

ENVIRONMENTAL REPORT

2016

French Civil Aviation Authority (DGAC)



MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET SOLIDAIRE



MINISTRY FOR AN ECOLOGICAL AND SOLIDARY TRANSITION



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2016 will be remembered as the year when CORSIA (*Carbon Offsetting and Reduction Scheme for International Aviation*) was adopted by the 191 member States of the International Civil Aviation Organization (ICAO). CORSIA is civil aviation's worldwide CO₂ emissions offsetting scheme that aims to stabilize CO₂ emissions from aviation at the level they will reach in 2020. As the first economic sector to adopt a worldwide scheme of this type, with environmental ambitions that can be reviewed and reinforced over time, aviation is contributing to the achievement of the climate objectives set forth in the Paris agreement.

But last autumn's historic agreement should not eclipse the other efforts that are being made to reduce aviation's impact on the climate. ICAO's Committee on Aviation Environmental Protection (CAEP) has laid the foundations for the development of the first international CO₂ emissions certification standard for aeroplanes. Manufacturers are being encouraged to use state-of-the-art technologies for all their ranges of aircraft in order to limit emissions at the source. The standard will apply to new aircraft types from 2020 and to all aircraft rolling off production lines from 2023.

But the definition of a regulatory framework is only one aspect of environmental conservation. Voluntary commitments made by the aviation sector are equally fundamental. The operators and constructors of aircraft and airport operators are all keenly aware of this responsibility. The Airport Carbon Accreditation (ACA) program is a good illustration of this. Introduced by the Airports Council International (ACI) in 2009, this program aims to reduce the carbon footprint of the airports that agree to join it. In 2016, Nice Côte d'Azur became France's first airport to achieve carbon neutrality, which is the final stage of the program. Others will certainly follow and will contribute to reaching ACI Europe's goal of 50 carbon-neutral airports by 2030.

The actions taken under the carbon accreditation program can be rewarded within the framework of the application of the law on energy transition for green growth. In 2016, this law required France's main airports to draw up plans to reduce emissions of the greenhouse gases and pollutants caused by their activity.

Europe is also present on the environmental front, in the form of the SESAR (Single European Sky ATM Research) research project, as part of which several experiments have been conducted in France to make traffic more fluid, or the Clean Sky 2 project, which aims to encourage more sustainable aviation. Landings that follow the so-called continuous descent procedure help reduce noise pollution by using specific flight paths and limiting variations in engine speed. Since September 2016, this procedure has been applied almost systematically at Paris-Charles de Gaulle airport in the middle of the night, when traffic is light. The progress made by SESAR should allow the use of such procedures to be extended in the medium-term.

Alongside these major programs involving hundreds of industrial manufacturers, more modest initiatives that also open up new prospects must also be highlighted. On October 19, 2016, the first fully electric single-seater helicopter, known as Project Volta, completed a 15-minute experimental flight from the Paris-Issy-les-Moulineaux heliport. This helicopter is very quiet and does not emit any pollutants.

Our industry is mobilized in an effort to reduce the environmental footprint of aviation. As traffic continues to grow on a worldwide scale, the challenges are tough, but we will rise to them in order to guarantee the sustainable development of aviation.

Patrick Gandil,
Director General of Civil Aviation





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THE HIGHLIGHTS 2016

THE SKY: OUR HOME TOGETHER



The first international CO₂ emissions certification standard for aircraft adopted by ICAO represents an unprecedented step forward for States, operators and the aeronautics industry. The development of more sustainable aviation in the wake of the COP21 conference is not just an idea. It is a reality





REDUCING EMISSIONS: THE TIME HAS COME FOR HARMONIZATION

On October 6, 2016, the member States of ICAO adopted a global market-based measure (GMBM) to limit CO₂ emissions from international aviation activity. It supplements the measures already adopted, while encouraging industrial manufacturers in the sector, and their partners, to continue their research and development efforts. The measure has generated considerable momentum.

POLLUTION: OCCASIONAL AND LONG-TERM ACTION

2016 saw several peaks in pollution, in particular in Paris and Lyon. During these episodes, DGAC stepped up checks at airports and prohibited a number of operations, such as aerodrome circuit training or certain engine tests. In addition to these specific and time-limited measures, airports have committed to joining the fight against background air pollution by drawing up action plans for 2020 and 2025, as part of the French energy transition law.

A SMOOTH DESCENT TO SUMMER'S END AT PARIS-CHARLES DE GAULLE

2016 saw the introduction of the first measures recommended by the report of the "Night flights" working group, which was completed in 2015. They included continuous descents, which came into

force on September 16, 2016. The specific flight paths defined for this measure, plus the reduced variations in engine speeds of the aircraft that follow them, help reduce noise pollution at night.

INNOVATE, THEN INNOVATE AGAIN

Thanks to the financial support received from the State, industrial manufacturers and research centers have scored some significant successes. The twin-engine Airbus A350-1000, which can compete with existing four-engine models, but with a significantly reduced

environmental footprint, completed its first test flight in November 2016. Thanks to the CORAC (French Council for Civil Aeronautics Research) and its RTE (Environmental Thematic Network), players in aviation have access to a comprehensive tool for research in aviation and its impact on the environment.

INTERNATIONAL MEASURES

As international traffic continues to grow by 5% a year, air transport has become the first sector of the economy to adopt a worldwide CO₂ emissions offsetting scheme. A measure that will create momentum towards environmental performance and industrial innovation.

A HISTORIC EVENT IN THE FIGHT AGAINST CLIMATE CHANGE

THE WORLDWIDE OFFSETTING SCHEME BECOMES A REALITY

On October 6, 2016, the GMBM (Global Market Based Measure), now known as CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation), was adopted by the 191 Member States of ICAO. International aviation's worldwide CO₂ emissions offsetting scheme, which had been expected for some time already, arrived in the wake of the COP21 conference. Aviation, which accounts for almost 2% of worldwide CO₂ emissions, is now fully committed to the achievement of the goals of the Paris agreement. CORSIA is designed to be adapted to the capacities of States all over the world. It will be deployed in two stages:

> **THE FIRST PHASE**, between 2021 and 2026, will be on a voluntary basis. 66 States, including France, China, the United States, the United Arab Emirates and Singapore, representing 87% of international air transport, have already agreed to take part in this first phase;

> **THE SECOND PHASE**, starting in 2027, in which the scheme will be

universally applied, with the exception of a number of States, in view of their level of development, insularity and/or low contribution to worldwide traffic.

CORSIA aims to stabilize CO₂ emissions from 2020 onwards. In concrete terms, airlines will have to buy emission reduction credits from eligible projects or programs, equaling the volume of emissions exceeding the level reached in 2020. Estimates claim that CORSIA will cover almost 80% of worldwide CO₂ emissions from aviation. Experts from the French DGAC made a significant contribution to this successful result, which has crowned years of efforts.

CORSIA contains a clause for regular three-yearly revisions to assess the scheme and, where necessary, to gradually reinforce the climate-related objectives in order to contribute to the limitation of the rise in the average worldwide temperature to well below 2° C, or even 1.5° C, by the end of the century.

WHAT WILL THE CONSEQUENCES BE FOR THE EUROPEAN CARBON MARKET?

The European Union CO₂ emission allowance trading system (ETS) exchange system was adopted by the European Union in 2005 in order to contribute to the fulfillment of its commitments to combating climate change. Initially only applicable to fixed facilities, ETS was extended to include the air transport sector in 2012. ETS currently applies to all flights between two airports in the European Economic Area [EEA]. With the introduction of CORSIA in 2021, the European Commission will soon explain the measures applicable to flights within Europe, that take account of both the commitments made by the States under ICAO's scheme and Europe's climate goals for 2030.

