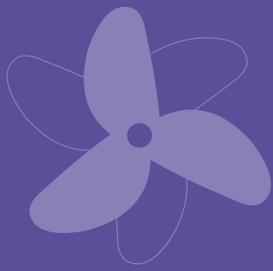


2014 Environmental Report





2014 was yet another year full of initiatives and concrete actions aimed at improving the energy efficiency of air transport and reducing its environmental footprint.

Although the aviation sector only represents approximately 2% of global CO₂ emissions, it must continue to take action to reduce its environmental footprint. Given that the sector is due to increase in the years ahead, does it have any alternative? While the aviation industry's expansion is an opportunity for the French economy, it also imposes a duty to act in terms of the environment.

This is why the DGAC, the French Civil Aviation Authority, supports research into this area as much as possible. Innovation is the main lever for preparing the future of a sustainable air transport industry.

In 2014, the Civil Aviation Research Council (CORAC) pursued its virtuous cycle towards aeronautical research by proposing new projects devoted to aircraft configurations, onboard systems and advanced functions as well as to the aeronautics industry of the future. Direct support was also given to industry projects, in particular those relating to the new generations of turboprops that consume less fuel and therefore emit less greenhouse gas.

It should also be noted that, in the medium term, air transport does not have any credible alternative to liquid fuel combustion as a source of energy for aircraft propulsion. Biofuels are therefore an additional means

of reducing aviation's carbon footprint. The DGAC has already brought together a great number of players on the subject of future aviation fuels. A promising initiative - "Lab'line for the future" - was launched in 2014 by Air France: by undertaking weekly flights between Toulouse/Orly that run partly on biofuel, the industry will gain tremendous feedback on the subject.

The light aircraft industry is not lacking in terms of innovation. Supported by the DGAC and developed by Airbus, the E-Fan, an electric propulsion aircraft, underwent initial tests in March 2014. This twin-seater is a digest of technological innovations and will fulfil the need to provide pilots with initial training, without disturbing local residents and without emitting any pollution.

Finally, the DGAC has pursued its involvement in the ICAO's efforts to introduce a global system of regulation of the international aviation industry's CO₂ emissions. These efforts will become apparent in the context of the global event that is 2015 Paris Climate Conference (COP21), which will take place at Le Bourget in December 2015.

Our industry will therefore need to address major challenges in the next few years if it wants to continue to develop in a way that is environmentally friendly. We should be confident that the industry will, yet again, demonstrate its great ability to adapt for the benefit of all.

Patrick Gandil,
directeur général de l'Aviation civile

table Environmental Report 2014



THE KEY EVENTS OF 2014 04

chapter 01 **INTERNATIONAL ACTIONS**

The ICAO sees the future of aviation in green	07
The CAEP - rally for a better sky	08
Towards a global system of regulation	08
FABEC flies greener	09

chapter 02 **PREVENTING POLLUTION**

Taking greater action against air pollution	11
Noise pollution: forecast, certify and control	13
CALIPSO spreads its wings	15

chapter 03 **REDUCING THE IMPACT OF POLLUTION**

Pulling out all the stops	17
Let's be smart about navigation	19
Protecting the local environment	21
Preserving air quality	23

chapter 04 **PREPARING THE FUTURE**

CORAC at the forefront	25
Essential support to the industry	26
The search for green fuel	27
Forward thrust in European research	29

Glossary 30

THE KEY EVENTS OF 2014



A year devoted to the environment

Two major events marked 2014 in terms of the environment: the Environmental Conference and the bill on energy transition towards green growth. These were significant occasions for an aviation sector heavily involved in the fight against environmental pollution.



Achieving environmental excellence

Launched five years after the multi-party talks in France known as the Grenelle de l'environnement, the Environmental Conference helped instigate ambitious projects geared towards France's ecological transition.

The third session of this conference, which was held on the 27 and 28 November 2014 in Paris, centred on three issues: nationwide awareness and support for the 2015 Climate Change Conference in Paris (COP 21), transport and sustainable mobility, environment and health.

The 2015 ecological transition roadmap adopted by the French Government in February 2015 consists of 74 measures grouped into 22 objectives, whose implementation will be regularly monitored during the course of 2015. Two measures relate specifically to aviation. The first is designed to support research and innovation efforts in the field of aircraft construction and the second relates to the development in the use of sustainable aeronautical biofuels.



Preparing the energy transition

The bill on energy transition towards green growth aims at formulating a policy for the future of France's energy up to 2030 and even 2050 and implement the means to achieve it. In order to establish this new French energy model, the bill includes five principle objectives :

- reduce the emission of greenhouse gases by 40%,
- reduce France's consumption of fossil fuels by 30%,
- limit nuclear's share of energy production to 50%,
- increase the share of renewable energy in France's final energy consumption to 32%,
- and, lastly, to halve France's final energy consumption.

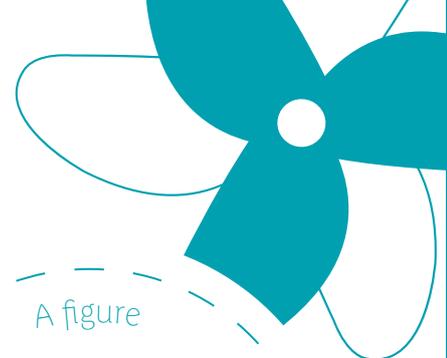
Air transport contributes to these objectives in several ways. Legislation requires the main airport operators to define an action program to reduce greenhouse gas emissions and air pollutants linked to the aviation industry's activities. It also confirms public policy support for aeronautical research towards the reduction in energy consumption, and in the emission of carbon dioxide and air pollutants.

2015 will also be marked by a global event: the 2015 Paris Climate conference. The challenge is huge: to obtain a new, ambitious and legally binding agreement on climate that applies to all countries, in order to respond to the urgent need to reduce greenhouse gas emissions. The conference will rest on an international agreement, national contributions, a financial chapter devoted to the most vulnerable countries and concrete initiatives from non-state stakeholders. The aviation sector will be part of this drive towards achieving an historic agreement on climate.

INTERNATIONAL ACTIONS

Air transport is the first major sector to become involved in a global regulatory system designed to reduce CO₂ emissions. In 2014, works aimed at putting in place a global mechanism of market-based measures were undertaken. France participated in these works and in the drafting of standards intended to limit aviation noise and gas emissions.





A figure

The volume of worldwide air traffic has doubled every 15 years since 1977.

(Source: Global air navigation plan 2013-2028 ICAO)

The ICAO sees the future of aviation in green

During its 38th Assembly session, the ICAO confirmed its commitment towards a more environmentally friendly aviation. In terms of fighting climate change, the ICAO set itself the goal of stabilising CO₂ emissions produced by international aviation from 2020. However, experts believe that the actions that are already in place to renew fleets, develop low fuel consumption technologies and improve air navigation procedures will not, by themselves, be able to meet this ambitious target of carbon-neutral growth. The 38th Assembly therefore decided to formulate, between now and 2016, a global mechanism of market-based measures (Global MBM) for international aviation. This mechanism is due to come into force in 2020. France participated in the Environmental Advisory Group, which was established in order to develop the Global MBM and try to reach an agreement during the next ICAO assembly session in October 2016.

The ICAO also undertook works designed to reduce aviation noise pollution. In March 2014, it adopted a new "Chapter 14" acoustic standard which lowers the current noise level of Chapter 4 aircraft by 7 decibels. This standard will apply to new types of aircraft presented for certification from 31 December 2017, or, for aircraft of less than 55 tonnes, from 31 December 2020. This standard will apply to the acoustic certification of tilt-rotor aircraft⁽¹⁾ from 1st January 2015. In 2014, experts from the French Civil Aviation Authority (the DGAC) participated in the works embarked upon by the ICAO to develop a standard designed to limit the noise produced by future supersonic aircraft.

COMBINING MEASURES IN ORDER TO REDUCE CO₂ EMISSIONS

Air transport accounts for approximately 2% of global CO₂ emissions. According to estimates by the Committee on Aviation Environmental Protection (CAEP), the volume of aviation emissions will be 4 to 6 times greater between now and 2050 than 2010 levels. To help achieve the targets set by the IPCC⁽¹⁾ in order to prevent an average increase in the global temperature of more than 2°C, the ICAO advocates a "global approach", combining technological and operational improvements and a wide raft of economic measures, such as MBMs.

(1) Intergovernmental panel on climate change
(Source ICAO – Doc. 38th Assembly)

AVIATION EMISSIONS TO EACH THEIR TASK

The 1997 Kyoto protocol distinguishes between domestic and international air traffic. Article 2.2 states that measures intended to limit emissions produced by domestic flights are a matter of national competence while emission reduction policies related to international flights must be defined by the ICAO.

