduction measures taken, either at supra-national level in Europe or, by any of the 30 individual states implementing the EU ETS, will of course make their own contribution towards the ICAO global goals. Such measures are likely to moderate the anticipated growth in aviation emissions in Europe and therefore reduce the extent to which the absolute level of CO_2 emissions from aviation will exceed the number of allowances allocated to aviation. However, assuming that absolute aviation emissions will nonetheless in future exceed the additional aviation cap, the aggregate contribution towards the global goals is likely to remain that which is determined by the EU ETS cap.

Expected co-benefits

The EU ETS covers both international and domestic aviation and does not distinguish between them. It is not therefore possible to identify how the "net" emissions reductions it delivers are apportioned between international and domestic aviation.

3.5 SUPPORT TO VOLUNTARY ACTIONS: ACI AIRPORT CARBON ACCREDITATION

Airport Carbon Accreditation is a certification programme for carbon management at airports, based on carbon mapping and management standard specifically designed for the airport industry. It was launched in 2009 by ACI EUROPE, the trade association for European airports.

This industry-driven initiative was officially endorsed by Eurocontrol and the European Civil Aviation Conference (ECAC). It is also officially supported by the United Nations Environmental Programme (UNEP). The programme is overseen by an independent Advisory Board. ACI EUROPE is looking at expanding the geographical scope of the programme through the other ACI regions. Discussions are currently under way with ACI Asia Pacific for a possible extension of the programme to the Asia Pacific region.

Airport Carbon Accreditation is a four-step programme, from carbon mapping to carbon neutrality. The four steps of certification are: Level 1 "Mapping", Level 2 "Reduction", Level 3 "Optimisation", and Level 3+ "Carbon Neutrality". One of its essential requirements is the verification by external and independent auditors of the data provided by airports. Aggregated data are included in the *Airport Carbon Accreditation* Annual Report thus ensuring transparent and accurate carbon reporting. At level 2 of the programme and above (Reduction, Optimisation and Carbon Neutrality), airport operators are required to demonstrate CO2 reduction associated with the activities they control.

In June 2011, 2 years after the launch of the programme, 43 airports were accredited, representing 43% of European passenger traffic. ACI/Europe's objective for the end of the 3rd year of the programme's operation is to cover airports representing 50% of European passenger traffic. Programme's implementation is twofold: on top of recruiting new participants, individual airports should progress along the 4 levels of the programme.

Anticipated benefits:

The Administrator of the programme has been collecting CO2 data from participating airports over the past two years. This has allowed the absolute CO2 reduction from the participation in the programme to be quantified.

	2009-2010	2010-2011
Total aggregate scope 1 & 2 reduction (tCO2)	51,657	54,565
Total aggregate scope 3 reduction (tCO2)	359,733	675,124

Variable	**Year 1**		**Year 2**	
	Emissions	**Number of airports**	**Emissions**	**Number of airports**
Aggregate carbon footprint for 'year 0'[7] for emissions under airports' direct control (all airports)	803,050 tonnes CO2	17	2,275,469 tonnes CO2	43
Carbon footprint per passenger	2.6		3.73	

7 'Year 0' refers to the 12 month period for which an individual airport's carbon footprint refers to, which according to the Airport Carbon Accreditation requirements must have been within 12 months of the application date.

	kg CO2		kgCO2	
Aggregate reduction in emissions from sources under airports' direct control (Level 2 and above)[8]	51,657 tonnes CO2	9	51,819 tonnes CO2	19
Carbon footprint reduction per passenger	0.351 kg CO2		0.11 kg CO2	
Total carbon footprint for 'year 0' for emissions sources which an airport may guide or influence (level 3 and above)	2,397,622 tonnes CO2	6	6,643,266 tonnes CO2[9]	13
Aggregate reductions from emissions sources which an airport may guide or influence	359,733 tonnes CO2		675,124 tonnes CO2	
Total emissions offset (Level 3+)	13,129 tonnes CO2	4	85,602 tonnes CO2	8

Its main immediate environmental co-benefit is the improvement of local air quality.

Costs for design, development and implementation of *Airport Carbon Accreditation* have been borne by ACI EUROPE. *Airport Carbon Accreditation* is a non-for-profit initiative, with participation fees set at a level aimed at allowing for the recovery of the aforementioned costs.

The scope of *Airport Carbon Accreditation,* i.e. emissions that an airport operator can control, guide and influence, implies that aircraft emissions in the LTO cycle are also covered. Thus, airlines can benefit from the gains made by more efficient airport operations to see a decrease in their emissions during the LTO cycle. This is coherent with the objectives pursued with the inclusion of aviation in the EU ETS as of 1 January 2012 (Directive 2008/101/EC) and can support the efforts of airlines to reduce these emissions.