THE GOALS OF THE PARIS AGREEMENT

GRADUAL DISINVESTMENT
by nations in fossil energies

LIMITING GLOBAL WARMING
to less than 2° C compared
with pre-industrial levels.

**CAPPING, THEN GRADUALLY LIMITING
EMISSIONS** in order to reach carbon
neutrality between emissions from human
activity and their absorption by forests
and oceans.

THE BASKET OF MEASURES DEMONSTRATES ITS WORTH

CORSIA is not the only measure that the air transport sector has taken to combat climate change. It is part of a basket of measures drawn up by ICAO after its 38th general assembly. This broader set of measures includes:

> **OPERATIONAL MEASURES**, directly linked to the optimization of air traffic management and the improvement of infrastructures

> **TECHNOLOGICAL MEASURES**, such as reduced CO₂ emissions from aircraft

> **THE DEVELOPMENT OF SUSTAINABLE
ALTERNATIVE FUELS**

> **ECONOMIC MEASURES**, including CORSIA.

The air transport sector is prioritizing the first three measures, which have a direct impact on CO₂ emissions, and is using CORSIA as a complementary measure to achieve the goal of stabilized emissions from 2020 onwards.



A MULTITUDE OF INITIATIVES

AN INTERNATIONAL CERTIFICATION STANDARD GOVERNING AIRCRAFT CO₂ EMISSIONS

ICAO's Committee on Aviation Environmental Protection (CAEP) has set the heading for manufacturers. It has laid the foundations for the development of the first international CO₂ emissions certification standard for aircraft. Manufacturers are being encouraged to adopt state-of-the-art technologies for all their

ranges of aircraft in order to limit emissions at the source. The standard will apply to new aircraft types from 2020 and to all aircraft rolling off production lines from 2023. From 2028, all the aircraft produced (wide-body, regional and business aircraft) will have to comply with the standard.

WIDE-BODY AIRCRAFT COME FIRST

The CAEP's calculation model combined fleet renewal scenarios, the expected environmental benefits and the corresponding costs. The committee showed that aircraft with a maximum take-off weight greater than 60 tons alone account for almost 92% of CO₂ emissions. Therefore, the most stringent demands of the future standard will apply to this category of aircraft. Exceptions will only be granted under particular operating conditions in certain regions of the world.

CAEP

A NEW CYCLE TO REDUCE ENVIRONMENTAL IMPACTS

With its 24 member countries, 5 observer countries and 10 observer organizations, the CAEP initiated the "balanced approach" to the management of noise pollution, which provides for measures adapted to the local specifics of airports.

THE CAEP MEETS EVERY THREE YEARS TO:

- > **REDUCE THE NOISE** made by aircraft;
- > **REDUCE EMISSIONS** of atmospheric pollutants and particles;
- > **IMPROVE AIR NAVIGATION PROCEDURES;**
- > **REDUCE IMPACTS** on climate change.

The CAEP has opened a new three-year cycle (2016-2019) to reduce environmental impacts. 18 experts from the DGAC are taking an active part in this work.

THE FIRST EVER STANDARD FOR PARTICLE EMISSIONS

In February 2016, the 10th meeting of the CAEP in Montreal ratified the first ever standard on emissions of non-volatile fine particles from turbojets, which is based on the measurement of the concentration of particles by unit of volume. Its regulatory level matches the pre-existing regulations on exhaust fumes indexes. The revision of this standard is included in the CAEP's 2016-2019 three-year cycle, with a view to basing the standard on the number and mass of particles. Experts from the DGAC are playing an active role in all of this work.

AIR NAVIGATION MAKES PROGRESS THANKS TO CANSO

The French DGAC's air navigation service provider (DSNA) welcomed the 30th meeting of the environmental working group of the Civil Air Navigation Services Organization (CANSO) to Marseille. CANSO brings together service providers and manufacturers from air navigation from all over the

world. The CARPEDIEM (Compute ATM Relevant Performance Efficiency to Drive and Influence Environmental Management) flight efficiency measurement tool, developed by the DSNA, was presented at the meeting.

NOISEDB BECOMES AN INTERNATIONAL BENCHMARK

In 2016, more than 800 aircraft were added to the NoisedB international database of certified aircraft engine noise levels, developed by the DGAC under the aegis of ICAO. Today, the database contains the certified noise levels of more than 12,300 aircraft used for public transport. NoisedB, which came online in 2006, has become the preferred source of information for the development of ICAO's standards.



THE SINGLE EUROPEAN SKY IS GETTING ORGANIZED

SELECTION OF RUNWAYS IN SERVICE COOPERATION BETWEEN FRANCE AND BELGIUM

In December 2016, the RAAS [Runway Allocation Advisory System] tool, designed to support runway allocation decisions, was presented to a delegation from Belgocontrol, on the occasion of a visit to Basel-Mulhouse airport, where the tool is in service. It was an opportunity for the DGAC to support the projects underway in Belgium to reduce the environmental impact of air traffic, as part of the reorganization of air space and flight paths.

TRANS-BORDER FLIGHTS A NEW FRANCO-SWISS CHAPTER OPENS

France and Switzerland are taking original joint action in the management of frontier airspace. This cooperation comprises an in-depth study of the Collaborative Environmental Management [CEM] concept, or the practices of the French and Swiss air navigation service providers. The extension of the action to the operational sphere has started. A four-month noise measurement campaign by the Air Navigation Service Provider in France

allowed for the analysis of the overflight conditions over the French bank of Lake Geneva by aircraft approaching runway 23 at Geneva airport, which have prompted some complaints. Proposals to improve this procedure will be unveiled in 2017. The action has been supplemented by the signing of protocol for the transmission of radar data to consolidate the analysis of trans-border noise emissions.

FABEC AS THE CROW FLIES

Between 2011 and 2014, the seven partners of the Functional Airspace Block Europe Central (FABEC), namely the air navigation service providers from six European States [France, Germany, Belgium, Luxembourg, the Netherlands and Switzerland] and the Maastricht control center, managed to reduce the average deviation between the most direct air route [selected in the flight plan]

and the route actually followed by 12%. These seven partners have again committed to reducing the average deviation by a further 10 % by 2019.

This major contribution is part of the continuous efforts that are now part of the Free Route Airspace [FRA] project launched in 2013, since when 651 direct routes, of diverse lengths and availabil-

ities, have come into service in the airspace managed by FABEC, and some of which are trans-border routes. Since 2010, FABEC's air navigation service providers have created 1,365 direct routes. The goal is to deploy a complete network of direct routes by the end of 2018, in keeping with the commitments made as part of the SESAR European modernization program.

DEPLOYMENT OF SESAR

SESAR [Single European Sky Air traffic management Research], the technological dimension of the Single European Sky, aims to modernize Europe's air traffic management systems. After a definition phase between 2006 and 2008, and a development phase between 2008 and 2014 that established the operational procedures and the pre-industrial technologies of the future air traffic management system, SESAR has now entered the deployment phase that will last from 2015 to 2025. This period covers the new air traffic management infrastructures and the universal installation of onboard equipment by operators, manufacturers and air traffic controllers.





PREVENTING ENVIRONMENTAL NUISANCE

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The prevention and the reduction of noise and air pollution remain essential sources of concern for residents who live in the vicinity of an airport. As the operators in the aviation sector continue to renew their fleets, the French DGAC is stepping up its initiatives to establish dialog and is pursuing its actions for the adoption and the improvement of new air navigation procedures.