(1) Tilt-rotor aircraft combine the vertical take-off features of a helicopter and the cruising speed of a fixed-wing aircraft.

STANDARDS ON CO₂ AND PARTICLES: A LITTLE PATIENCE IS REQUIRED

Very early on, as problems of local air quality came to be recognised from the end of the 1970s, the ICAO introduced standards aimed at limiting emissions of pollutants such as nitrogen oxide (NO_x), carbon monoxide (CO) and hydrocarbons (HC). As concerns over climate change and the consequences of particle emissions are more recent, however, greenhouse gas emissions are not yet regulated and particle emissions are only very partially so.

The CAEP - rally for a better sky

The CAEP is an ICAO committee of 23 Member States. It assists the ICAO Council in formulating new environmental policies and developing new standards relating to aircraft noise and gas emissions. Twelve experts from the IPCC participate in the CAEP's works. The work cycle currently extends over a period from 2013 to 2016 and the main objective is to define emissions standards. These standards relate to the certification of aircraft engines – one for CO₂ emissions and the other to limit particle emissions. The DGAC is involved in formulating these standards, which contain environmental and industrial issues. It runs the group responsible for economic forecasts and analyses and participates in the works relating to the certification of turbo-reactors in terms of particle emissions.

Alongside this regulatory component, the DGAC participates in the CAEP works designed to develop good practice guides for airport operators. The manual on airport air quality was added to the CAEP's roadmap at the DGAC's request.

The DGAC experts also take part in the works relating to the development of sustainable alternative fuels. In order to promote the development and distribution of alternative fuels, the ICAO maintains an online platform presenting the major advances in this field.

SPOTLIGHT

*There are four sources of aircraft emissions:
Main and auxiliary engines emit gas and particles.
Tyres and brakes only emit particles.*



A figure

12 million

the number of tonnes of carbon emissions saved by the global aviation industry in 2012.

(Source: IATA Annual Report 2013)

Towards a global system of regulation

The DGAC takes an active part in the work of the ICAO in putting in place a global mechanism for limiting aviation's CO₂ emissions. The success of a global climate agreement during the United Nations Climate Change Conference (COP21) to be held at the end of 2015 in Paris would be an encouraging sign for achieving a Global MBM agreement in 2016. Air transport is currently the only sector in the industry to have become involved in the establishment of a global regulatory system of this sort for reducing greenhouse gas emissions.

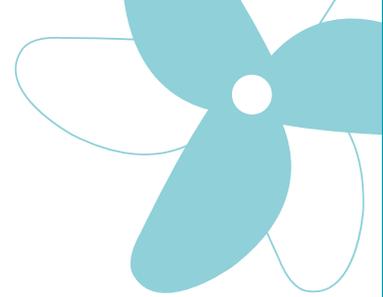
The European mechanism for trading greenhouse gas emission credits (EU-ETS) remains in force. However, since 2013 and until 2016, its scope will be limited to flights between two European airports. This regulatory development, which arose against a backdrop of strong opposition from certain countries to the EU ETS system, must give the ICAO sufficient time to reach an agreement on the adoption of a global MBM mechanism in 2016. There are ongoing discussions as to how to achieve a fair balance between the principle of non-discrimination and the wish of emerging countries for their level of development to be taken into consideration and some form of differentiation to be made accordingly. The aim of this global system is to achieve carbon neutral growth in 2020.



ECONOMIC MEASURES STRIKING A BALANCE BETWEEN EFFICIENCY AND EQUITY

Market based measures form one of the four pillars of the global strategy to reduce aviation emissions, alongside technologies, infrastructures and operational measures. A first draft of what could become a global MBM system has been drawn up by the ICAO. It provides for:

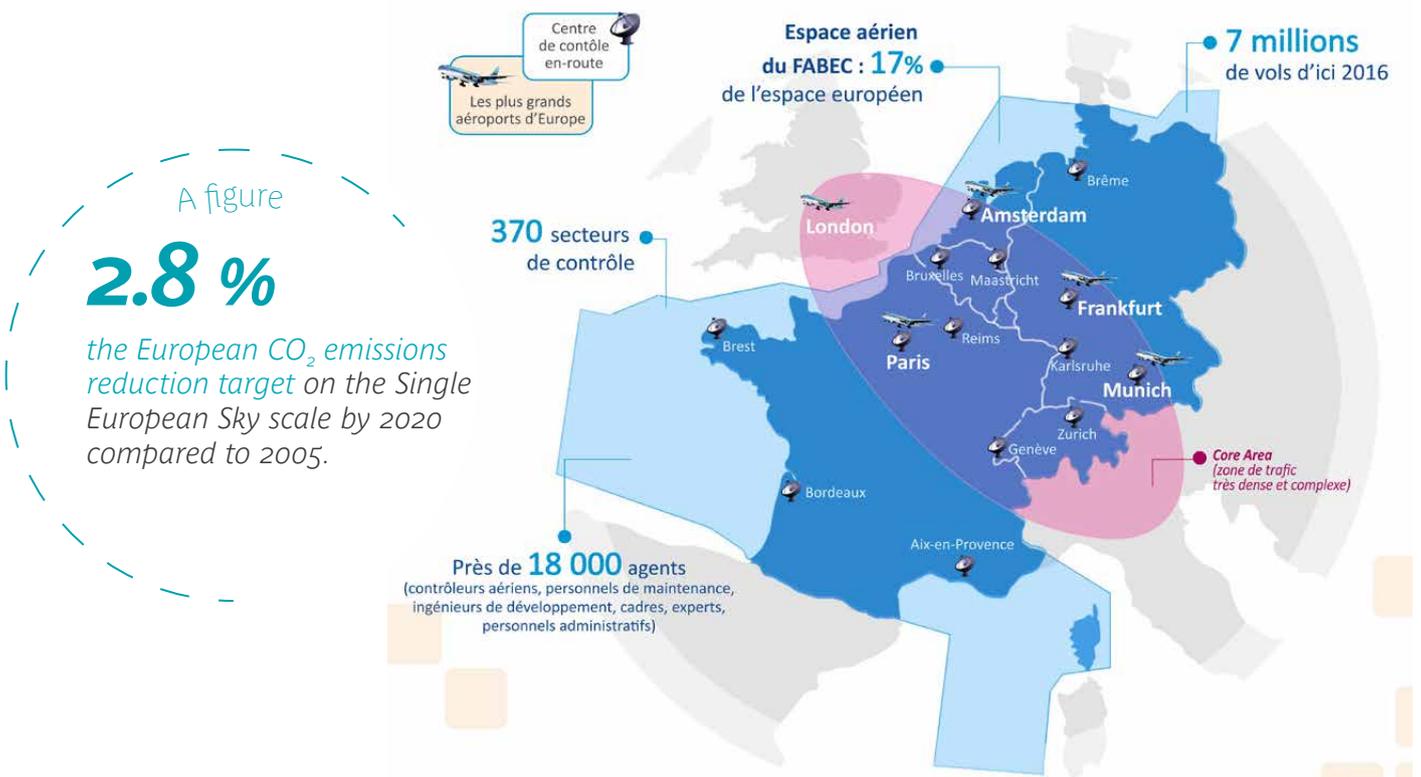
- A target of carbon neutral growth from 2020;
- Greenhouse gas emissions compensation that does not generate revenue;
- Limiting the application to aircraft operators that emit more than 10,000 tonnes of CO₂ per year.