4. NATIONAL ACTIONS IN AUSTRIA

National framework with regard to climate change

8 This figure includes increases in emissions at airports that have used a relative emissions benchmark in order to demonstrate a reduction.

Under the burden sharing agreement of the European Union, Austria is committed to a reduction of its greenhouse gases by 13% below 1990 levels by 2008–2012.

The following figure depicts the trend of Austria's GHG emissions and also shows Austria's Kyoto Target for 2008–2012. The figure excludes emission sources and sinks from the sector Land Use, Land Use Change and Forestry (LULUCF) as reported under the UNFCCC.

In 2010 Austria's total greenhouse gas emissions (without LULUCF) amounted to 84.600 Gg CO_2 equivalents. Compared to the base year 1990 emissions increased by 8,2% and compared to 2009, emissions increased by 6,1%. The trend is dominated by the trend of the most important sector – the energy sector.

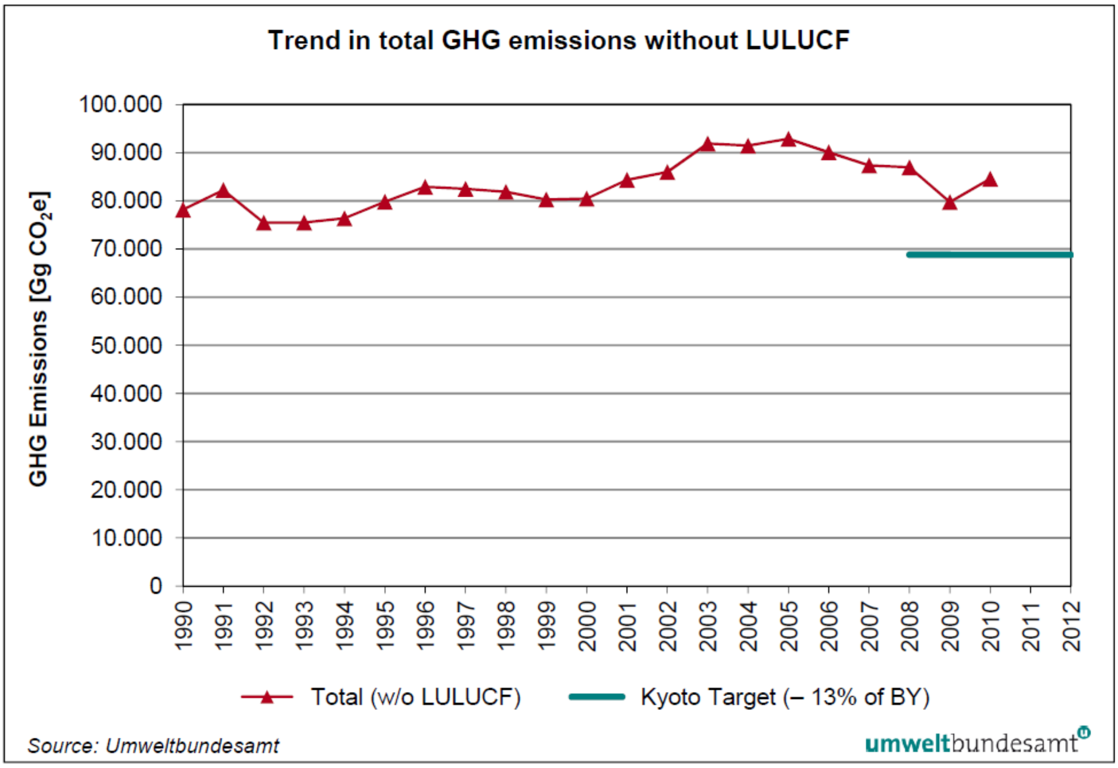

Figure 1: Trend in total GHG emissions 1990–2010 without LULUCF.

Austrian Airlines Group

Domestic short haul flights to the Vienna International Airport, e.g. from Linz or Salzburg to Vienna, that are now operated by Austrian Airlines, will be cancelled as soon as the new Central Station Vienna is operational. This is an example for replacing uneconomical and environmentally harmful flights by fast and comfortable rail connections.

Bio fuel is the most important means to significantly reduce CO2 emissions in aviation. Austrian Airlines Group is willing to use bio fuel when sufficient amounts will be available at competitive prices. At the present the prices of conventional and bio fuel differ by a factor of 3, making a change very unrealistic (about 25% of the total costs of this carrier is fuel costs).

An intense cooperation with airports, especially Vienna International Airport, opens further possibilities to save CO2: optimized taxiing, electro mobility and ground-based infrastructure for aviation are potential sources to reduce CO2 emissions.