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A CLEARER LAW ON ENVIRONMENTAL ASSESSMENTS

Two orders were published on August 3, 2016. The first one reinforces preliminary dialog on plans, programs and projects, at a stage of their development where changes can still be made to take the general public's observations into consideration. The second order changes the provisions pertaining to environmental assessments.

Environmental assessments are compulsory for the building of airports with a take-off and landing runway measuring at least 2,100 meters. For other aerodromes, including heliports, projects are examined on a case-by-case basis, and the environmental authority decides whether the project must undergo an environmental assessment.

The impact study must contain a number of items, including a description of the project, with its location, its physical characteristics, a description of any notable consequences the project may have on the environment or health, and the compensatory measures to be taken, the vulnerability of the project to climate change, etc.



NOISE ABATEMENT CONSULTATIONS ARE ON THE RISE

THE INDISPENSABLE CCEs!

Consultative commissions for the environment [CCE] are the privileged forum for exchanges between residents and environmental protection associations, the local authorities, the aviation professions and the State. All the important questions on the development or the operation of an airport that could impact the environment are discussed in these commissions. By way of example, the West DSAC has 15 CCEs, including those for the airports in Brest, Caen, Nantes and Rennes. In June 2016, residents approved the new and quieter air navigation procedures, known as continuous descents, between 12:30 a.m. and 5 a.m. at Paris-Charles de Gaulle, during a CCE meeting.

IMPROVED HANDLING OF COMPLAINTS THROUGH CENTRALIZATION

The one-stop system used to manage complaints is gradually being ramped up on aerodromes in France. At Bordeaux-Mérignac, Pau and Biscarosse, the public is received in a new area set aside for dialog and information. Some aerodromes are taking additional measures, such as Caen, where complaints can be made on the Internet. The publication of aviation events keeps residents informed in advance of any possible noise pollution.

INCREASED DIALOG WITH THE GENERAL PUBLIC

The criteria used to trigger public inquiries when changes are made to air traffic came under review in 2016 and should be revised before the end of 2018. These changes will help to better identify the impacted localities and to reinforce the scope of the consultations.

NOISE EXPOSURE PLANS TOOLS TO PREVENT URBAN DEVELOPMENT NEAR AIRPORTS

Noise exposure plans prolong the preventive approach by limiting urban development close to airports in order to prevent the exposure of new populations to noise from aircraft and to guarantee the long-term operation of the airport. Noise exposure plans may be subject to review, in particular on the basis of the observed aviation activity. By way of example, 24 aerodromes in the zone covered by the North DSAC have a noise exposure plan, of which 10 were drawn up in keeping with the standard required by decree No. 2012-1470 (as codified in articles R.112-2 and R.112-3 of the French urban planning code), in order to give greater consideration to the characteristics of low-traffic airports. In the West DSAC zone, 26 out of 32 aerodromes now have noise exposure plans. The definition of Rouen's noise exposure plan will continue, once the airport's new operator has been appointed. The plans for Saint-Nazaire, La Baule, Amboise and Blois are being drafted. In the Paris region, a public inquiry into the draft noise exposure plan for Paris-Le Bourget opened at the end of 2016, and the plan was approved in February 2017.



FOCUS

Theoretically, CCEs meet at least once a month under the aegis of the departmental Prefects, or the regional Prefect for Paris-Charles de Gaulle, Paris-Orly and Paris-Le Bourget.

WHAT'S THE DIFFERENCE BETWEEN A NOISE EXPOSURE PLAN AND A NOISE POLLUTION PLAN?

While these two types of plans almost share the same name and have some points in common (airborne noise map, use of a common noise index, demarcation of three noise zones, in most cases, etc.), they take distinct approaches:

> **NOISE EXPOSURE PLANS** apply to urban development in the vicinity of aerodromes, from a preventive and long-term perspective,

> **NOISE POLLUTION PLANS** adopt a curative standpoint. On the basis of short-term traffic forecasts, they observe actual noise pollution, with a view to defining the zones where residents are eligible to financial aid to soundproof their dwellings. Noise pollution plans apply to a smaller number of airports than noise exposure plans, i.e., only the 11 main airports in France.



LESS NOISE AROUND PARIS-CDG

In July 2016, the French airport pollution control authority (ACNUSA) confirmed the continuation of the reduction in noise emissions at Paris-Charles de Gaulle airport. The value of the global weighted and measured index (IGMP) was 71.6 in 2015, representing a 3.9-point drop over the preceding year. At a time when air traffic is increasing,

albeit moderately, this represents a significant step forward. This reduction can be explained mainly by the new distribution of movements between the daytime, evenings and nighttime, and the continued modernization of fleets. The specific nighttime indicator also dropped to its lowest value since 2008.

LANDING FEES AS A MEANS OF REGULATION

On August 1, 2016, a 47% hike in the landing fees between 10 p.m. and 6 a.m. was introduced at Rennes airport. New flight paths have also been adopted to avoid flying over the built-up areas to the West of the airport.

ENVIRONMENTAL MANAGEMENT A NATIONAL PLATFORM THAT SETS THE STANDARD

The national platform for exchanges and communications between aeronautical operators and the representatives of populations living on flight paths was set up at the 2015 Le Bourget airshow. Made up of representatives of the French Union Against Aircraft Nuisances (UFCNA), the French national federation of merchant aviation (FNAM), the union of French airports (UAF) and the DSNA, this new instance examines operational solutions designed to reduce the environmental impacts of aviation and airport activities.

In June and December 2016, the DSNA presented the members of the platform with the actions taken to contribute to the achievement of the goal to stabilize CO₂ emissions by 2020 and to reduce noise pollution around airports.

This collaborative environmental management (CEM) initiative is the first of its kind in Europe. The DGAC's European partners, BELGOCONTROL and EUROCONTROL, have both shown an interest.



THE STAC: AN EXPERT IN NOISE MEASUREMENTS

France's 11 main airports are obliged to install the means of measuring noise emissions. The civil aviation technical department (STAC) has developed a specific methodology to homologate noise measuring systems, becoming the first laboratory to be accredited by the ACNUSA for this type of expertise in doing so.



AIR QUALITY

MEASURING THE DISPERSION OF GASES

The STAC's guide to the calculation of emissions from aircraft, which proposes a global methodology for the calculation of atmospheric emissions on and around airports, has been updated. Airport operators and the DGAC's departments can use this guide to take environmental initiatives as part of their emissions inventories. The principles set forth in the guide are being applied to the revision of the atmospheric protection plan in the Paris region, which started in 2016. Inventories are an elementary building block, with which air quality monitoring instances can assess the level of air pollution - in other words, the concentration of pollutants - at any point in a given area, using software to calculate dispersion.

THE AIR AND THE ROAD: AN UNPRECEDENTED STUDY

The STAC has compared emissions from road and air traffic in an effort to address the rising number of questions that the French population is asking about atmospheric pollution caused by transport. The comparison was based on the studies and inventories of the statistics and observation department (SOeS) and AIRPARIF, in particular. The data in the DGAC's TARMAAC tool was also used. Comparisons were made for

a trip between Paris and Toulouse (flight performed by an Airbus A320), and for a trip between Paris and Lorient (flight performed by an ATR72). In absolute terms, land-going vehicles produced fewer emissions than aircraft over a complete cycle (take-off, cruising, landing). But the interest of the study lies in the ratios per passenger, which reveal opposing results.