FABEC flies greener

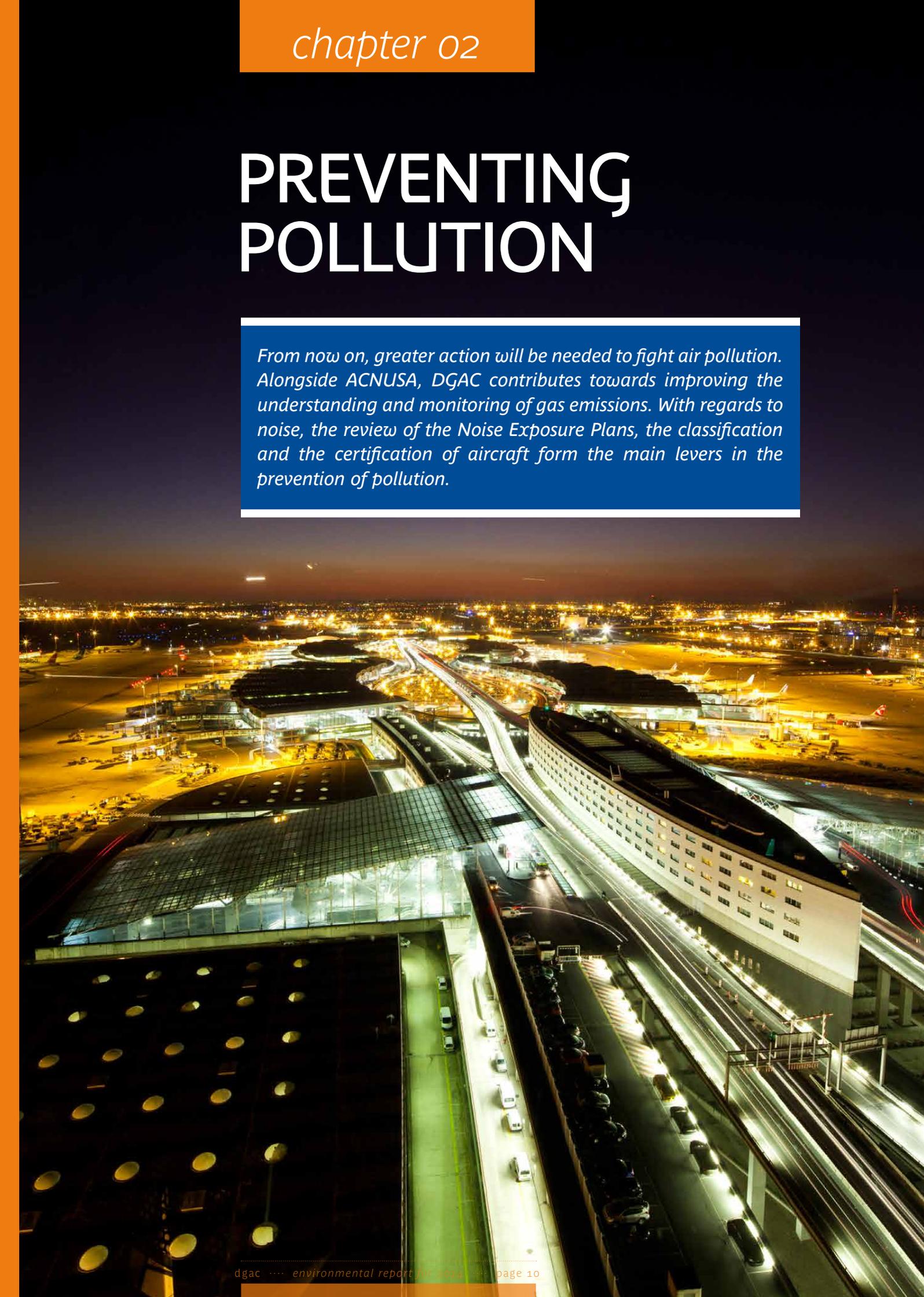
As part of the establishment of the FABEC (functional airspace block – European Central), the DGAC and its five European partners undertook to reduce the average difference between the most direct air route and the route actually taken by 5% by the end of 2014. The decrease of almost 12% observed at the end of 2014 shows that this target has been widely exceeded. This result represents a reduction in the distance travelled of approximately 15 million kilometres. In accordance with the commitments of the seven air navigation service providers of the FABEC⁽¹⁾, the main airports of this functional airspace block have implemented continuous descent approach procedures. In 2014, five additional airports (Hamburg, Düsseldorf, Nuremberg, Stuttgart and Brussels) put in place procedures to reduce fuel consumption and environmental pollution during the approach phase.

(1) The air navigation service providers of each State and MUAC, the Maastricht Control Centre



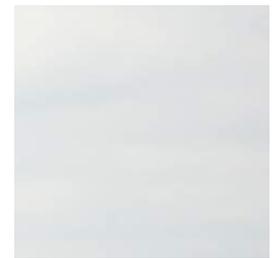
PREVENTING POLLUTION

From now on, greater action will be needed to fight air pollution. Alongside ACNUSA, DGAC contributes towards improving the understanding and monitoring of gas emissions. With regards to noise, the review of the Noise Exposure Plans, the classification and the certification of aircraft form the main levers in the prevention of pollution.





Taking greater action against air pollution



The consequences of emissions from aircraft engines on local air quality have been an increasing cause for concern among those living near airports. Despite the progress made towards controlling gas emissions related to air transport, there was an increase in these emissions between 1990 and 2012 due to the heavy increase in air traffic. The extension, in 2020, of the jurisdiction of the Airport Nuisance Control Authority (ACNUSA) to cover air pollution should improve understanding in term of local air pollution and strengthen the fight on this issue. A scientific and technical working group on airport activities and the control of air quality has been set up to improve awareness in this field. This working group, which

includes DGAC, air quality associations, Paris Airports, the Union of French Airports, the Directorate General for Energy and Climate (DGEC), Air France and ONERA (the French aerospace research agency), met during the course of 2014. The main areas of work were identified as:

- Defining air pollution index indicators and improving the information provided on airport internet sites in relation to air quality;
- Recommending measures for monitoring air quality at and around airports;
- Establishing a common methodology for calculating emissions at source.

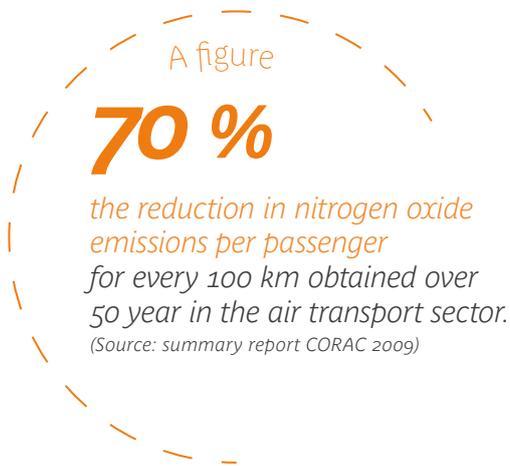
Improving our understanding of air pollution at airports will strengthen the fight against it



VARIOUS LOCAL SOURCES OF EMISSIONS

The contribution by aviation activity to air pollution around airports has several origins: the Landing and Take-Off (LTO) cycle of aircraft (whose phases include approach, landing, ground circulation, take off and ascent to 3,000 feet (950 m) and the other activities in the industry (maintenance, ground handling, energy production, and so on) as well as road traffic related to the airport. The main gas emissions to affect local air quality are nitrogen oxide (NO_x), carbon monoxide (CO), particles, unburned hydrocarbons (HC), volatile organic compounds (VOCs) and sulfur dioxide.

Paris-Charles de Gaulle Airport



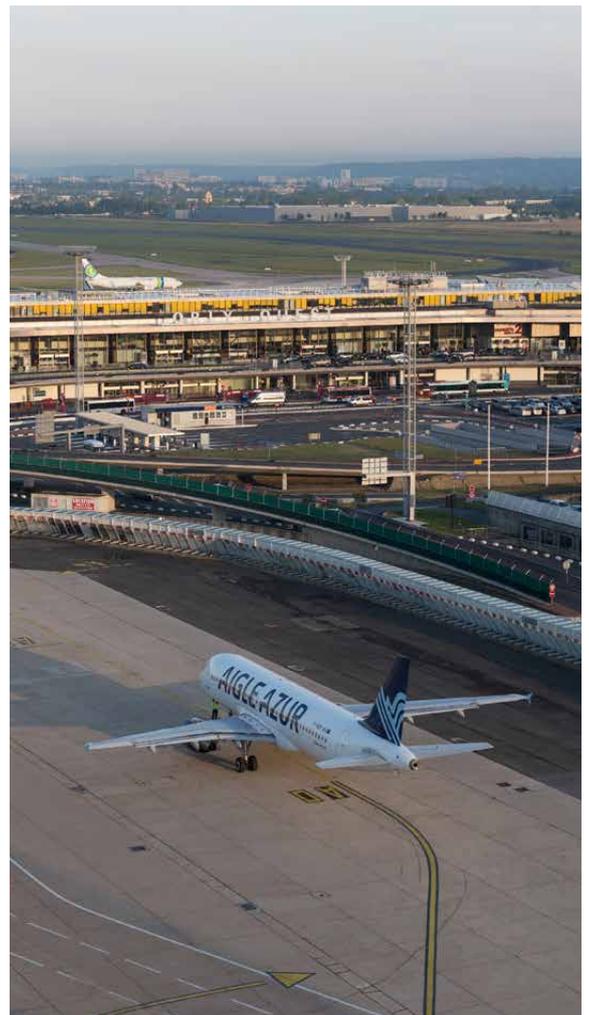
SPOTLIGHT

GAS EMISSIONS: CONTRASTING RESULTS OF PARIS AIRPORTS

Between 1990 and 2012, the annual emissions of NO_x linked to the LTO cycle at the Paris-Charles de Gaulle airport more than doubled (from 1997 to 4095 tonnes) and particle emissions have increased by approximately 80% (from 74 to 133 tonnes).