Aeronautical Technology in Austria

As a result of the dynamic growth and changes within this sector in recent years, the field of Austrian aeronautics has assumed increasing significance. In 2009, the aeronautics (supplier) industry alone achieved a turnover of 712 million Euros and employed 4042 people. The export quota of the Austrian aeronautics (supplier) industry is nearly 100%. Austrian aeronautics company customers are not only located in Europe (50%); many are also in the USA (24%) and several other countries. In addition to OEM manufacturers such as EADS (Airbus, Eurocopter), Boeing, Embraer and Bombardier Aerospace, and supplier companies such as BAE Systems, Rolls Royce, MTU Aero Engines, General Electric, Pratt&Whitney and Snecma, the list of customers also include airports, airlines and air traffic control facilities.

The Austrian aeronautics (supplier) industry and air transport sector exhibits several areas of expertise in the fields of general aviation, complex aircraft structures and components, innovative materials, production technology, cabin equipment (including infotainment), aircraft electronics/avionics, intelligent aircraft infrastructure, ground testing and other testing equipment, propulsion, air traffic infrastructure and air traffic control applications (ATM and airport technology, air- and landside).

In Austria as well, the air transport sector has undergone marked growth in recent years. The number of passengers in Austria has virtually doubled since 1995 (96%). In 2011, Vienna airport, the largest airport in Austria, recorded 21 million passengers. This corresponds to nearly 80% of the total air traffic in all of Austria. The remainder was divided between the airports in Salzburg (8%), Graz (4%), Innsbruck (4%), Linz (3%) and Klagenfurt (2%).

The European Commission still expects a doubling in air traffic over the next 10 to 15 years; this growth will follow the temporary slump due to the economic and financial crisis. The amount could even grow to three times as much traffic within the next 20 years.

In order to deal with this growth in Europe, central issues have to be confronted. These include the impact on the environment, safety, customer satisfaction, affordability and expansion of air transportation capacity with

Europe-wide harmonized and optimized air traffic management. This requires the application of new technologies and innovative advances in operational methodologies. These are the basis for higher performance, greater environmental compatibility, reduced air traffic noise, the aircraft used, air traffic management systems and airport technologies. Such advances are also in the interest of time and costs saving.

The Austrian Aeronautics Strategy for Research, Technology and Innovation

In order to meet these challenges, in 2008 the Austrian Federal Ministry of Transport, Innovation and Technology has published a national civil aeronautics strategy for research, technology and innovation (RTI aeronautics strategy). This RTI aeronautics strategy has been developed in close collaboration with 30 experts and representatives of the aeronautics (supplier) industry, air transport sector, supporting institutions and ministries. The objective of the process was to strengthen the position of this sector by supporting research, technology and innovation and, for the first time, also consider the air transport sector (airports, airlines and air traffic control).

The results of trend analysis and global changes in aeronautics were analyzed in relation to the Austrian air transport sector and the related challenges, and so-called ″windows of opportunity‶ were identified. These are the areas which could open up opportunities for the civil air transport sector in Austria in the coming years. On this basis, in Vision 2020, the growth chances for the Austrian civil air transport sector have been identified. In parallel the very ambitious goals of the Advisory Council for Aeronautics Research in Europe had been outlined as very important and have been adopted in this Vision 2020. The high level targets concept of the Strategic Research Agenda SRA2 include Reduce perceived noise by 50%, reduce CO_2-emission by 50% and reduce NOx by 80% until 2020.

The factors which could support the already existing and highly competitive companies in this industry by advancing these activities have been outlined. At the same time the inclusion of other companies currently engaged in similar activities, although not directly working in the aeronautics industry, is viewed as generally in the best interest of reaching these goals. The realization of critical masses via the improved consolidation of research institutions and suppliers has also been identified as an essential task. Simultaneously, the research activities and actions of those companies towards the end of the supplier chain should be better integrated in existing primary operations.

The heart of the RTI aeronautics strategy is the identification of six market segments within the Austrian business and research community in which Austria exhibits particular strengths. The goal is to network each of these market segments along the horizontal and vertical value added chain and thus contributes to the development and extension of the air transport sector. The following six market segments have been identified and since then were being supplemented by the market segments basic systems and propulsion.