DECREE IN APPLICATION OF ARTICLE 45 OF THE LAW ON ENERGY TRANSITION FOR GREEN GROWTH

The decree in application of article 45 of the law on energy transition for green growth was signed on May 10, 2016. France's main airports are now obliged to launch precise programs to reduce pollutant emissions resulting from their direct and ground activities. The objective is to reduce by 2020 the intensity of pollutant emissions by at least 10%, in comparison with 2010, used as the reference year. Emissions must be reduced by 20% by 2025.

The decree also lists the greenhouse gases (carbon dioxide,

nitrogen protoxide, methane and four compounds containing fluorine) and the atmospheric pollutants (nitrogen oxides, total suspended particles and volatile organic compounds) in question. It also describes the methodology to be adopted by airport operators to measure their emissions in the past and to produce reduction forecasts.

The French environmental and energy management agency, ADEME, will present the results of the action programs of all the airports on December 31, 2017 at the latest.

FOCUS

On a trip from Paris to Toulouse, the passenger in a vehicle emits 20 times more CO₂, almost 1.8 times more NO_x and 1.7 times more particles (PM10) than a passenger in an aircraft. On a trip from Paris to Lorient, the occupant of a vehicle emits 16 times more CO₂, almost twice as much NO_x and 1.3 times more particles than an aircraft passenger on the same route.

POLLUTION PEAK THE AVIATION SECTOR'S PROCEDURES COME UNDER REVIEW

The aviation sector did not wait for the next revision of the national civil aviation action plan to take action in the event of a persistent episode of ambient air pollution. In addition to the measures included in the Paris airports authority's plan of voluntary commitments, a number of measures were taken during the peak in pollution in December 2016:

> **TIGHTER CONTROLS OF THE LENGTH OF USE OF AUXILIARY POWER UNITS (APU)** were applied between December 4 and 17 by the air transport police (GTA). The 46 checks revealed three breaches of the regulations,

> **ENGINE TESTS BEARING NO RELATION TO A FLIGHT** were banned at Paris-Charles de Gaulle, Paris-Orly and Paris-Le Bourget,

> **NINE AERODROMES IN THE PARIS REGION** (Paris-Charles de Gaulle, Paris-Orly, Paris-Le Bourget, Chavenay, Chelles, Enghien, Lognes, Saint-Cyr and Toussus-Le Noble) **SUSPENDED THE USE OF AERODROME CIRCUIT TRAINING**, apart from for initial training, under the supervision of an instructor.

Lyon-Saint-Exupéry, Lyon-Bron, Lyon-Corbas and Lyon-Brindas also banned aerodrome circuit training on several occasions in the month of December 2016.



AIR TRAFFIC STRIKING THE RIGHT BALANCE

IN-DEPTH ANALYSIS OF RNAV PROCEDURES

When plans are afoot to create or modify instrument flight procedures, the DSNA conducts a study of the impacts on air traffic. The results are submitted to the CCEs (Consultative Commissions for the Environment), or the ACNUSA, when the changes affect one of the main French airports. Studies of this kind have been made for new RNAV-type (area navigation) procedures at Biarritz, Bordeaux, Chambéry, Montpellier, Rennes, Saint-Etienne, Saint-Nazaire, Paris-Charles de Gaulle and Paris-Orly. In 2016, all the air traffic files submitted to the CCEs by the air navigation services were favorably received.





THE DSNA BULLETIN GETS A FACELIFT

The information bulletin on air traffic in the Paris region, published at the request of the region's residents who live near an airport, provides a complete overview of the breakdown of traffic by airport. It also contains information on the use of the various runways or the monthly rate of con-

tinuous descent approaches at Paris-Orly and Paris-Charles de Gaulle. Soon, more space will be set aside for questions about night flights, in response to the discussions of the working group chaired by Prefect Régis Guyot since 2014.

THE EPNDB

[Effective Perceived Noise Decibel]
is the effective basic unit of perceived noise. It is used to certify jet aircraft and turboprop aircraft weighing more than 8,618 kg.



AN AERONAUTICAL APPLICATION FOR THE IGN'S GEOPORTAL

The online application covering the environment of characteristic aeronautical flight paths (ENTRACT) can be accessed from the website of the French Ministry for an Ecological and Solidary Transition. This new tool monitors the flight paths and overflights of the populations living near France's 11 main airports. The data is displayed according to the wind configuration or showing flight paths for every 1,000-meter altitude layer.

VIEWING NOISE EXPOSURE AND NOISE POLLUTION PLANS

The publication of digital overflight data is completed by maps of the noise and urban amenities around airports. The noise exposure and noise pollution plans can both be accessed from the geoportail.

OBEYING ENVIRONMENTAL LEGISLATION RAISING THE AWARENESS OF AIRLINES

The “Maestro” meetings held at Nantes airport offer an opportunity to examine overflights not complying with planned flight paths, as part of a drive to make airlines aware of the need to obey the applicable environmental procedures. The environment department of the Nantes airport operator (AGO), the air navigation services and the West DSAC meet once a month to take preventive action.

environmental procedures. The environment department of the Nantes airport operator (AGO), the air navigation services and the West DSAC meet once a month to take preventive action.

FOLLOWING FLIGHT PATHS IN REAL TIME

The DSNA is reinforcing the protection of its data networks with a view to publishing flight paths online and in real time. The VITRAIL software can already be used on dedicated computers in the “Maisons de l'Environnement” at Paris-Charles de Gaulle and Paris-Orly, and in 31 nearby town halls.



REDUCING POLLUTION



The DGAC is developing new measuring tools, intensifying controls and increasing exchanges with residences in support of the measures taken by the national and European legislators.



THE COMBINED EFFORTS OF PLAYERS IN AVIATION

OPTIMIZING FLOWS, OR HOW CAN THE FOOTPRINT OF AVIATION-RELATED ACTIVITIES BE CONTROLLED

MORE FLUID TRAFFIC WITH SESAR

Thanks to the SESAR (Single European Sky ATM Research) program, industrial manufacturers in the aeronautics sector have been able to combine their efforts to further harmonize the air navigation systems of the future. SESAR is based on a simple idea: better flight management makes traffic more fluid and reduces pollution. A number of experiments have already been conducted on this basis.

ISTREAM DEMONSTRATION

Experiments in the improvement of air flow management have been conducted as part of iStream, one of the SESAR demonstration projects. The concept behind iStream, which applies to both airports and en-route control centers, is based on the definition of a target time, which is the time at which an aircraft must reach a pre-identified point. Two exercises were completed at Paris-Charles de Gaulle

at peak arrival times (8 a.m. to 9:30 a.m.). Significant progress was observed on 2,000 demonstration flights:

> **In the North en-route control center zone, delays were reduced by 36%, despite a 5% rise in demand;**

> **Allocating target times to incoming flights reduced**

waiting times by 20%, while allowing airlines to make gains in flight efficiency and flexibility.

After iStream, work on improving the management of flows will continue with xStream.

EXTENDED-AMAN

In 2014, the early management of arrival sequences at London underwent trials in the Reims en-route control center located in France. By slowing down aircraft earlier, rather than in the terminal areas, potential savings of about 15,000 tons of CO₂ were measured. This system came into permanent service in the Reims and Brest en-route control centers in 2015 and 2016. The concept will be extended to 25 European airports by the end of 2023.