However, a downward trend can be observed at the Paris-Orly airport, with a decrease in NO_x emissions of almost 20% (from 1432 tonnes to 1154 tonnes) and a decrease in particle emissions of more than 14% (from 51 tonnes to 44 tonnes) over the same period. The reduction is due to a significant improvement in energy efficiency as well as a moderate increase in traffic at the airport

(Source: Gas emissions linked to air traffic in France in 2012 – Key figures – Air Transport Directorate)



Paris-Orly Airport

Noise pollution, forecast, certify and control



Take-off above Nice

CONTROL OF URBANISATION AROUND AIRPORTS

The Noise Exposure Plans (NEP) currently relate to approximately 215 aerodromes. These plans are being updated all around the country. In 2014, the adoption of the NEP by the Paris-Le Bourget airport took place in consultation with the relevant municipalities and inter-municipality cooperation agencies. The NEP for Europe's principal business airport is due to be adopted at the beginning of 2016 at the latest.

The NEPs for Bastia-Poretta, Vannes, Dieppe-Saint-Aubin, Alençon, Saint-Yan, Lyon-Corbas, Montélimar-Ancône and Nogaro were approved in 2014.

The NEP is a town planning document that limits or prohibits building construction in order to prevent the exposure of new populations to aircraft noise pollution. It forecasts the development of aviation activity, the extension of infrastructures and the change in aviation procedures over the next 15 to 20 years. It includes a report and a map indicating the different zones according to their level of exposure to noise (zones A and B - loud or very loud noise, zone C - moderate noise and a zone D, low noise).

THE ACOUSTIC CERTIFICATION OF AIRCRAFTS

Before they are put into operation, commercial aircraft must be subject to acoustic certification measures that comply with ICAO standards. The acoustic certification guarantees that an aircraft will not exceed a set maximum noise level. The "Chapter 4" standard, which is currently in force, relates to public transport aircraft that have been certified since January 2006.

In 2014, the DGAC certified the Airbus A 400 M, on behalf of the European Aviation Safety Agency (ESA). In the light aviation sector, the DGAC also certified changes made to the TBM 700 and TBM 900 business aircraft.

Released online and developed by the DGAC under the aegis of the ICAO, the NoisedB database has become an international reference. A comprehensive source of information, and precise and easy to use, NoisedB lists the certified noise levels of more than 11,000 public transport aircraft. In 2014, NoisedB acquired fresh data on more than 200 aircrafts.



Airbus A 400 M

THREE LEVELS OF MEASURED NOISE

The acoustic certification of aircraft is carried out by measuring three levels of noise, corresponding to approach, full power take off and flyover. These noise levels are expressed in EPNdB (Effective Perceived Noise Decibel), the unit that expresses the actual level of perceived noise.



Night-time runway at Paris-Charles de Gaulle Airport



DEBATES ON THE NOISE PRODUCED BY NIGHT FLIGHTS AT PARIS-CHARLES DE GAULLE

The noise pollution generated by night flights over Paris-Charles de Gaulle, the second largest airport in Europe, is a major cause for concern for local residents. During the Environmental Consultation Committee's (ECC) meeting of 21 January 2014, the préfet of the Ile-de-France region decided to establish a working group to identify actions to reduce noise impact of these night flights. This group, of which the DGAC is secretary, met for the first time in July 2014. Six issues emerged from the meeting: optimising take-offs, maintaining the runways, optimising flights at the start and end of the night, optimising landing trajectories, alternating the use of twin runways and optimising the information given local residents on the treatment of noise nuisance. The results of the work are expected by summer 2015.

All the measures that have already been introduced (in particular, the cap on time slots in the middle of the night) have enabled the proportion of night flights between 10pm and 6am to be maintained. Since 2000, it has represented between 11% and 12 % of the total number of flights at Paris-Charles de Gaulle.



NOISE ENERGY STILL FALLING PARIS-CHARLES DE GAULLE

The Weighted Measured Noise Index (IGMP) has been assessing the change in noise energy at Paris-Charles de Gaulle airport for the past 12 years. The Index is calculated from noise measurements taken by a network of eight stations placed in line with the airport's runways, and measures the noise energy produced by take-offs and landings over one year. The Index must not exceed the value 100. The DGAC is responsible for monitoring this regulatory index and, in July 2014, it presented the value for 2013. At 76.9, it represented a fall from the previous year (79.8 in 2012) – the lowest level observed at the airport.



Installation of a sound level meter

MEASURING NOISE

The 12 main French airports have a duty to put in place approved aircraft noise monitoring systems. These systems are currently specific to each airport. In 2014, in order to meet ACNUSA's request for standardised monitoring, the DGAC developed a method for assessing noise and aircraft trajectory monitoring devices. This method covers a broad area, from the processing of data on trajectories to the acquisition or processing of acoustic and weather data. This process is currently being tested at Nice-Côte d'Azur airport.

The DGAC has also updated the guide on producing noise maps around civilian and military airports. The aim of this guide is to describe a common methodology in order to standardise practices in the field. It is intended to be used not just by modelers tasked with producing noise maps but by the various players for whom this mapping would present an interest, such as State services, local government, ACNUSA, ECC and even local residents and airport operators. The guide received a positive opinion from ACNUSA in January 2014.

DATA ON TRAFFIC...

The DGAC has developed various tools to keep the public informed as to the state of air traffic in the Ile-de-France region. The Ministry of Ecology, Sustainable Development and Energy's website⁽¹⁾ shows a typical air traffic day for each of the three main Ile-de-France airports. In 2014, the DGAC also introduced VOLANS software in the environmental and sustainable development centres of Paris-Orly and Paris-Charles de Gaulle airports. This software provides a 3D visualisation of the flow of aircraft leaving and arriving at the three main airports of Ile-de-France. The DGAC also distributes a quarterly information bulletin on air traffic. It shows the ILS altitude intercepts actually followed at the three main Ile-de-France airports and the monthly rates of continuous descent approaches at Paris-Charles de Gaulle and Paris-Orly.

(1) <http://www.developpement-durable.gouv.fr/Journees-caracteristiques-traffic.html>

... AND ON AIRCRAFT NOISE

Developed by the DGAC and intended for use by the public at large, VisioBruit is an educational tool that describes the basic concept of acoustics and provides information on methods of measuring aircraft noise. Set up in the environmental centres, VisioBruit also compares different sounds that have the same amount of power as that produced by a passing aircraft.

CALIPSO spreads its wings

CALIPSO (Classification of light aircraft according to their sound performance index), is an innovative noise classification method for light aircraft, which came into operation in 2013. Developed by the DGAC, this tool uses an acoustic performance index with, as reference, the maximum noise level of conversation. This specific approach is based on an understanding of exposure to noise, rather than on the number of decibels emitted. It demonstrates the noise produced by an aircraft in real flight, in particular during airfield traffic circuits. Thanks to the objective data on the perceived noise that is supplied to the public, CALIPSO constitutes a tool for dialogue between users of light aircraft and local residents, and an aid in the choice of aircraft when renewing fleets. The database currently holds information on a hundred or so referent aircraft, enabling the classification of almost 2/3 of the light aircraft fleet registered in France.

During its first meeting in October 2014, CALIPSO's monitoring committee stressed the need to continue using this tool when classifying 350 referent aircraft. It also recommends applying CALIPSO to a test airfield. The public may find out more about the classified aircraft on the Ministry for Ecology, Sustainable Development and Energy website (<http://www.developpement-durable.gouv.fr/>).

A figure

31,721

the number of light aircraft in France in 2012. France ranks 3rd in the world for the number of light aircraft, behind the USA and Canada.

(Source: General Aviation Manufacturers Association)

SPOTLIGHT

AIRFIELD TRAFFIC CIRCUITS ARE VERY LOUD

The airport traffic circuit is the main source of nuisance for local residents. A study carried out by the DGAC in 2004 demonstrated that more than 40% of registered complaints over noise nuisance at the public airfields of France related to airport traffic circuits.

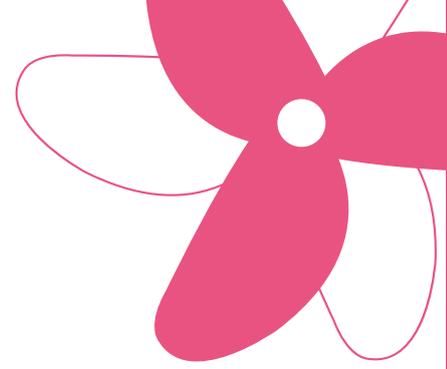


Nantes-Atlantique Airport

REDUCING THE IMPACT OF POLLUTION



The protection of local residents and prevention against aircraft pollution are among the main concerns of the DGAC, which led a number of actions in 2014 for that purpose. New more environmentally-friendly air navigation procedures have been introduced at several airports. The civil aviation's action plan in cases of prolonged pollution was launched for the first time in the regions of Ile-de-France and Rhône-Alpes.