1. General aviation

2. Complex aircraft structures and components, innovative materials and production technology

3. Cabin equipment (including infotainment)

4. Equipment, aircraft electronics/avionics

5. Intelligent aeronautical infrastructure, ground testing and testing equipment

6. Networked air traffic infrastructure and air traffic control applications (ATM and airport technology, airside and landside)

The RTI aeronautics strategy brochure can be downloaded via the following link: http://www.bmvit.gv.at/innovation/luftfahrt/index.html

The TAKE OFF Program for Research and Technology in Aeronautics

TAKE OFF, the Austrian research and technology program for aeronautics, was started in 2002 by the Federal Ministry of Transport, Innovation and Technology. Its objective is the provision of new stimulus for the Austrian aeronautics (supplier) industry by supporting targeted research and development activities. These are in the interest of improving competitiveness and thus strengthening the industry in terms of international cooperation and improving networking with the existing research institutions.

In the TAKE OFF program, the research activities of companies and research institutions in the area of aeronautics technology are combined according to subjects of particular emphasis which were formulated in advance. By way of annual calls for proposals, project ideas from interested parties are sought in the form of proposals. Within the proposal the applicants have to do a self-assessment according to the ACARE goals. These proposals are then evaluated, selected and monitored by international experts for quality and innovative content, ensuring the high quality of the projects ultimately supported. Following the creation of the RTI aeronautics strategy, the goals and instruments of support for the TAKE OFF technology program were oriented to the goals of this strategy. Important here was, above all, the extension of the program to match the R&D requirements of the Austrian air transport sector, the realignment of the subject areas emphasized with focus on the market segments, an extended portfolio of support instruments, and special consideration for small and medium sized companies. At the same time, other goals are addressing new companies in the aeronautics industry, better targeting in the orientation of research co-operation between industry and research, supporting the expansion of human resources, and the integration of foreign research partners for better international networking as well as enhanced measures to disperse the results among the Austrian research community.

Focal points of TAKE OFF

1) Securing and enhancing the competitiveness of Austrian aeronautics research and the aeronautics industry by targeted networking over the market segments

2) Including the requirements of the air transport sector in research and development topics and therefore strengthening the orientation to the entire research, technology and development relevant aeronautics sector

3) Supporting a safe, efficient, climate protecting and comfort oriented air transport system

4) Educating qualified researchers and technicians and intensification of ambitious co-operative research projects

5) Improving the Europe-wide and international transparency and thus strengthening the external image of Austrian research and development

In order to fulfill the ACARE goals, it is necessary to examine the aircraft engine, aircraft, flight mission, airport and maintenance, repair and overhaul as a single, unified system. Important advances are possible here with e.g. the use of new lightweight materials (use of nickel-based, wrought and titanium-aluminium alloys), the improvement of aerodynamics, the application of new aircraft engine concepts (development of a turbofan, with and without shrouding), the improvement of the configuration, the optimization of the ”all electric aircraft‟ concept, and the improvement of runway times. All of these areas will significantly influence the overall fuel consumption for future generations of aircraft and thus reduce emissions.

Therefore TAKE OFF supports research and development-projects in the defined market segments to reach the ACARE goals. Among the 122 R&D-projects, which have been funded until now, there are a lot of projects with research topics belonging to light-weight materials, efficient engines and optimized air traffic management. With all of those research activities new Austrian aeronautical components and systems are expected, which will reduce more and more CO_2-emissions.

Annex

1. RTK of air operators registered in Austria based on ICAO definitions.

2. CO_2 emissions of Austrian aviation based on IPCC guidelines.

Annex 1

RTK of air operators registered in Austria based on ICAO definitions
(Source : ICAO APER website)

Year	International RTK	Total RTK
2000	2.091.332.000	2.101.932.000
2001	2.043.069.000	2.053.033.000
2002	2.2941.97.000	2.305.929.000
2003	2.321.248.000	2.333.561.000
2004	2.727.779.000	2.740.584.000
2005	2.898.355.000	2.911.108.000
2006	2.984.016.000	2.997.749.000
2007	2.529.588.000	2.543.853.000
2008	2.374.832.000	2.395.979.000
2009	2.351.355.000	2.370.228.000

Annex 2

CO_2 emissions (Gg) of Austrian aviation based on IPCC guidelines
(Source: Umweltbundesamt GmbH - Environment Agency Austria)

Year	Domestic flights	International Flights
1990	32,00	885,97
1991	37,52	
1992	43,04	
1993	48,57	
1994	54,11	
1995	57,61	1.327,42
1996	63,50	
1997	70,50	
1998	77,26	
1999	81,10	
2000	67,24	1.695,58
2001	60,04	1.651,28
2002	62,21	1.540,85
2003	62,57	1.452,97
2004	64,35	1.724,93
2005	66,78	1.959,83
2006	71,77	2.048,88
2007	73,71	2.175,79
2008	70,78	2.181,97
2009	67,49	1.893,40
2010		2.049,55