PARALLEL APPROACHES AT CDG AND LE BOURGET

The Paris-Charles de Gaulle/Paris-Le Bourget control centers and Eurocontrol's experimental center in Brétigny-sur-Orge are working on parallel approaches, as part of the SESAR 2020 Enhanced Arrivals and Departures project. The aim is to make the regulation of parallel, triple and simultaneous approaches, which are quite specific to these two airports, easier and safer.

In addition to the expected progress in terms of safety, significant gains are also expected on the environmental front. New downwind crossed flight

paths should result in the better separation of the North-South flows. Here again, the significant limitation of low-altitude inter-axis crossovers would also represent a step forward. Finally, making the procedures symmetrical would be conducive to the simplification of the existing air traffic system.

Simulations were conducted in Brétigny in 2016, and the project will be stepped up with numerous simulations lasting until mid-2018.



FRENCH AIRPORTS LOOK FAR AFIELD

THE CARBON ACCREDITATION PROGRAM (ACA)

Airports that join the ACA program ultimately aim to offset their carbon emissions. Carbon neutrality is the last stage of a process, in which airports map out their carbon emissions, then reduce their direct emissions and optimize those of the other operators on the airport.

In 2016, two new airports, Brest-Bretagne and Saint-Tropez, joined

the scheme. Even more remarkably, Nice-Côte d'Azur became France's first carbon-neutral airport, contributing to the achievement of the target of 50 carbon-free airports in Europe by 2030 that was set by the representatives of European airports at the COP21 conference.

REDUCING THE VULNERABILITY OF AIRPORTS

In 2011, the DGAC tasked the STAC with developing a method to assess the vulnerability of aerodromes to the effects of climate change. Drafted in the French plan for adaptation to climate change (PNACC), this initiative was completed in 2013. Four aerodromes have volunteered to collaborate in the development of the Vulclim program. The plan was unveiled at the COP22 conference in Marrakesh, with the goal of delivering a means of assessment that is adapted to every airport by the end of 2017.

THE EXAMPLE OF OVERSEAS TERRITORIES

In Réunion, special efforts are being made to improve the management of the air conditioning, to centralize the technical management of the terminal and to replace the lights at Roland-Garros airport that consume the most energy.

A competition has been launched in New Caledonia for the construction of a new

terminal at Koné airport. The infrastructure must limit or offset its carbon footprint. At Nouméa-Magenta airport, lights on the traffic aprons have been replaced with LED lights that consume less energy. Hydrocarbon separators are currently being brought up to standard in order to reduce the impacts of effluents on the natural ecosystem.

61%

of the total tonnage of waste produced by Roland-Garros airport in Réunion is now recycled.



BIODIVERSITY

DAC - NEW CALEDONIA ENTERS AN AGREEMENT WITH WWF FRANCE

On August 4, 2015, the New Caledonia branch of the French civil aviation directorate (DAC-NC) and WWF France signed a 3-year agreement to protect and restore the dry forests and rainforests of the island. The WWF commits to:

- > **SUPPLY THE SEEDS AND PLANTLETS** and the expertise required to successfully grow dry forest plants in the DAC-NC nursery located in Magenta;
- > **ORGANIZE COALITIONS OF CITIZENS INVOLVED IN FOREST RESTORATION AND TREE-PLANTING PROJECTS** on one of the two dry forest sites in Nouméa involving the DAC-NC's personnel;
- > **RAISE AWARENESS AMONG AIRCRAFT PILOTS OF THE VULNERABILITY OF THE FORESTS IN NEW CALEDONIA TO FIRE AND THAT THEY CAN HELP PREVENT FOREST FIRES BY AERIAL RECONNAISSANCE.**

Since the WWF declared that it was highly satisfied with this environmental partnership last year, a call for funds has been made for 2017.



70%

the average proportion of the surface area of the 450 or so airports in metropolitan France covered with lawns, crops or meadows. Residents and users are often surprised by the wealth of ordinary biodiversity (fauna, flora, insects) living in airports, due to the measures taken to protect their perimeters, and changes in their surrounding environments (growing urbanization and intensive farming).



AIRPORTS COMMIT TO PROTECT POLLINATORS

In 2016, 30 pollinator nest boxes were installed on the 12 airports belonging to the "Hop! Biodiversité" association. This initiative aims to estimate the presence and the diversity of the populations of wild pollinator insects at airports. Late mowing and semi-natural meadows allow these pollinators to flourish and to improve the floral resources, their staple diet, in terms

of quantity, diversity and quality [pollen and nectar].

"Hop! Biodiversité", of which the DGAC is a member, was created in 2015 at the initiative of the airline "HOP!" It assists airports in taking actions in favor of biodiversity, based on scientific programs developed by the French National Museum of Natural History (MNHN).

STRICTER CONTROLS

INCREASED SURVEILLANCE IN THE NORTH DSAC

The Paris-Charles de Gaulle, Paris-Orly, Paris-Le Bourget, Beauvais-Tillé, Toussus-le-Noble and Pontoise-Cormeilles airports and the Issy-les-Moulineaux heliport are under environmental restrictions in order to reduce the noise pollution caused by their activities. Any failure to comply with these administrative rules is systematically recorded by the DGAC's sworn agents or the Air Transport Police (GTA) and sent to the ACNUSA. Aircraft operators that fail to remain within the permitted noise levels of aircraft or to respect night flight restrictions are liable to pay to a €40,000 fine.

In 2016, for the Paris region, the North DSAC or the GTA recorded:

- ⊗ **122 FAILURES** to respect time slots,
- ⊗ **36 FAILURES** to respect aircraft noise performance levels,
- ⊗ **35 FAILURES** to respect environmental protection volumes,
- ⊗ **14 FAILURES** to respect procedures for the use of auxiliary power engines on aircraft.

207

reports of breaches of environmental restrictions in the Paris region were forwarded to the ACNUSA in 2016, compared with 239 in 2015, accounting for about one half of the breaches reported in France.

THE SOUTH-EAST DSAC LIMITS NOISE POLLUTION AT NIGHT

Should the noisiest aircraft be banned from flying at night? This is one of the solutions recommended by the South-East DSAC's airports CCEs, in an effort to reduce noise pollution. In 2016, 45 breaches were recorded at Marseille, Nice and Cannes-Mandelieu. The reports have been forwarded to the ACNUSA, which will decide on sanctions.

THE ANCUSA ISSUES ITS FIRST SEIZURE ORDERS

On August 10, 2016, a seizure order was issued for an aircraft belonging to an airline operating at Paris-Charles de Gaulle for the non-payment of numerous fines amounting to more than €1 million, for flights by the airline in breach of the environmental regulations. The aircraft was

detained at Paris-Charles de Gaulle airport at 12:30 p.m. and released at 6 p.m. on the same day, after the due sums had been paid. On December 16 and 17, 2016, a second procedure of the same type was successfully applied to another airline.

GREEN AIRCRAFT TAKE TO THE STAGE

In 2016, the DGAC continued the certification of three innovative aircraft on behalf of the European Aviation Safety Agency (EASA).

- > **THE E-FAN 2.0**, a two-seater aircraft with an electric engine,
- > **THE LH10 ELLIPSEE**, a turboprop observation aircraft that makes extensive use of composites,
- > **THE SONACA 200**, intended for flying schools, with a take-off weight of less than 750 kilos.