Pulling out all the stops



AIRPORT OPERATIONS IN BOX

The implementation of restrictions on operations at some airports forms one of the four levers of the ICAO's "balanced approach" principle, aiming at examining solutions for limiting noise pollution at airports. Operational restrictions should only be approved after all other measures, such as noise reduction at source, land use planning and management, and operational noise abatement procedures, have been examined. Restrictions on operations have increased progressively for several years, as is the case at Paris - Charles de Gaulle where, since March 2014, aircraft with a cumulative margin of less than 10 EPNdB have been prohibited between 10pm and 6am. The DGAC is responsible for supervising the proper application of these restrictive measures and notifying failures to ACNUSA. Operators in breach of these measures

face fines of up to €20,000. This amount was raised on 1st January 2014 to €40,000 for certain breaches, such as non-compliance with night-time restrictions or failures related to aircraft noise performance.

SPOTLIGHT

CONTROLLING COMPLIANCE WITH REGULATIONS

In the regions of Ile-de-France and Picardie five airports and one heliport, among the largest in terms of traffic and pollution, are currently subject to environmental restriction orders to reduce operational noise nuisance.

In 2014, the DGAC sent 252 infringement statement concerning these airports (Paris-CDG, Paris-Orly, Paris-Le Bourget, Beauvais-Tillé, Toussus-Le-Noble and Issy-les-Moulineaux). 133 of them related to non-adherence to time-slot allocations at night, 96 were due to failure related to aircraft noise performance and 19 to non-compliance with "low-noise" flight paths.

A SIGNIFICANT REDUCTION IN NOISE AT SOURCE

Technological progress has enabled aircraft noise at source to be reduced. In 1972, the area exposed to a high level of noise (85dB) on take-off of a B 747 100 was approximately 30 km². In 1988, the area exposed to noise of 85 dB on take-off of a B747 400 was no more than 7.4 km². And, in 2008, the area exposed to this level of noise on take-off of an A 380 was 4 km².

(Source: Air France sustainable development)

IMPROVING NOISE MANAGEMENT THROUGH NOISE MAPPING

The European directive of 25th June 2002 made it compulsory to produce noise maps and environmental noise prevention plans (ENPP, or *PPBE* in French) in order to put in place environmental noise assessment and management actions, particularly around large airports (more than de 50,000 flights per year).

The ENPP rely on strategic noise maps as a diagnostic tool. The production of ENPP using this mapping continued in 2014, when the Paris CDG and Paris-Le Bourget ENPP projects were signed in anticipation of approval by the *préfets* in 2015. The mapping of nine major French airports is published on the Ministry of Ecology, Sustainable Development and Energy's website (<http://www.developpement-durable.gouv.fr/>).

ASSISTING LIGHT AIRCRAFT

The DGAC is working towards the proper integration of light aircraft within its environment. Its interregional services assist dialogue between users and local residents in order to find solutions that limit the environmental impact of light aircraft on the 500-odd airfields used by light aircraft (restricting flights by introducing periods of quiet and by modifying and limiting airfield traffic circuits, and so on).

The DGAC also provides financial assistance to aeroclubs that take steps to reduce noise at source. In 2014, €127,000 was paid in subsidies to 84 aeroclubs, a net increase on the previous year (€90,000). The subsidies were used to install 21 exhaust silencers, 2 quieter propellers, and 3 winches for gliders.



A figure

1,580,860

the number of flight hours spent on activities involving light aircraft in 2014.



Improving air navigation procedures is one of the levers in reducing pollution linked to air traffic.

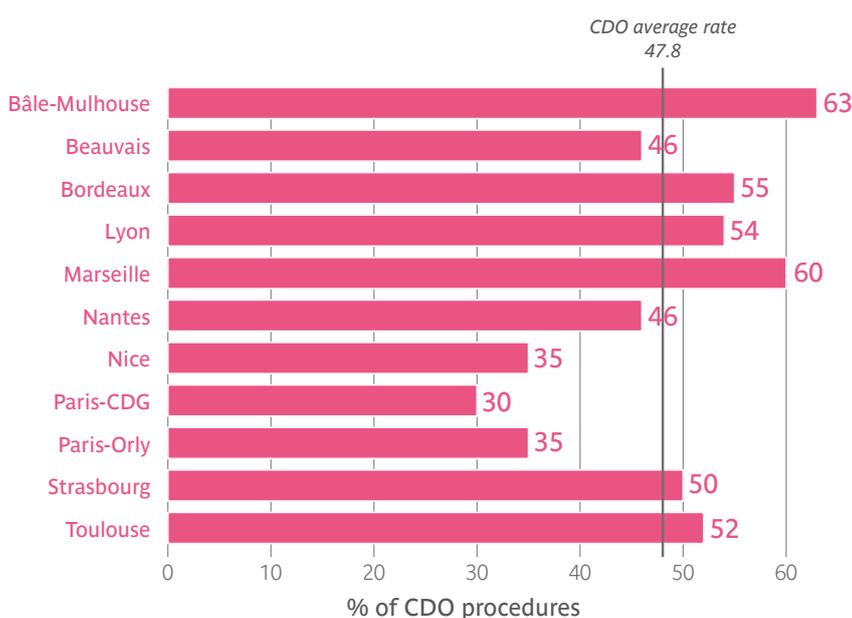
Let's be smart about navigation

GREENER APPROACH PROCEDURES

Implemented by the Air traffic control centre - North (CRNA/Nord), the "Point Merge" procedure is a method used to improve safety and reduce the environmental impact of arriving aircraft in these terminal control sectors, during periods of high traffic. This new control procedure for flights to Paris-CDG from the North-West involves aircraft flying in an arc around a convergence point known as the "Point Merge". The air controller then sequences their flights ahead of their passage through, at the appropriate time, the convergence point. The Point Merge technique, which applies to the approach and landing phases at Paris-Orly, is currently being assessed as part of a SESAR European research program. In addition to the expected benefits in terms of safety, the future implementation of Point Merge should lead to a reduction in fuel consumption and in the noise heard by those beneath the flight paths.

The plan for the publication, by the DGAC, of continuous descent approach procedures at main French airports is being finalised. The decrease in stacks during these procedures will avoid variations

in engine speed and limit environmental pollution. The average achievement rate for these procedures varies between 30% at Paris-CDG and 63% for Bâle-Mulhouse airport.



Achievement rate of continuous descent approach procedures (CDO) in 2014

TRAVEL BUT CALCULATE YOUR EMISSIONS

Since the decree related to information about the quantity of CO₂ emitted during a journey came into force on 1st October 2013, using data that is accurate and up to date has been essential. The “ecocalculator” designed by the DGAC tells passengers how much CO₂ has been emitted from their flights. In 2014, this calculator was updated with actual data on fuel consumption.

CO₂ emissions per passenger for a return flight between Paris-Beijing, for example, amount to 1,108 kg. Globally, CO₂ emissions per passenger carried decreased by 32% between 1990 and 2012. Online help for using the ecocalculator, designed for English-speaking web users, was made available in summer 2014.

SPOTLIGHT

FEWER LEVELS LESS CO₂

The DGAC uses continuous descent approach procedures at the main airports of the Hexagone. Thanks to the decrease in the stack phases of flights, the continuous descent technique reduces noise pollution and CO₂ emissions around airports.

An Airbus A 320 which performs an approach using this technique reduces the noise around the airport by 4 to 6 dB and saves 175 kg of kerosene (equivalent to 550 kg of CO₂).



WHAT ARE THE GAS EMISSIONS IN THE VICINITY OF AIRPORTS?

In 2014, the DGAC made available to the public a set of files, which included Bâle-Mulhouse airport for the first time, detailing the gas emissions from aircraft at departure and on arrival at the 13 airports with the greatest number of passengers, for mainland France, updated with data from 2012. In addition to the CO₂ calculation, the files include an assessment of the other types of emissions that contribute to the greenhouse effect (methane, nitrous oxide, and so on) or to the local pollution (NO_x, particles, and so on) over the take-off – landing cycle.

The complete report is available online at: http://www.developpement-durable.gouv.fr/IMG/pdf/Emissions_gazeuses_2012_VF.pdf

MORE DIRECT ROUTES FOR LESS POLLUTION

As part of the SESAR European research program, the DGAC is leading important projects on the optimisation of the air route network, such as the “the Free Route” preferential routes project. This demonstration flights project proposes introducing direct routes, and methods and procedures for a more flexible control of airspace, as well as savings on fuel and reductions in CO₂ emissions. As part of the FABEC – FRA (Free Route Airspace) project, simulations carried out in 2014 at the Eurocontrol Experimental Centre situated in Brétigny-sur-Orge enabled various direct route options to be tested. As a result of these simulations, the first group of direct routes should be opened from 2015.



SPOTLIGHT



BETTER ROUTES FOR THE PLANET

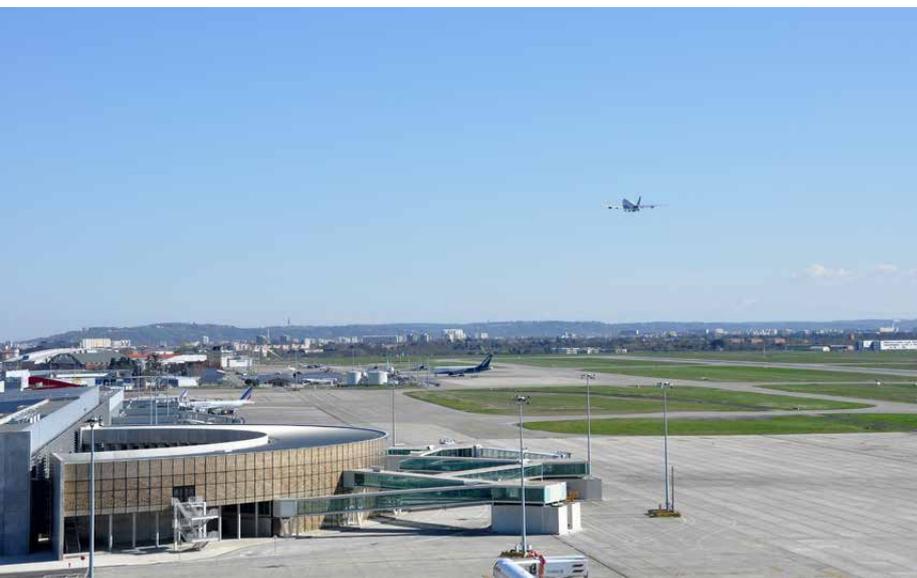
The horizontal efficiency of the network of air routes defined by the DSNA, the French ANSP, is measured in two ways, by comparing the ideal direct routes ("as the crow flies") with:

- the routes selected in flight plans by airline companies,
- the routes actually followed during these flights.

Value obtained in 2014 for the first indicator: 94.07 %

Value obtained in 2014 for the second indicator: 96.79 %

The difference between these two values (2.72 %) represents the efficiency gained in real time in air traffic control. The gain corresponds to approximately 85,000 tonnes of kerosene saved each year, equivalent to more than 260,000 tonnes of CO₂ less in the atmosphere.



Toulouse-Blagnac Airport

ASSESSMENTS MAKE FOR BETTER DECISIONS

Any new or change in flight procedure at a French airport must first be subject to an air traffic impact study (in French, EICA). These studies are carried out by the DSNA, and predict the consequences of a change in air traffic flows on the people beneath the flight path. EICA are presented before an environmental consultative committee (ECC) and the ACNUSA, when the change relates to one of the main principal French airports.

In 2014, impact studies were carried out for Lyon, Marseille, Toulouse, Nantes, Carcassonne, Chambéry, Poitiers and Saint-Etienne airports.

By updating its EICA guide, the DSNA continues to improve the methodologies used in impact studies.

Protecting the local environment

NOISE DISTURBANCE PLANS

The Noise Disturbance Plan (in French, the *PGS*) delineates the zones of noise that residents near an airport are exposed to and the grants that they are eligible for in order to soundproof their home. It forms the remedial element of the French system to mitigate noise exposure. Currently, the residents living near the 12 principal airports⁽¹⁾ are entitled to benefit from these soundproofing grants, which are funded by taxes on air transport noise pollution (in French, *TNSA*)⁽²⁾. The *PGS*s for Bâle-Mulhouse and Toulouse-Blagnac were revised in 2014.

(1) Bâle-Mulhouse, Beauvais-Tillé, Bordeaux-Mérignac, Lyon-Saint-Exupéry, Marseille-Provence, Nantes-Atlantique, Nice-Côte d'Azur, Paris-Charles-de-Gaulle, Paris-Le Bourget, Paris-Orly, Strasbourg-Entzheim, Toulouse-Blagnac.

(2) At Bâle-Mulhouse airport, soundproofing grants are funded by a specific "noise charge".

SPOTLIGHT

In 2014, the revenue from taxes on air transport noise pollution (*TNSA*) came to 44 million Euros. The decrease in the amount of this revenue from the previous year was due to the reduction in the *TNSA* charges imposed at Paris-Orly, Paris-CDG and Nice-Côte d'Azur following the implementation of the air operators' competitiveness plan. It is also due to the decrease in the number of flights. Last but not least, the *TNSA*, as with many other earmarked taxes, was subject to a cap (€49M for 2014, €48M for 2015) above which receipts go to the State's general budget.

FUNDING FOR SOUNDPROOFING

Offshoots of the environmental consultative committees (ECC), the residents' grants consultative committees (in French, CCAR) advise on the allocation of grants towards sound insulation. 2,300 applications, amounting to a total of 25 million Euros, were favourably considered by the CCAR in 2014. These numbers were down on the previous year due to reserve periods related to local and European elections, which prevented the CCAR from meeting at certain airfields.

Over the last few years, the grant system has gradually benefitted from improvements, such as the ability to receive advance payments in 2010, the generalised provision of 100% funding and the increase in funding in 2011 for particularly heavy-duty works. Over a few years, the amount of funding has increased by more than two thirds, from 50 million Euros in 2010 to 87 million Euros in 2013 for all 12 airports concerned, and was maintained at 66 million Euros in 2014.

Against a background of both a marked rise in needs for funding and a reduction in resources over the last few years, the Government asked the General Council of the Environment and Sustainable Development (in French, the CGEDD) to identify measures to improve and sustain the soundproofing grant program.

The CGEDD made the following principal recommendations: taxes on aircraft noise pollution (TNSA) should be

A TAX TO INCENTIVISE FLEET MODERNISATION

For those living near airports situated in zones that are particularly exposed to noise pollution, the funding of home soundproofing grants is an application of the polluter-pays principle. To encourage companies to modernise their fleets, the noisiest aircraft flying at times that cause the greatest disturbance are subject to most stringent taxes. TNSA is calculated on the basis of the time of take-off, the mass of the aircraft, its acoustic features and the category of the airfield. It is paid by companies for every aircraft of more than 2 tonnes that takes off.

redirected towards airports with the greatest needs (airports in the Ile-de-France region); to the extent that the generalised 100% rate has borne fruit, there should be a return to differentiated grant rates that favour collective housing and encourage group operations; both acoustic and thermal insulation should be considered, in order to treat buildings more efficiently and cover the costs of insulation more fully; a grant program based on prioritising demands should be introduced.

These recommendations are being implemented. With regards to the first one, the TNSA rates were changed on 1 April 2015; with regards to the grant rates, the dispositions that applied prior to 2012 are once again in force and have been so since 1 January 2015; with regards to the grant program, the CCAR for Ile-de-France gave their approval, in the first quarter of 2015, to the projects proposed by the Paris Airports; with regards to the "acoustic/thermal" treatment, additional studies are to be conducted in order to identify the conditions for implementation.

LESS ECCS, BUT PLENTY OF DIALOGUE!

Environmental Consultative Committees (ECC) function using discussion and dialogue and are consulted on all important issues related to airport developments or operations that may impact on the environment. Despite the constraints imposed by the electoral periods, a good number of ECCs were able to meet in 2014, at the three main Paris airports where questions related to the state of the soundproofing grant mechanism and the results of the SURVOL study* were discussed. For Paris-CDG, the two ECC meetings with took place in 2014 provided an opportunity to look at the options for operations involving heat and noise insulation, the advances in the equipment of Air France's A 320 fleets to eliminate the particular noise produced by this type of aircraft, and the results of the additional operational restrictions that were introduced in 2012. The ECC for Paris-Le Bourget examined the Noise Exposure Plan (in French, PEB) and gave a favourable opinion.

* Environmental impact study on Paris CDG, Orly and Le Bourget



Paris-Le Bourget Airport

Preserving air quality



THE AIR INDUSTRY RALLIES AS POLLUTION PEAKS

Civil aviation's national action plan for dealing with prolonged peaks in pollution was launched for the first time on 17 March 2014 in the regions of Ile-de-France and Rhône-Alpes. The Civil Aviation's interregional safety divisions for North and Centre-East introduced a number of measures as part of this plan. That day, certain air traffic circuits were prohibited, control over the use of auxiliary power units (APUs) was tightened and engine trials that were not intended for a flight were prohibited.