AIR QUALITY

STAY THE COURSE

MORE DIRECT ROUTES

The DGAC regularly reviews the efficiency of flight paths, and Europe-wide targets are set for the following indicators:

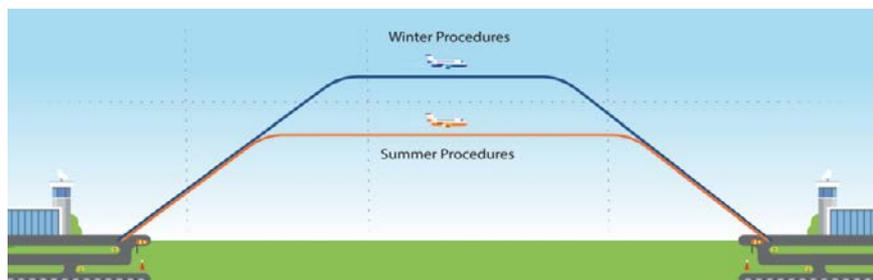
> **DEVIATIONS BETWEEN THE FLIGHT PLANS DEPOSITED BY AIRLINES AND THE SHORTEST ROUTE**

> **DEVIATIONS BETWEEN THE ROUTE TAKEN AND THE SHORTEST ROUTE.**

In 2016, the DGAC has continued to achieve a high level of performance for both indicators, thanks to an optimized network of routes and the direct routes authorized by air traffic controllers whenever possible.

OPTING FOR SEASONAL FLIGHT PATHS

The Member States of the FABEC are cooperating with a view to proposing more route options in sectors where flows can vary significantly between different times of year. Since 2014, seasonal scheduling has optimized 80 air route profiles, representing fuel savings of 2,500 tons every winter. CO₂ emissions have been reduced by 7,500 tons for more than 100,000 flights.



MEASURING AIR QUALITY UNDER ALL CIRCUMSTANCES

The assessment of air quality in airport environments involves coordinated work in three areas: modeling tools, inventories and measurement campaigns. Launched in 2016, the MOSIQAA project aims to meet the objective of precisely modeling and simulating air quality in airport environments, in view of weather conditions, chemical reactions, etc. MOSIQAA brings together three expert partners in the field: the ONERA, the INERIS and the CERFACS. It is entirely funded by the DGAC.

A LABEL FOR AIRPORT MANAGEMENT

On November 15, 2016, Euro-control awarded the Airport-Collaborative Decision Making [A-CDM] label to Paris-Orly airport. The principle behind this global mode of airport management involves sharing operational information between the various

actors at the airport in real time [air navigation services, airlines, airport operators]. Shared tools allow full use to be made of the runway capacity for incoming and outgoing flights. Taxiing time is cut by an estimated 3%, saving 800 tons of CO₂ per year.

280,000

tons of CO₂ were saved in 2016, thanks to the optimized management of flows in French airspace by air traffic controllers.

FOCUS

A GUIDE TO REDUCING CONSUMPTION

A working group of experts from the five en-route control centers (CRNA) is preparing a user guide to assess the fuel savings that could be made, and the greenhouse gas emissions that could be prevented, by making changes to the en-route and approach networks.

CONTROLLING NOISE EMISSIONS

NIGHT FLIGHTS CONTINUOUS DESCENTS AT PARIS-CHARLES DE GAULLE

The main recommendation in Prefect Guyot's 2015 report on the findings of a working group to look into night flights at Paris-Charles de Gaulle, which consisted of adopting landings according to the so-called "continuous descent" procedure between 12:30 a.m. and 5 a.m., came into force on September 16, 2016. Elected representatives and inhabitants would like the measure to be extended to the whole night, or even the whole day too, but the complexity of implementing the measure at times when both pairs of the airport's runways are in use simultaneously prevents this request from being met immediately.

Nevertheless, the accumulated effects of continuous descents, operational restrictions on the noise performance

levels of aircraft, the punctuality plans of certain airlines and improvements in the scheme to sanction breaches of environmental regulations will improve the situation.

A monitoring committee has been tasked with further investigating, assessing or implementing other measures in the Prefect Guyot report, including:

- > **ALTERNATING CLOSURE OF THE PAIRS OF RUNWAYS AT NIGHT**
- > **PREFERENTIAL USE OF THE EAST FLOW CONFIGURATION**
- > **IMPROVEMENT OF THE SYSTEMS USED TO INFORM RESIDENTS AND AIRLINES.**

90%

A target of 90% of landings according to the continuous descent procedure has been set at Paris-Charles de Gaulle airport between 12:30 a.m. and 5 a.m.

A BETTER UNDERSTANDING OF NOISE THANKS TO THE CORAC

The environmental thematic network's (RTE) report on air noise, available on the CORAC website, recommends a multidisciplinary approach to gain a better understanding of the phenomena of the perception of noise. After some initial discussions of the acoustic factors, the report approaches aspects relating to human and social sciences, in order to take into account the other dimensions of the issue of the disturbance perceived by residents living close to airports. These "individual factors", related to the experience and the specific characteristics of the various individuals, and "socio-territorial" factors, place the inhabitants' living conditions and experience in a broad social and political context. Research into these non-acoustic factors represents a new opportunity to work on the improvement of our understanding of disturbance by noise.

NOISE MEASUREMENTS OBJECTIVE DATA

When discussions between the players in aviation and residents come up against the question of perceived noise, in situ measurements can provide objective input. At the request of the French Member of Parliament representing the third circumscription in the Aube department, a two-month measurement campaign was conducted in Romilly-sur-Seine, which is overflowed during the Paris-Charles de Gaulle approach procedure. It is located close to the OKIPA navigation point, one of the entry points for air traffic in the South-East of the Paris region.

But sound measurements are not only used for arbitration purposes. They can also help measure the efficiency of various approach procedures at an airport, in an effort to improve the quality of life of nearby residents. The introduction of RNAV procedures at Paris-Charles de Gaulle in the middle of the night (12:30 a.m. to 5 a.m.) was backed up by a six-month measurement campaign from August 1 to November 30, 2016, which highlighted the very positive results of the new system.

600 CALIPSO-CLASSIFIED AIRCRAFT

The DGAC continues to take part in the improvement of the acoustic performance of aircraft with the cooperation of the French national commission on aids for light aircraft (CNAAL). The West DSAC allocated a total of €12,000 to accredited flying clubs that

requested aid for the acquisition of silencers. In return, the flying clubs agreed to join the CALIPSO program for the acoustic classification of light aircraft. The DGAC database contained more than 600 classified aircraft at the start of 2017.



A COMMITMENT BY PROPELLER MANUFACTURERS

In an effort to encourage the universal adoption of the CALIPSO classification, the DGAC has asked the manufacturers of silencers to publish a catalog of the aircraft equipped with their products. The silencer manufacturers CHABORD and SCAI-TECH have teamed up with the propeller manufacturer DUC to offer noise-reduction kits.

MORE RESOURCES TO SOUNDPROOF HOUSING

The system to allocate financial aid for soundproofing for residents living close to an airport is a precious tool that helps aerodromes to become integrated in their environment. This system, which is applicable around the 11 main airports in France, is managed by the airport operators and financed by a tax on noise pollution from the air (TNSA). It is based on the "polluter pays" principle: the airlines pay the tax on noise pollution; its amount depends on the take-off weight, the acoustic characteristics and the departure time of the aircraft. The income from the TNSA also depends on tariffs specific to each aerodrome that are set according to the need for

soundproofing in the vicinity of the airport. The 2014 law on public finances introduced a limit on TNSA's general income, with any amounts exceeding this limit being transferred to the State budget. The €49 million limit set in 2014 was later reduced by €1 million per year. In 2016, the limit could have resulted in the repayment of income from the TNSA, to the detriment of residents. However, in view of the difficult situation at some airports, especially in the Paris region, at the end of 2016, the French parliament passed an amendment to the law on public finances, increasing the limit to €55 million to prevent it from being capped.