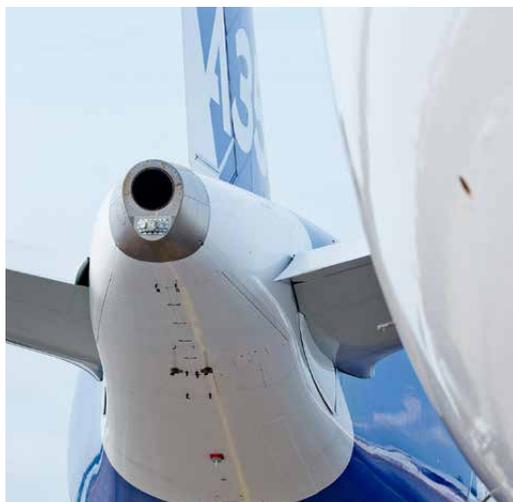
A figure

80

the number of micrograms per m³ ($\mu\text{g}/\text{m}^3$) above which pollution alert procedures are triggered. These alert thresholds were lowered in 2011, by 125 to 80 $\mu\text{g}/\text{m}^3$, which caused an increase in episodes of pollution in Ile-de-France.

POLLUTION OBSERVATORY FOR AIRPORTS IN ILE-DE-FRANCE

A scaled-up sound and air quality monitoring device around the three main airports in Ile-de-France was introduced as part of the SURVOL project. The aim is to have an increased understanding of the levels of exposure to noise and gas emissions and to better inform local residents. The agreement between Airparif and the DGAC over the availability of and right of access to air traffic data necessary for compiling an inventory of the air emissions in Ile-de-France and for the SURVOL study was renewed in 2014. Airparif also carried out a map model of the concentrations of local pollution around the three airports and put the model online.

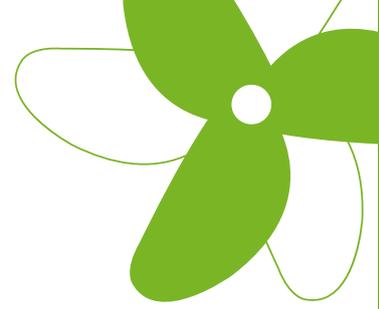


IS THERE AN ALTERNATIVE TO APU?

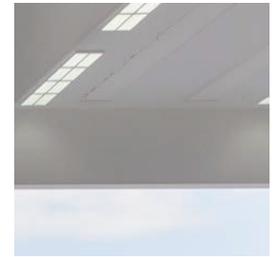
The auxiliary power units are used to provide electrical energy and supply different aircraft systems, such as air conditioning. The use of these APUs while aircraft are parked or taxiing is a source of pollution. It has been regulated at several airports, including the three main airports of Ile-de-France since October 2012. Where alternative and functional means exist (400 Hz connectors, air conditioning adapters, auxiliary power units) they must be used. The control procedure for this regulation, which was set up between the DGAC and the Air Transport Police (in French, GTA) has been in operation since January 2014.

PREPARING THE FUTURE

Air transport will continue to grow in the years and decades to come, and will pursue its strong involvement in innovation in order to prepare a more sustainable future. The DGAC is taking part in this movement by supporting manufacturers and collaborating in national and international projects to develop the technologies and operations of the future. France is equally active in the field of alternative fuels and all-electric aircraft.



CORAC at the forefront



In 2014, CORAC (the French Civil Aviation Research Council), chaired by the secretary of state for transport, pursued its virtuous cycle towards technological research. In October, it put forward three new research and development programs devoted to new aircraft configurations, onboard systems and advanced functions, in addition to the aeronautics industry of the future. The State will be supporting these works, which are essential to the preparation of the future.

In 2014, the DGAC also supported the various works of the Aeronautical and Environmental Thematic Network (RTAE) launched within the framework of the CORAC. Interdisciplinary research led by this network should lead to a better understanding of the mechanics of the environmental impact of aircraft transport, such as the formation of vapour trails produced by aircraft.

CORAC was set up in 2008 to rally all the players in aeronautics around ambitious European targets for improving aircraft performance and reducing its environmental footprint.

CORAC'S GREEN HORIZONS

Since the launch of the technology demonstrators' program in 2010, the works carried out within CORAC have already offered the prospect of a decrease in fuel consumption of more than 15% compared with the last generation of engines and a reduction by several hundred of kilos in the mass of future aircraft thanks to the provision of composites. Non-propulsive energy (used for an aircraft's electrical, hydraulic and pneumatic systems) should be reduced by one half thanks to the optimised control of this form of energy. These environmental benefits will be felt as and when fleets are renewed.

A figure

80 %

The reduction in CO₂ emissions per passenger per 100 km registered by the air industry over the past 50 or so years.

(Source : CORAC)

Essential support to the industry



In 2014, the DGAC supported research programs in a number of fields, such as the program dedicated to the new generations of turboprops. These engines equip regional transport aircraft (between 70 and 95 seats) and use less fuel than turboreactors for this type of operation. Technological breakthroughs appraised by French motorists could reduce the fuel consumption of turboprops even further. Research projects led by component manufacturers also aim to reduce aircraft mass and the consumption of energy on board. Research is being carried out on different aspects, such as making seats, materials and onboard energy sources lighter.

SPOTLIGHT

THE ELECTRIC AIRCRAFT TAKES OFF

In March 2014, the E-Fan gathered new momentum. Supported by the DGAC and developed by Airbus with the assistance of Aero Composites Saintonge (ACS), a French SME, this experimental twin-seat electric propulsion aircraft underwent initial test flights at Bordeaux-Mérignac airport. This demonstrator, a digest of technological innovations, has a composite structure and is propelled by two 60 kW motors which are powered by 250-volt lithium-ion polymer batteries and drive streamlined propellers. The aircraft also has a small electric motor for the plane to run on the ground. Its absence of pollution emissions and extremely low level of noise mean that the E-Fan helps fulfil the need to provide pilots with initial

training, without disturbing local residents. As it consumes €2 worth of electricity, against €36 to 40 worth of fuel for an engine plane on an identical flight, the E-Fan is also an important issue for the French training sector. France is currently the second country in the world in terms of the number of pilots and it is estimated that the sector has between 500 and 800 aircraft. The national school of civil aviation (ENAC) is one of the partners of this electric aircraft project, and is collaborating with Airbus to help integrate this electric aircraft into pilot training and practice programs. The E-Fan is due to be marketed before the end of the decade.



A figure

150 kW

the onboard non-propulsive electric power of a current-generation aircraft.

The aircraft of tomorrow will have onboard electric power, without propulsion, of 1000 kW.

(Source Safran)



The search for green fuel



As there is currently no alternative in the aircraft industry to liquid hydrocarbons, developing sustainable biofuels is a priority for the industry. Alongside the efforts made by the aeronautics industry to reduce the energy consumption of new generations of planes and helicopters, sustainable alternative fuels are an essential lever in reducing air transport's carbon footprint. France is the first European country to acquire a network for future aeronautical fuels.

Attached to CORAC and run by the DGAC, the coordinating committee for future alternative fuels brings together all the relevant French players: the aeronautics sector, airline companies, oil companies and research bodies. Its aim is to provide France with a shared vision in this field and to coordinate efforts in researching aeronautical fuels.



SPOTLIGHT

BIOFUELS FOR TOULOUSE-PARIS FLIGHTS

The DGAC is associated with the "Lab'line for the future" initiative which was launched in 2014 by Air France. Since October 2014, a biofuel-powered Airbus A321 has been undertaking weekly flights between Toulouse and Paris-Orly. The biofuel used is farnesane. Produced by Total-Amyris, this biofuel comes from the fermentation of sugar cane. It does not compete with the food industry and meets the sustainability requirements recognised by the Commission. The DGAC-backed experiment should enable a study on the operational and socio-economic impacts of the regular operation of flights using biofuels. First studies have shown that the use of farnesane could reduce greenhouse gas emissions by up to 80% compared to fossil fuel-based kerosene.



THE HUNT FOR EXCESSIVE KILOS

Trolleys, meal-trays, cups, baggage containers, pilots' technical documentation, flooring, seats, and so on. Carriers leave no stone unturned in order to lighten the payload of aircraft. The introduction of materials such as composite fibres or titanium has enabled excess weight onboard to be tracked down. Since 2008, Air France has reduced the weight of its cabin equipment by 15%. Every onboard kilogram eliminated from each aircraft in the fleet saves 72 tonnes of CO₂ emissions per year.

(Source: Environmental report Air France 2013)

SPOTLIGHT

3 LITRES PER 100 KM ON A PARIS-NEW-YORK FLIGHT

When the Boeing 707 was brought into service, in October 1959, the amount of fuel consumed per passenger per 100 km amounted to 9.2 litres. 50 years on, the consumption per passenger on board an Airbus A380 flying from Paris to New-York, was only 3 litres per 100 km.

(Source : CORAC)

A figure

8 %

Air transport's share of the global consumption of petroleum.

In 2050, and depending on the scenario, this share could represent between 11% and 17% of the global demand for petroleum.

(Source : IFP Energies nouvelles)



Forward thrust in European research

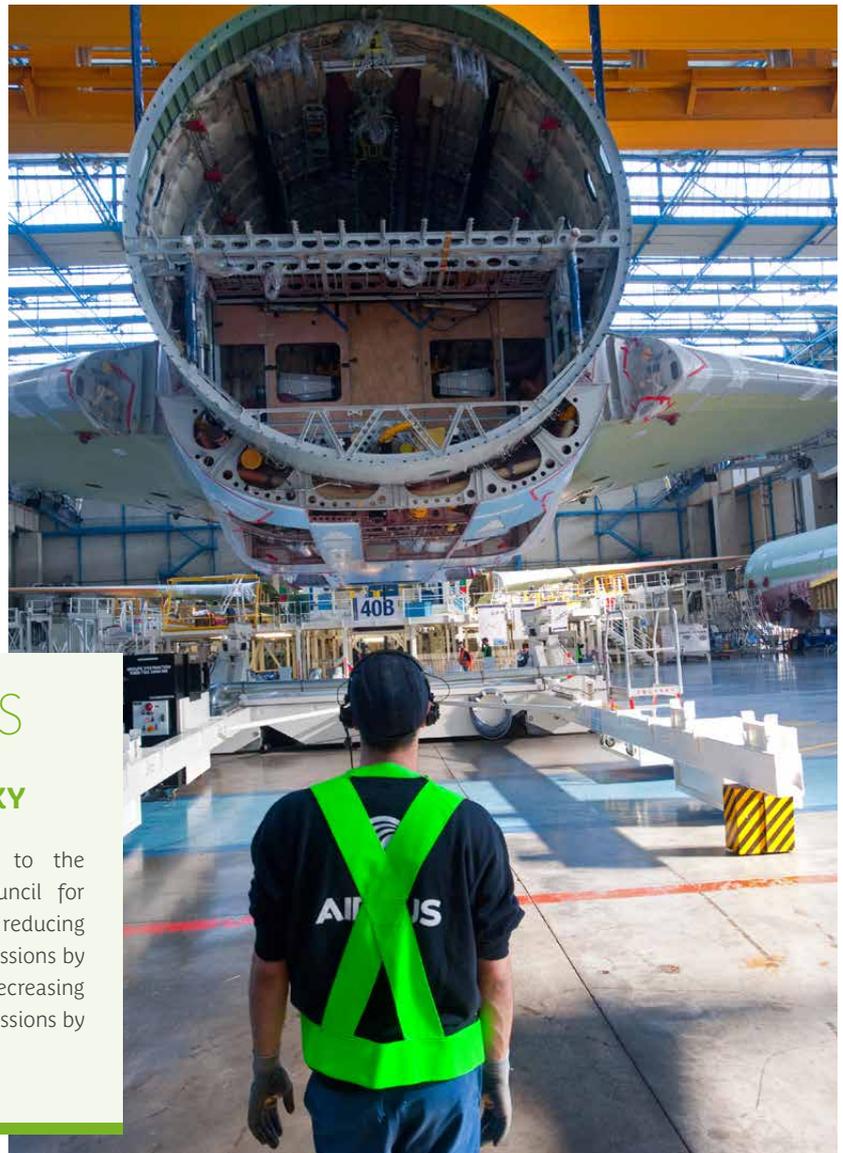
The DGAC is involved in the Clean Sky joint technology initiative. Launched in 2008, this significant aeronautics research program relies on public-private partnerships to develop and speed up the gestation and approval of breakthrough technologies that reduce aviation's environmental footprint. The second stage of this program began in 2014. Clean Sky 2 is due to place more emphasis on flying demonstrators and develop projects such as the test flight of an open rotor engine or the new regional transport aircraft.

The DGAC is also taking part in the SESAR program. As the technology element of the Single European Sky project, SESAR aims at modernizing European air traffic control by 2020. In 2014, this European program, which unites some 70 organisations and businesses, was unrolled. This stage is due to continue until 2025 and is intended to enable the large-scale introduction of the elements developed during the previous stage such as the evolution in the tools and means of controlling air traffic and new onboard equipment.

TOWARDS A MORE ENVIRONMENTALLY-FRIENDLY SINGLE SKY

Through the idea of a future single sky, Europe's air traffic could be organised so as to shorten flight times and save 10% on fuel on every journey – an appreciable reduction in the gas emissions of air transport.

(Source: Environmental report Air France 2013)



REDUCING AVIATION'S ENVIRONMENTAL FOOTPRINT: THE GUIDING PRINCIPLE OF CLEAN SKY

The Clean Sky program contributes significantly to the environmental targets of ACARE, the Advisory Council for Aeronautical Research in Europe. These targets include reducing noise levels by 50%, No_x emissions by 80% and CO₂ emissions by 50% by 2020. ACARE's Flighpath 2050 targets include decreasing noise levels by 65%, No_x emissions by 90% and CO₂ emissions by 75% by 2050.

glossary



A

ACARE: Advisory Council for Aeronautics Research in Europe

ACNUSA: Airport Pollution Control Authority

AESA: European Aviation Safety Agency

APU: Auxiliary Power Unit

C

CAEP: Committee on Aviation Environmental Protection

CALIPSO: Classification of light aircraft according to their sound performance index

CCAR: Consultative committee for aid to local residents

CORAC: Civil Aviation Research Council

D

DGAC: Civil Aviation Authority

E

ECC: Environmental Consultative Committee

E-FAN: All electric aircraft concept

EICA: Air traffic impact study

EPNdB: Effective perceived noise in decibels

ETS: Emission Trading Scheme

F

FABEC: Functional Airspace Block Central Europe

FRA: Free Route Airspace (program allowing users to freely plan routes in a specified airspace)

G

GTA: Air Transport Policy

I

IATA: International Air Transport Association

ICAO: International Civil Aviation Organisation

IGMP: Weighted measured global index (measure of sound energy generated by air traffic at Paris-Charles de Gaulle)

IPCC: Intergovernmental Panel on Climate Change

M

MBM: Market-Based Measures

N

NoisedB: ICAO database of certified noise levels of aircraft

NO_x: Nitrogen oxide

P

PEB: Noise Exposure Plan

PGS: Noise nuisance plan

Point Merge: Point of convergence of aircraft flows at an airport

T

TNSA: Tax on airport noise pollution

V

VisioBruit: Educational tool that provides the general public with an understanding of basic notions of acoustics and enables them to listen to full-scale simulations of the noise produced by the most common aircraft.

A publication of the French Civil Aviation Authority // Ministry for Ecology, Sustainable Development and Energy // 50 rue Henri-Farman – 75720 Paris Cedex 15 // Tel. : +33 158094321 – Fax: + 33 158093535 // Editorial Coordination DTA – Environnement Bureau // Design and Production :  – 35, boulevard de Strasbourg 75010 Paris – Tel. +33 145 260 260 – Fax : +33 142264894 – www.etat-desprit.fr // Editorial: Henri Cormier // Picture credits : DGAC, page 2 et 6 // DGAC-DSNA, pages 16/Sylvain Cambon, page 18 et 19/Vincent Colin // Airbus, 1^{ère} de couverture et page 20/A. Doumenjou, page 4 et 8/P. Pigeyre, page 7 et 24/P. Masclat, page 9 et 28/S. Ramadier, page 11/F. Espinasse, page 13 et 26/C. Brinkmann, page 17/Bengt Lange, page 23/P. Pigeyre, page 27/C. Springer, page 29/H. Goussé // STAC, page 13 et 15/ Marie-Ange Froissart, page 14/ Isabelle Rossi, page 21/Marie-Ange Froissart, page 23 et 26/Richard Metzger, page 27/Véronique Paul (Graphix) // ADP, page 10 et 30/Emile Luider (La Company), pages 12/Sylvain Cambon, page 12/Gwen Le Bras (Zoo Studio), page 14/Philippe Stroppa (Studio Pons), page 22/David Delaporte // Impression : Bialec – n° 85900

A large, stylized graphic of a leaf with a light beige background and a darker beige outline. The leaf has a central vein and several smaller veins branching out. The leaf is positioned in the lower-left quadrant of the page.

Direction générale de l'Aviation civile
50, rue Henry-Farman, 75720 PARIS CEDEX 15
Tél. : 01 58 09 43 21
Fax. : 01 58 09 35 35