HOW DOES CALIPSO WORK?

Since 2013, the classification of light aircraft according to their acoustic performance index (CALIPSO) has enabled noise produced by light aircraft to be broken down in comparison with a simple conversation. Indeed, each level of the classification is based on the ability to understand the human voice when the aircraft flies over. This new approach goes beyond the simple notion of decibels emitted in an attempt to improve exchanges between the users of light aircraft and residents living in the vicinity of aerodromes. The classified aircraft list can be found on the website of the French Ministry for an Ecological and Solidary Transition.



PREPARING FOR THE FUTURE

Against a backdrop of the rise in competition and climate-related issues, aviation manufacturers, their entire supply chains and research organizations are joining forces and multiplying innovative projects to build aircraft that meet the ever more stringent demands for competitive performance, safety and environmental protection. The needs are gigantic in scale. 10,000 aircraft will be built over the next 10 years.

Not only is environmental performance included in every single aeronautical building program, but it is also now emerging in the airports' agenda.

40%

The European Commission's Transport Strategy for 2050 aims to increase the proportion of sustainable alternative fuels used in air travel to 40% by 2050.



RESEARCH IS PROGRESSING IN FRANCE AND EUROPE

CLEAN SKY 2 A BROADER SCOPE OF ACTION FOR EUROPEAN RESEARCH

The first Clean Sky cycle made significant progress in integrated systems and propulsion (e.g., the turbojet with an unducted fan). The European Commission launched Clean Sky 2 with a view to extending the scope of Europe's largest aeronautical research program. This unprecedented public-private partnership brings together almost 800 industrial manufacturers, research

organizations and small and medium-sized companies. Its medium-term goal is to foster the technological emergence of a more sustainable, innovative and competitive aviation. A major step forward has already been made with the development of "small aviation"-oriented technological demonstrators (aircraft with no more than 19 seats).

FOCUS

**CLEAN SKY:
A PROGRAM THAT BRINGS NUMEROUS
INNOVATIVE CONCEPTS TOGETHER**

ECO-DESIGN

TILTROTOR
HELICOPTERS

MORE ELECTRIC
AIRCRAFT

LAMINAR WINGS

COMPOSITE FUSELAGES

NEW AIRCRAFT
CONFIGURATIONS

THE COCKPITS
OF THE FUTURE

THE EUROPEAN COMMISSION A LONG-TERM STRATEGY

Using 2000 as the reference year, the major environmental goals set by the European Commission's Transport Strategy for 2050 for a leading-technology aircraft are:

A 90% REDUCTION IN NOX
PER PASSENGER
AND PER KILOMETER

A 65% REDUCTION
IN PERCEIVED
NOISE

A 75% REDUCTION IN CO₂
PER PASSENGER AND PER
KILOMETER

THE CORAC 10 YEARS SOON, AND A MULTITUDE OF PROJECTS

The French Council for Civil Aeronautics Research (CORAC) was founded in July 2008 on the basis of the commitments made at the Grenelle environmental round table at the end of 2007. Organized along the same lines as the Advisory Council on Aeronautics Research in Europe (ACARE) at the instigation of the French Civil Aviation Authority (DGAC) and the Group of French Aerospace Industrial Manufacturers (GIFAS), the CORAC brings together all the French actors in the air transport sector:

- > AIRCRAFT AND EQUIPMENT MANUFACTURERS,
- > USERS (AIRLINES AND AIRPORTS),
- > RESEARCH CENTERS,
- > THE STATE, IN PARTICULAR THROUGH THE DGAC.

As it enters its tenth year, the CORAC has clearly demonstrated the benefits of unifying research and innovation activities in the aeronautical sector.

THE AERONAUTICAL FACTORY OF THE FUTURE THE END OF THE LINE-BASED ORGANIZATION?

The Aérolia factory located in Méaulte, in the Somme department (France) makes the nose sections of the Airbus A350 with the help of some 500 subcontractors. The site was recently completely reconfigured to replace the product lines with moving lines. The production lines bring together various activities and specialties that advance in step with the production process.

4.0 TRAINING

The factory of the future now has its own school. SAFRAN's future training center in Bondoufle, France, specializing in the industrial mechanics of the future, will open for business in 2018. The new center will train over 250 apprentices every year. The center was created by a consortium of businesses and university training centers.

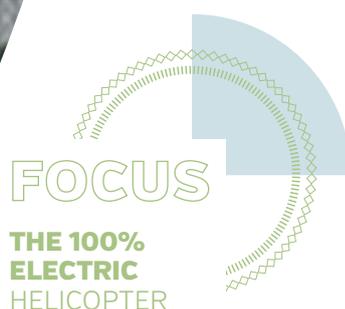


THE AIRCRAFT OF THE FUTURE IS APPROACHING

THE VOLTA HELICOPTER NEITHER NOISE NOR EMISSIONS

The electric helicopter promises mechanical reliability, easy maintenance, very low noise levels and the absence of any pollutant emissions. On October 19, 2016, the first fully electric single-seater helicopter completed a 15-minute experimental flight around the Paris-Issy-les-Moulineaux heliport. The project, initiated by Aquinea, received technical and logistical support from the French national school of aviation (ENAC), which used the DJNN human-machine interface. This interface already features in the cockpits of the future projects developed by Airbus and Thales Avionics, both supported by the DGAC.

This world record was intended to demonstrate the feasibility of a fully electric two-seater aircraft for use in the first hours of pilot training (Volta 2).



THE 100% ELECTRIC HELICOPTER

- > Manufacturer: **Aquinea (France)**
- > **Two 54 hp motors**
- > **430 kg** empty mass
- > Maximum payload of **105 kg**
- > Battery life in cruise flight: **30 minutes**
- > Battery life in stationary flight: **20 minutes**

A conventional helicopter model (a single variable-pitch rotor and a tail rotor) was preferred to the multi-rotor models developed in Germany and Asia that are found on drones. Single-rotor aircraft are 30% more energy-efficient. Pilot training will also benefit from the aircraft's autorotation capacities in the event of a failure, and its compliance with the standards used in existing aircraft.



AND WHAT IF AIRCRAFT CHANGED SHAPE?

High-dilution open rotors or turbojets with unducted fans could come into service by 2030. These massive engines, which are unducted and equipped with contra-rotating propellers, should be able to reach the same speeds as aircraft equipped with turbo-

jets. But only if the profile of the aircraft is changed and the engines are positioned well above the fuselage. This technology could achieve fuel savings of 10% in comparison with the CFM LEAP engines installed on the Airbus A320 Neo and the new Boeing 737 Max.

AFTER SOLAR IMPULSE...

Bertrand Piccard's flight around the world onboard Solar Impulse turned an important new page in the history of aviation. But we are still a long way from seeing any electric commercial aircraft. Along the same lines as what we have seen in the automotive industry, these aircraft could be hybrids that use electric energy in cruise flight, but only in 2030 or 2040. In addition to the questions of energy storage, available

power and battery life, criteria that are difficult to reconcile, the management of high-voltage power at high altitude is a challenge for engineers in itself. But significant short- and medium-term progress is expected in the field of training aircraft, in the wake of Solar Impulse. The E-Fan prototype, developed by Airbus Group Innovations, is already capable of flying at 100 mph.



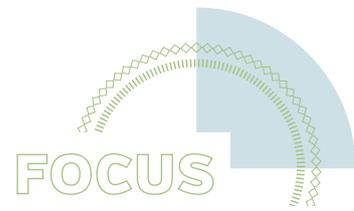
QUIETER SUPERSONIC AIRPLANES ARE COMING SOON

How can we reduce the intensity of the detonation produced when the speed of an aircraft reaches that of the propagation of sound in air? ICAO is working on the development by 2025 of a standard adapted to new-generation supersonic aircraft.

LOWER NOISE LEVELS THANKS TO IMPROVED AERODYNAMICS

Based on the statement that the engines alone are not responsible for all the noise produced by an aircraft, Dassault Aviation decided to launch a project to control the aerodynamic noise generated in the approach phase. The solution consists in identifying the sources using new aero-acoustic tools and adopting new-generation landing gear and high-lift devices with low noise levels. The program also aims to minimize the noise made by aircraft on the ground. To achieve this, the manufacturer is modeling the various sources of noise pollution, such as the APUs and the air-conditioning systems.





The customer survey, conducted by Air France as part of “Lab’Line for the future”, revealed that the customers questioned overestimated the contribution of air transport to worldwide emissions of greenhouse gases. Customers estimated its contribution at 15.79%, compared with 2.5% in reality.



BIOFUELS GET ORGANIZED

LAB’LINE: MORE THAN 50 “GREEN” FLIGHTS

Flying on biofuel is no longer something new. While the safety concerns are covered by the ASTM international technical certification, more and more experiments to determine the positive or negative impacts of biofuels on flights have already demonstrated their operational efficiency. As part of the “Lab’Line for the future” operation, Air France, together with 14 partners, including Total and Safran, has completed 78 domestic flights using biofuel, including 24 departing from Nice airport



on the occasion of the 2016 Cannes Film Festival. These experiments have resulted in two studies supported by the DGAC, one technical and one socio-economic, to look more closely at how biofuels can be used in aviation.

NATIONWIDE EFFORTS TO PROGRESS BEYOND THE EXPERIMENTAL STAGE

Some European countries are trying to set up industries to produce sustainable aviation fuel. Hindered by the price, which is currently significantly higher than that of fossil kerosene, the development of these fuels is nevertheless essential to reducing the environmental footprint of air transport. The French State and French industrial companies from the aeronautical and energy sectors are currently working on the development of innovative partnerships to turn the use of sustainable fuel in aviation into an economically viable reality.



INNOVATING ON THE GROUND...



MORE SUSTAINABLE FIRE-FIGHTING PRODUCTS

In 2016, a study was launched to examine the environmental impact of the fluorine-based foam generators used by aircraft rescue and fire-fighting services. Fluorine is a non-degradable component that is present in most of the products currently used at airports. A test protocol is being prepared to assess the quantity of residues containing fluorine around the fire-fighters' practice zones.



SOFT PAVEMENTS REDUCE THE CARBON FOOTPRINT OF AIRPORTS

The French Institute of Transport, Development and Network Science and Technology for Transport and Network Development (IFST-TAR) and the DGAC are looking into the characteristics of soft pavements used at airports. Their work incorporates the latest research into pavement mechanics and

the behavior of materials. A free technical guide can be downloaded from the STAC website. The associated Alizé-Aéronautique software has been available for sale since autumn 2016. The proposed solution, which lasts for the complete lifespan of the structure, significantly reduces the carbon footprint.

HOW ECOLOGICAL STRIPPING HELPS TO PREVENT RISKS

Most of the finishing operations at the end of the aeronautical production line are still performed manually. The AEROSTRIP research and development project adopts a new approach to the stripping of the fuselages of an aircraft's structural parts. Financed by the French Single Interministerial Fund (FUI), this automated system uses natural elements, such as wheat or corn starch that is sprayed and recycled in real time. This cheap process does not emit any chemical particles and should do away with the manual operations that cause 30% of musculoskeletal disorders among operators. In another promising example, the French Program of Investments for the Future (PIA) is funding a project to develop a new generation of innovative coatings (RING).



DEPOLLUTING WATER AT AIRPORTS WITH PLANTS

The experiments at Orly in the ecological depollution of run-off water containing de-icing or ice clearing products have demonstrated their efficiency. Plants other than rhizomes could also be used. Research is continuing to select new species capable of improving the plant-based filter system.

GLOSSARY

A

A-CDM: Airport-Collaborative Decision Making
ACA: Aéroports de la Côte d'Azur
ACA: Airport Carbon Accreditation
ACARE: Advisory Council for Aeronautics Research in Europe
ACI: Airports Council International
ACNUSA: French airport pollution control authority
ADEME: French environment and energy management agency
AEROSTRIP: Research and development project that adopts a new approach to the stripping of the fuselages of an aircraft's structural parts
AESA: European Aviation Safety Agency
AGO: Western France Airports (airport operator)
APU: Auxiliary Power Unit
ASTM: American Society for Testing and Materials (International standardization organization)

C

CAEP: Committee on Aviation Environmental Protection
CALIPSO: Classification of light aircraft according to their sound performance index
CANSO: Civil Air Navigation Services Organization
CARPEDIEM: Compute ATM Relevant Performance Efficiency to Drive and Influence Environmental Management
CCE: Consultative Commission for the Environment
CEM: Collaborative Environmental Management
CERFACS: French center of fundamental and applied research specialized in modeling and digital simulation
CNAAL: French national commission on aids for light aircraft
CO: Carbon monoxide
CO₂: Carbon dioxide
COP21: 2015 Paris Climate Change Conference
CORAC: French Council for Civil Aeronautics Research
CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation
CRNA: En-route control centers

D

DAC-NC: French civil aviation authority - New Caledonia
DGAC: French Civil Aviation Authority
DSAC: French civil aviation safety authority
DSNA: French air navigation service provider in France

E

EEA: European Economic Area
E-FAN: All-electric aircraft
ENAC: French school of civil aviation
EICA: Air traffic impact study
ENTRACT: Characteristic flight path environment
EPNDB: Effective Perceived Noise Decibel
ETS: Emission Trading System

F

FABEC: Functional Airspace Block Europe Central
FNAM: French national commercial aviation federation
FRA: Free Route Airspace
FUI: French Single interministerial fund

G

GIFAS: Group of French Aerospace Industrial Manufacturers
GMBM: Global Market Based Measure
GTA: French air traffic police

I

IATA: International Air Transport Association
ICAO: International Civil Aviation Organization
IFR: Instrument Flight Rules
IFSTTAR: French institute of science and technology for transport and network development
IGMP: Global weighted and measured index
INERIS: French national institute of industrial environment and risks

M

MOSIQAA: Modeling and simulation of air quality in airport environment

N

NoisedB: ICAO database of the certified noise levels of aircraft
NOX: Nitrogen oxide

O

ONERA: French national office of aeronautical studies and research

P

PEB: Noise exposure plans
PGS: Noise pollution plans
PIA: Program of investments for the future
PNACC: French plan for adaptation to climate change

R

RAAS: Runway Allocation Advisory System (tool aimed at helping to decide the runway in service)
RING: Innovative new-generation coating
RTE: French environment thematic network

S

SESAR: Single European Sky ATM Research
SNA: Regional air navigation service in France
SOes: French observation and statistics department
STAC: French civil aviation technical department

T

TNSA: Tax on noise pollution in France

U

UAF: Union of French airports
UFCNA: French union against aircraft nuisances

V

Visual RNAV: Satellite-assisted visual approach procedure

W

WWF: World Wide Fund for Nature



ENVIRONMENTAL REPORT

2016

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